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2019 Wastewater Treatment Plant Facility Plan

City of Pasco Washington

City of Pasco

July 2019

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Table of Contents

3. Existing Conditions – Treatment Facilities

4. Existing Capacity Analysis

5. Future Conditions

6. Liquid Stream Alternatives

7. Biosolids Handling Alternatives

8. Project Implementation

Figures

Tables

Appendices

References

AACE International Recommended Practice No. 56R-08 Cost Estimate Classification System - As Applied for the Building and General Construction Industries - TCM Framework: 7.3 - Cost Estimating and Budgeting Rev. December 31, 2011

City of Pasco, City of Pasco Comprehensive Sewer Plan, May 2014

Daigger, G.T. Development of Refined Clarifier Operating Diagrams Using an Updated Settling Characteristics Database; 1995

Daigger G.T., Roper R.E.; The Relationship Between SVI and Activated Sludge Settling Characteristics, 1985

HDR, Primary Clarifier Performance Testing, February 2018

Metcalf & Eddy, *Wastewater Engineering: Treatment and Resource Recovery*. McGraw-Hill, 2017

NPDES Waste discharge permit No. WA-004496

State of Washington Department of Ecology; Criteria for Sewage Works Design (Orange Book); August 2008

State of Washington Department of Ecology; Water Quality Permitting and Reporting Information System (Paris); Pasco WWTP Facility Summary: https://apps.ecology.wa.gov/paris/FacilitySummary.aspx?FacilityId=23413, August 2018

Water Environment Federation, Design of Water Resource Recovery Facilities, WEF Manual of Practice No. 8, 5th Ed., 2010

Acronyms & Abbreviations

A	
AA	Average Annual
AACE	Association for the Advancement of Cost Engineering
ACH	aluminum chlorohydrate
B	
BA	Biological Assessment
BOD	Biochemical Oxygen Demand
C	
CCI	City Cost Index
CEPT	Chemically Enhanced Primary Treatment
CFM	Cubic Feet per Minute
CIP	Capital Improvement Plan
City	City of Pasco, Washington
CO_2	Carbon Dioxide
CSO	Combined Sewer Overflows
CWA	Clean Water Act
D	
DAFT	Dissolved Air Floatation Thickener
DO	Dissolved Oxygen
E	
Ecology	Washington Department of Ecology
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	
FEMA	Federal Emergency Management Agency
G	
GPH	Gallons per Hour
GPM	Gallons per Minute
H	
HP	horsepower
I	
IFAS	Integrated Fixed-Film Activated Sludge
I&C	Instrumentation and Control
L	
LCP	Local Control Panel
lb/day	pounds per day
M	
MBR	Membrane Bioreactor
MCC	Motor Control Center
MD	Maximum Day
MGD	million gallons per day
mg/L	milligrams per liter (roughly equivalent to ppm)
MG	million gallons

mm	millimeter
MM	Maximum Month
ml	milliliter
MW	Maximum Week
N	
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O	
O&M	Operations and maintenance
Orange Book	Ecology's Criteria for Sewage Works Design
P	
PCB	Polychlorinated biphenyl
pH	Hydrogen potential
PH	Peak Hour
PI	Peak Instantaneous
Plan	Facility Plan
R	
RAS	Return Activated Sludge
RDT	rotary drum thickener
RCW	Revised Washington Code
S	
SCADA	supervisory control and data acquisition
SCFM	Standard Cubic Feet per Minute
SCS	Soil Conservation Service
SEPA	State Environmental Policy Act
SF	Square Feet
SRT	Solids Retention Time
SVI	Sludge Volume Index
T	
TDG	Total Dissolved Gas
TDH	Total Dynamic Head
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
TSS	Total Suspended Solids
U	
UGB	Urban Growth Boundary
USDA	U.S. Department of Agriculture
UV	Ultraviolet Radiation
W	
WAC	Washington Administrative Code
WAS	Waste Activated Sludge
WQS	Washington Water Quality Standards
WWTP	Wastewater Treatment Plant

Executive Summary

Executive Summary

Purpose

This Wastewater Treatment Plant (WWTP) Facility Plan has been developed to be in conformance with Chapter 173-240 Washington Administrative Code (WAC) involving the Submission of Plans and Reports for Construction of Wastewater Facilities and Table G1-1 of the Washington Department of Ecology (Ecology) "Criteria for Sewage Works Design." This Plan will enable the City of Pasco (City) to improve WWTP unit processes and operations, and continue to meet effluent quality requirements. This Plan includes the recommended modifications to the City's WWTP for the next 20 years that are based on a detailed evaluation of feasible alternatives, with recommendations for improvements that are found to be cost-effective solutions to both the City's near and long-term needs.

Discharge Permit

The Federal Clean Water Act requires municipal facilities that discharge treated wastewater into waters of the United States to obtain a National Pollution Discharge Elimination System (NPDES) permit. The permit establishes maximum pollutant concentrations and loads allowed in the effluent discharge stream. The Pasco WWTP operates under NPDES Permit WA-004496-2, which allows discharge of treated wastewater to the Columbia River. This permit was issued June 29, 2010 and was scheduled to end on June 30, 2015 but has been administratively extended while the Washington Department of Ecology (Ecology) works on drafting the next permit. The projected wastewater flow growth in Pasco requires compliance with antidegradation standards. Based upon the results of a Tier II Antidegradation analysis and discussions with Ecology Staff, the new discharge permit is expected to be issued in 2019/20 and remain largely unchanged. Therefore, all analysis in this document is based upon the 2010 permit requirements.

It should be noted that statewide trending for discharge permits includes various levels of water quality and source control testing beyond what existing permit holders have experienced in the past. The City should review its pretreatment program and source control programs with an eye towards reducing the compliance effort to meet future discharge limits for toxics. While the permit conditions that will result from current rulemaking efforts are far from clear, the evidence points toward more stringent standards. Involvement with the rulemaking process will help the City achieve compliance flexibility and reasonable compliance schedules for any required pretreatment program, source control program, or WWTP facility changes that may become necessary in the future.

WWTP Evaluation

The City WWTP provides physical and biological treatment of the collected incoming wastewater prior to discharge of disinfected water to the Columbia River. The WWTP is located in the southeast region of the City. The facility was originally constructed in 1954 and was subsequently upgraded in the 1970s, 1990s, 2000s and 2010s. This 27.5 acre facility is the City's municipal WWTP. An industrial wastewater treatment plant treats industrial wastewater in the north part of the City. An aerial image of the WWTP facility, with major unit processes, is shown in **Figure ES-1**.

The City's current population is 71,934 (2016) and results in approximately 5.4 million gallons of wastewater per day being treated at the WWTP. Population, flow and load projections were also developed for this Plan and are expected to approximately double by the 2040 planning horizon. The City has been one of the fastest growing cities in the State of Washington and nation over the last several years.

The City has an excellent track record of meeting WWTP permit requirements. However, the capacity analysis of the WWTP identified portions of the WWTP that are currently at, or nearly at, capacity. With the additional flow projected to come to the WWTP, the majority of the WWTP will reach capacity limits during the planning horizon. These include aeration basins, the aeration system, secondary clarifiers, river outfall, dissolved air floatation thickening, anaerobic digestion, rotary drum thickener, drying beds and influent screens.

Alternatives Evaluation and Selected Improvements

Multiple alternatives to address the noted deficiencies were developed during workshops and site visits with City Staff.

Alternatives considered for the liquid and biosolids streams at the WWTP are presented in **Tables ES-1** and **ES-2, respectively**.

Figure ES-1
WWTP Site

Item	Description
1	Headworks
2	Screen
3	Grit Removal
4	Primary Clarifier
5	PC Effluent Box
6	Trickling Filter Recirculation Pump Station
7	Trickling Filter
8	Intermediate Clarifier
9	ICE Box

Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River (not pictured)
17	Columbia River Diffuser (not pictured)
18	Primary Sludge Pump Station

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
23	Sludge Storage
24	Gas Storage
25	Flare
26	Solids Thickening
27	Drying Bed

Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building
33	Laboratory
34	Blower Building
35	Machine Shop (not pictured)
36	Equipent Building

Table ES-1
Liquid Treatment Alternatives

Alternative Number	Alternative Name	Alternative Description	Deficiency Addressed
PRE-1	Screening No Action	Continued use of existing screens	None
PRE-2	Expand Screening	Expand headworks and with fourth perforated plate screen	Screen
SEC-1	Secondary Treatment No Action	Continued use of existing aeration basins	None
SEC-2	Activated Sludge - Plug Flow	Activated sludge with aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages	Secondary Treatment - Aeration Basin, Aeration System
SEC-3	Membrane Bioreactor (MBR)	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent	Aeration Basin Secondary Clarifier
SEC-4	Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth	Conventional activated sludge type basin with addition of suspended plastic media with biological growth to generate a higher total microbiological mass.	Secondary Treatment - Aeration Basin, Aeration System
SEC-5	Zee lung membrane aeration bioreactor – Fixed Growth	Conventional activated sludge type basin with submerged gas permeable membranes that support fixed film growth	Secondary Treatment - Aeration Basin, Aeration System
SEC-6	Trickling Filter/Activated Sludge	Plant flow treated over fixed film based trickling filter followed by conventional activated sludge	Secondary Treatment - Aeration Basin, Aeration System
SEC-7	BioMag Activated Sludge	Ballasted activated sludge	Secondary Treatment - Aeration Basin, Aeration System
SC-1	Secondary Clarifier No Action	Continued use of existing secondary clarifiers	None
SC-2	Secondary Clarifier 3 and 4	Expand secondary sedimentation with Secondary Clarifier 3 and 4- Gravity separation in quiescent tank	Secondary Clarifier
DIS-1	UV Disinfection No Action	Continued use of existing UV system	None
DIS-2	UV Disinfection Expansion	Expand UV system	Disinfection
OUT-1	Outfall No Action	Continued use of existing gravity outfall	None
OUT-2	Gravity Outfall	Effluent discharge through gravity pipeline and diffuser	Outfall

Table ES-2
Biosolids Handling Alternatives

Alternative Number	Alternative Name	Alternative Description	Deficiency Addressed
WAS-1	WAS Thickening No Action	Continued use of single Dissolved Air Flotation Thickener (DAFT)	None
WAS-2	Mechanical Thickening	Thickening of waste activated sludge through mechanical process prior to stabilization.	DAFT
STA-1	Anaerobic Digestion No Action	Continued use of two anaerobic digesters	None
STA-2	Anaerobic Digestion Expansion	Anaerobic digestion system to stabilize biosolids.	Anaerobic Digester
STA-3	Chemical Hydrolysis	Breakdown of sludge into smaller chemical compounds prior to stabilization process.	Anaerobic Digester
STA-4	WAS Only Thermal Drying	Drying WAS biosolids through application of heat to dry through evaporation of water. Other treatment of primary sludge biosolids will still be required.	Anaerobic Digester
FIN-1	Biosolids Finishing No Action	Continued use of single RDT and drying beds	None
FIN-2	Mechanical Dewatering	Mechanically dewater stabilized sludge to remove water and produce a "cake".	Rotary Drum Thickener Drying Beds

General Note:

1. RDT= rotary drum thickener

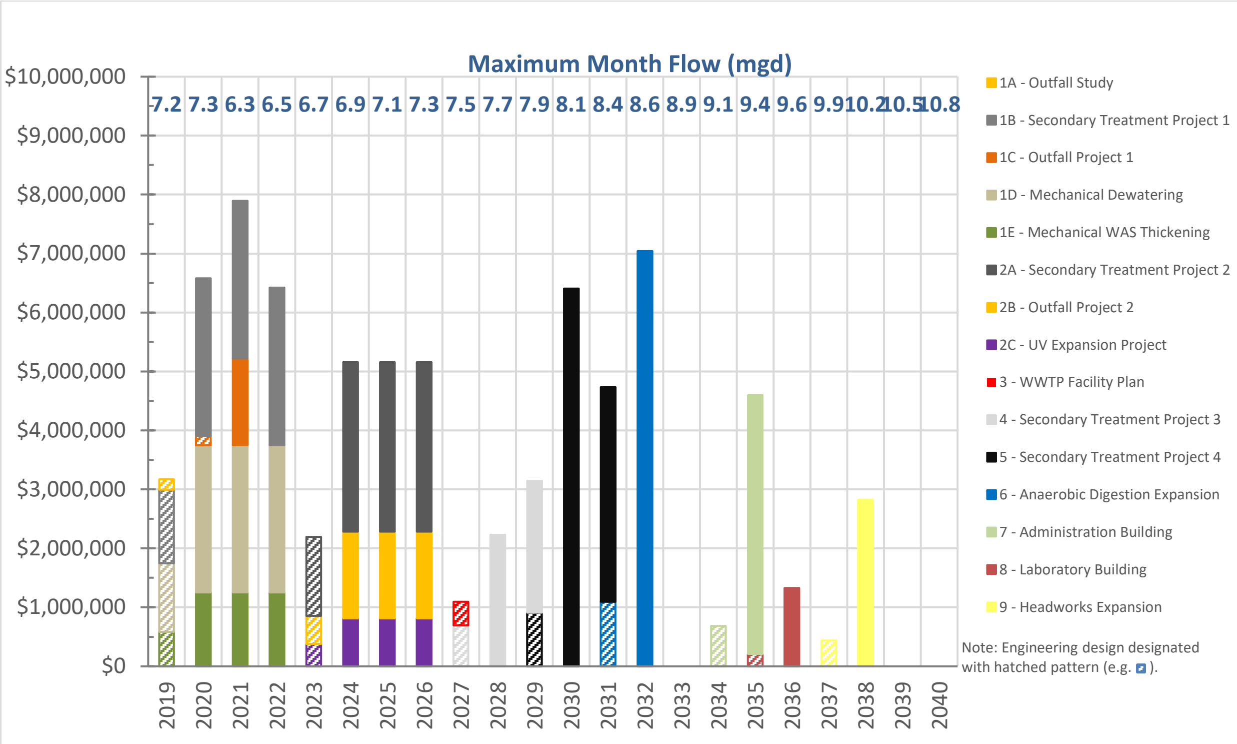
Capital Improvement Plan

The alternatives presented above were reviewed by the City and project team to determine which provided the required treatment capacity, were most cost effective, maintain reliable operation, and satisfy known permit conditions. The preferred improvements were developed into the WWTP Capital Improvement Plan and the projects were prioritized and spread out over the next 20 years. **Table ES-3** lists the proposed project timeframe for implementing each identified improvement, and **Figure ES-2** graphically illustrates the proposed project timeframe.

Table ES-3
List of Recommended Improvement Projects

Project Number	Project Name	2019-2022	2023-2026	2027-2033	2034-2040
1	Project 1	**$24,073,000**	-	-	-
1A	*1A Outfall Study*	*$175,000*	-	-	-
1B	*1B Secondary Treatment Project 1*	*$9,264,000*	-	-	-
1C	*1C Outfall Project 1*	*$1,637,000*	-	-	-
1D	*1D Mechanical Dewatering*	*$8,653,000*	-	-	-
1E	*1E Mechanical Thickening*	*$4,344,000*	-	-	-
2	Project 2	-	**$17,664,000**	-	-
2A	*2A Secondary Treatment Project 2*	-	*$9,950,000*	-	-
2B	*2B Outfall Project 2*	-	*$4,898,000*	-	-
2C	*2C UV Expansion Project*	-	*$2,816,000*	-	-
3	WWTP Facility Plan	-	-	$400,000	-
4	Secondary Treatment Project 3	-	-	$5,162,000	-
5	Secondary Treatment Project 4	-	-	$10,953,000	-
6	Anaerobic Digestion Expansion	-	-	$8,138,000	-
7	Administration Building	-	-	-	$5,076,000
8	Laboratory Building	-	-	-	$1,539,000
9	Headworks Expansion	-	-	-	$3,269,000
	TOTAL	**$24,073,000**	**$17,664,000**	**$24,653,000**	**$9,884,000**

Figure ES-2
Recommended Projects Phasing



Effect of Capital Improvement Plan Implementation

By implementing the recommended WWTP improvements in a timely manner, and as included in this Facility Plan, the City can ensure:

- The ability to handle wastewater generated within the collection system service area
- Compliance with discharge permit requirements for multiple constituents
- Protection of water quality in the Columbia River
- The ability to handle the projected biosolids generated at the WWTP

Ultimately, by following the recommendations in this Plan, the City will serve its sewer customers, the general public and the environment for years to come while avoiding regulatory enforcement actions and fines.

Section 1

Section 1

Introduction

1.1 Background

The City of Pasco (City) is one of the fastest growing cities in the State of Washington. Over the last several years, the City's wastewater treatment system has experienced increased and fluctuating loads which has created operational challenges and capacity concerns at the treatment plant (WWTP).

The primary purpose of this WWTP Facility Plan (Plan) is to assist the City of Pasco in developing an updated long-term strategy for their existing WWTP. Additional context for this Plan is included below in section 1.3. This work is the second of two phases associated with the City's 2017 Comprehensive Sewer Plan Supplement project. The first phase of the project focused on identifying operational and/or small capital improvements that could be implemented immediately to improve the overall stability and capacity of the WWTP while the Plan was being developed. By developing a Facility Plan instead of a Comprehensive Sewer Plan Supplement, eligibility for funding assistance through Washington Department of Ecology's (Ecology) water quality program is expedited.

The City's current Comprehensive Sewer Plan was approved by Ecology May 16, 2014. The Comprehensive Sewer Plan is available on the City's website and included improvements to both the sewer collection system and the WWTP. The City has been implementing the Comprehensive Plan by completing identified WWTP and collection system improvement projects (e.g. - primary clarifier expansion, various lift station and collection system improvements) as well as increasing sewer rates (Ordinance No. 4406, 12/3/2018). Additional WWTP projects have been deferred until the completion of this Facility Plan. This Facility Plan further refines and updates the analysis and recommended improvements to the WWTP. This Facility Plan 20-year boundary matches the Comprehensive Sewer Plan. This Facility Plan modifies the recommendations of the Comprehensive Sewer Plan and identifies improvements that are needed at the WWTP to meet the City's needs until the year 2040. The Comprehensive Plan includes analysis and recommended collection system improvements to ensure that the collection system has capacity to the end of its 20-year planning horizon.

1.2 Study Scope

The City of Pasco authorized Murraysmith, Inc. (Murraysmith) to complete this Facility Plan in accordance with Ecology requirements.

This document contains the chapters and appendices listed below:

Section 1 – Introduction

This section includes the purpose, scope, and organization of this Plan.

Section 2 – Existing Conditions - General

This section describes the planning area background characteristics.

Section 3 – Existing Conditions - WWTP

This section provides a brief history of the WWTP and improvement projects since its initial construction in the 1950's. It includes a WWTP site plan, schematic, summary of unit processes, and a detailed analysis of both the WWTP influent and effluent from 2012 to 2017.

Section 4 – Capacity Analysis

This section summarizes the existing individual unit process design criteria, total unit process assessed capacities, unit process capacities adjusted for City and Ecology redundancy and reliability requirements, and an assessment of electrical system reliability.

Section 5 – Future Conditions

The future flow and load projections for the WWTP are summarized in this section. This section also includes review and documentation of the current status and anticipated future trends of treated wastewater discharge regulations in the state and industry as a whole. This section concludes with a summary of the identified unit processes at the WWTP that are unable to meet the city's projected 20 year needs.

Section 6 – Liquids Stream Alternatives

This section includes discussion on various alternatives for liquid stream process upgrades to address identified WWTP deficiencies.

Section 7 – Solids Stream Alternatives

This section includes discussion on various alternatives for solids stream process upgrades to address identified WWTP deficiencies.

Section 8 – Project Implementation

The alternatives selected by the City for implementation are summarized in this section. A prioritized list of WWTP capital projects for the next twenty years are also discussed and documented.

Appendices

The various appendices mentioned throughout the Plan are organized and provided for reference in this section.

1.3 Compliance with Washington Department of Ecology and WAC Facility Plan Requirements

This document was prepared in accordance with Washington Department of Ecology and Washington Administrative Code (WAC) 173-240-060 requirements for an engineering report for a domestic wastewater facility. **Appendix 1-1** includes a summary of required facility plan contents from Orange Book Table G1-1 and G1-2. These tables include required information, e.g. Facility Plan "owner", and the section location of other required information contained in these tables, as an aid to the reader.

1.4 Acknowledgements

Many people were extremely helpful in providing documentation, information, and input throughout the course of this project. We wish, however, to especially thank the following who contributed to this report:

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Section 2

Section 2

Existing Conditions - General

2.1 Introduction

This section of the Plan provides a general overview and background of the City of Pasco's (City) current municipal wastewater treatment facility site and surrounding area. More specific details on the existing treatment facilities are provided in **Section 3**.

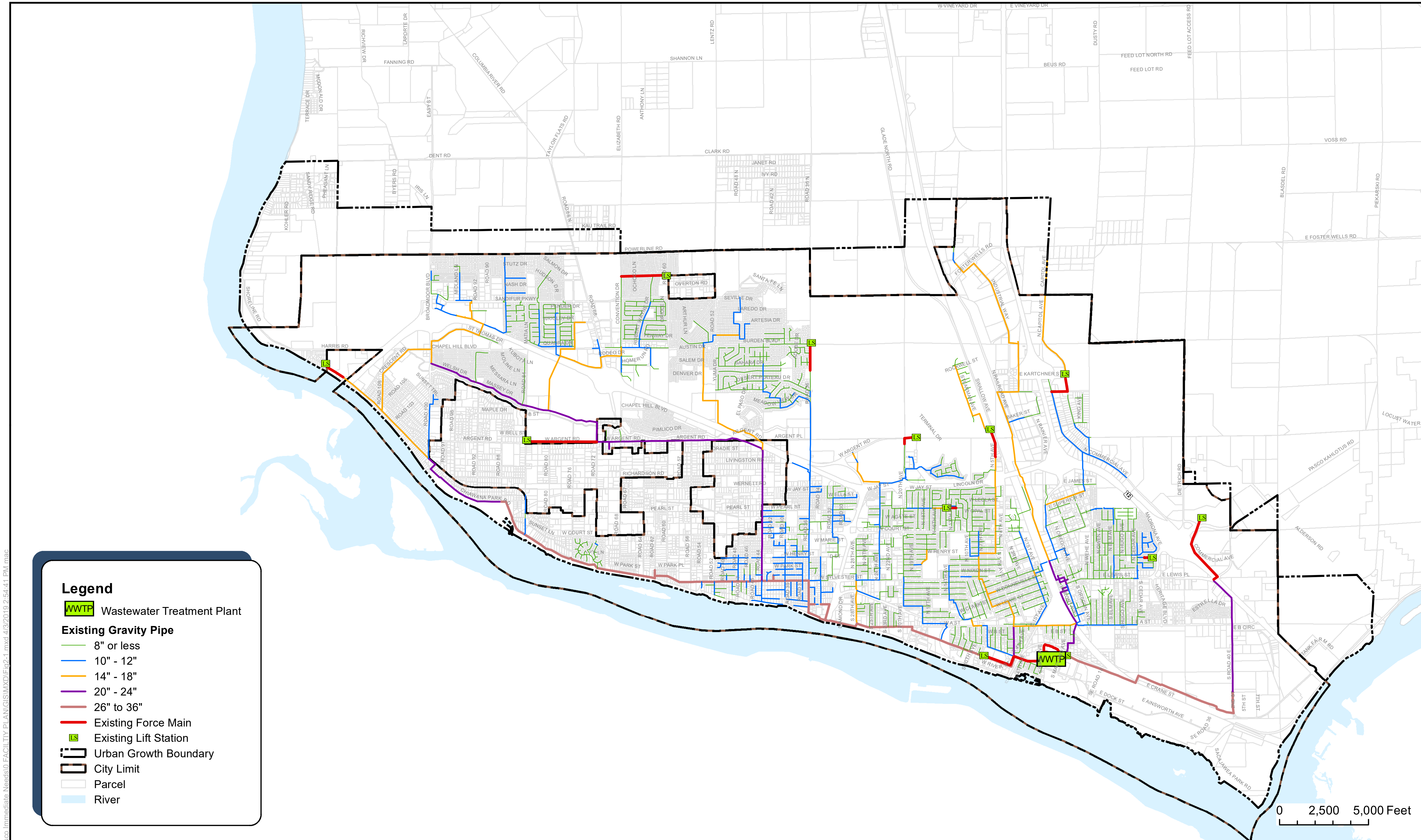
The City built their first municipal wastewater treatment plant (WWTP) in 1954 as a primary treatment facility. In the 1970s, biological treatment in the form of a trickling filter was added to meet secondary treatment requirements for a population equivalent of 30,000. The treatment facility was further upgraded in the mid to late 1990s to increase the design capacity to accommodate growth of the City's service area. These extensive improvements were completed through a series of contracts and included the construction of a new headworks building, aeration basins, secondary clarifiers, ultraviolet radiation (UV) disinfection, a multi-port outfall diffuser, and a second primary digester. In the early 2010s, new headworks screens and high-speed turbo blowers were installed along with automated aeration basin zone air control. The construction of two additional rectangular primary clarifiers was completed in 2016. In 2017, three small "immediate improvement" projects were installed to improve the stability and capacity of the WWTP prior to starting work on this facility plan.

The WWTP operates under National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA 0044962-5 (**Appendix 2-1**) and the associated NPDES Permit Fact Sheet (**Appendix 2-2**). The Service Area for the facility consists of all lands within the Urban Growth Boundary (UGB). The location of the WWTP and UGB are shown in **Figure 2-1**. This figure shows the collection system boundary that will be serviced by the WWTP during the planning horizon.

The City maintains a separate industrial reuse system that collects, stores and then land applies food processor wastewater north of the City. Constructed in 1995, the Reuse Facility specifically serves the City's major food processors and is operated seasonally. The Reuse Facility is a separate entity from the City's wastewater collection and treatment systems and therefore is not included in this plan.

2.1.1 Study Area

The WWTP is located at 1015 South Grey Avenue, immediately north of Ainsworth Avenue and approximately 1,000 feet north of the bank of the Columbia River. The WWTP facility and the route of the treated effluent outfall line (the study area) is shown in **Figure 2-2**. The main plant site consists of approximately 27.5 acres.



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City of Pasco Washington

Wastewater Treatment Plant Facility Plan

Figure 2-1
City of Pasco

April 2019 16-1916

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Wastewater Treatment Plant Facility Plan

Figure 2-2
WWTP Site

April 2019 16-1916

2.1.2 Physical Characteristics

The site has been a WWTP for over 60 years and as such, has been disturbed from its native state. Much of the area is dedicated to buildings, basins, tanks, asphalt, gravel, drying beds, or landscaping. A large portion (roughly 20 percent) of the WWTP site is utilized for biosolids drying beds.

2.1.3 Topography

The topography of the study area consists of flat and gently sloping terrain. The elevation of the WWTP site is approximately 370 feet above sea level. South of the WWTP site, the elevation gradually descends to meet the Columbia River's 340 feet above sea level normal pool level.

2.1.4 Climate

The climate of the area is semi-arid, characterized by low annual precipitation and large inter-seasonal temperature variations. Strong winds from the west and southwest occur throughout the year and are responsible for high evapotranspiration rates in summer. Annual precipitation seldom exceeds 10 inches, with much of the total arriving with summer thunderstorms. Climatological information for the City is summarized in **Table 2-1.**

Table 2-1
Summary of Climatological Information

Annual Average Temperature	55.10°F[1]
Annual High Temperature	91.46°F
Annual Low Temperature	27.20°F
Annual Rainfall	8.47 inches

Note
°F= Degrees Fahrenheit

2.1.5 Geology

The geology of the City's WWTP site is the result of the long history of volcanic activity and ice age floods, which have influenced the geology of the entire Columbia Basin. Throughout the City, the surface is a layer of unconsolidated alluvial and glaciofluvial materials ranging in depth from 0 to 120 feet. The depth of this overburden typically does not exceed 30 feet. The overburden rests on a thick series of basaltic strata, known as the Columbia River Basalts, each of which may consist of many distinct basalt flows.

2.1.6 Soils

The soils in and around the City of Pasco are classified by the U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS). Most of the soils in the WWTP site are of the Urban land-Torripsamments complex. The soil resource report from the USDA is included in **Appendix 2-3**.

The Urban land-Torripsamments complex is described as being gently sloping, deep soils that naturally drain groundwater well, do not store water and rarely pond water. These soils are formed from mixed eolina sand parent material and the precipitation zone range from 6 to 9 inches.

2.2 Sensitive Areas

The following paragraphs summarize a review of the sensitive areas located within the study area (**Figure 2-**1). A non-project State Environmental Policy Act (SEPA) Checklist was completed for this Facility Plan. The complete SEPA Checklist, DNS and public notice are found in **Appendices 2-4**, **2-5** and **2-6** (to follow after public notice is completed), respectively.

2.2.1 Flood Plains

To assess the flooding potential associated with the WWTP Facility, the most recent Federal Emergency Management Agency (FEMA) flood insurance rate map was obtained and reviewed (**Appendix 2-7**). The WWTP location at South Grey Avenue is marked as a Zone C flood risk area. Zone C is defined as 'area of minimal flood hazard'. The WWTP outfall is a buried pipeline from the WWTP to the Columbia River terminating in a diffuser located in the McNary Pool of the Columbia River.

2.2.2 Shorelines

The WWTP shares no shoreline with the Columbia river. The WWTP site and Columbia river are separated by approximately 1,300-feet of land. The WWTP outfall does pass under the shoreline of the Columbia River.

2.2.3 Wetlands

The National Wetlands Inventory (NWI) map (**Appendix 2-8**) does not identify any classified wetland areas at the main WWTP site. The nearest classified area is located on the banks of the Columbia River, approximately 1,000 feet south off the main WWTP site in the area of the buried WWTP outfall pipeline.

2.2.4 Prime or Unique Farmland

The Farmland Protection Policy Act (7 USC 4201) provides special requirements to projects that irreversibly convert farmland to nonagricultural use that are completed by a federal agency or with assistance from a federal agency. Prime or Unique Farmland is defined by the U.S.

Department of Agriculture as land that has the best combination of physical and chemical characteristics for producing food, high-value food, feed, forage, fiber, or oilseed crops. The Farmland Classification map, included in **Appendix 2-3**, does not identify any prime or unique farmland on the Pasco WWTP site or immediate surroundings.

2.2.5 Archeological and Historic Sites

Under the authority of the Historic Preservation Act, the federal government maintains a National Register of Historic Places (NRHP) for preservation of historic properties and resources. Additionally, the Washington State Department of Archaeology and Historic Preservation maintains a historic property inventory list. The NRHP and the Washington State Department of Archaeology and Historic Preservation mapping system for Architectural and Archeological Records data was accessed and there are no places or objects listed on national, state, or local preservation registers in the WWTP site. The maps are included in **Appendix 2-9.1** and **Appendix 2-9.2**. Future construction projects should include inadvertent discovery plans when applying for funding.

2.2.6 Wild and Scenic Rivers

The Columbia River is not listed on the National Wild and Scenic Rivers System. In addition, the portion of the Columbia River adjacent to the WWTP is situated on the slack water upstream of McNary Dam.

2.2.7 ESA Listed Species

The Biological Assessment (BA) developed for the WWTP Facility Plan is included in **Appendix 2-10**. The purpose of the BA is to describe proposed actions and their effects on Endangered Species Act (ESA)-listed species: species listed as endangered, threatened, proposed or candidate. The BA presents the ESA status of relevant species, species specific habitat descriptions and a determination of effect for each. The BA concludes that the proposed project actions should not affect any listed ESA species, associated critical habitat, or essential fish habitat. The BA is pending Environmental Protection Agency approval. The BA identifies endangered fish habitat in the outfall area and the City will need to evaluate this aspect of a project at the time of the instream work.

2.2.8 Public Health

The City owns the land for the WWTP, and this area has been used as a WWTP for over 60 years. The City's city-wide zoning map is included in **Appendix 2-11**. Land uses for all areas within the UGB have been established by the City Planning Department and the land use of the WWTP site is Light Industrial. There are no sensitive public health areas in the vicinity of the WWTP.

Section **3**

Section 3

Existing Conditions – Treatment Facilities

3.1 Introduction

This section of the Wastewater Facility Plan provides both background and a detailed overview of the City of Pasco's (City) current wastewater treatment facility.

3.2 Treatment Facility History

The City's collected wastewater is treated in a Class III Wastewater Treatment Plant (WWTP) (WAC 173-230-140; Classification of Wastewater Treatment Plant) that has been built in stages over the past 60 plus years. After treatment, the effluent from the plant is discharged to the Lake Wallula reach of the Columbia River.

In 1954, the City constructed its first WWTP. This primary treatment facility included a horizontal grit channel, primary clarification, an effluent Parshall flume, and an outfall pipeline to the Columbia River. Solids collected in the primary clarifier were pumped to a sludge digestion complex with one primary and one secondary digester. The digested sludge was conveyed to sludge drying beds for dewatering and storage prior to disposal.

Secondary treatment was added in the early 1970s with the addition of a trickling filter, associated clarifier, and chlorine disinfection facilities. The 1970 modifications increased the WWTP's design population equivalent to 30,000.

In the mid to late 1990s, the WWTP's design capacity was increased with the addition of a new headworks building (screenings and grit removal), activated sludge basins, two secondary clarifiers, a new primary digester and Ultraviolet Radiation (UV) disinfection. At the time of the design of these facilities, the City's outfall was an end of pipe discharge and the improvements were designed based on the presumed need to nitrify to avoid the detrimental effects from ammonia discharges to the aquatic biota in the Columbia River. However, a subsequent installation of a multi-port diffuser and extension of the outfall location in the river improved the mixing of the effluent and negated the need for an effluent ammonia limit in the City's discharge permit.

Additional capital projects completed at the WWTP since the 1990 upgrades include new drying beds, digested solids thickening facilities, a dewatered solids storage building, a second primary digester and an upgrade of the UV modules. More recently (2012), the City completed upgrades to the aeration basin air system (new blowers and controls) and the headworks building (new screens and washer/compactors). Recently (2016), the construction of two additional rectangular primary clarifiers were completed. In 2017, the latest modifications to the WWTP were completed. Three small “immediate improvement” projects were installed to improve the stability and capacity of the WWTP prior to starting work on this facility plan. These improvements included implementation of Chemically Enhanced Primary Treatment (CEPT) with the addition of a ferric chloride storage and pumping system; the addition of forced ventilation on the trickling filter; and piping and control modifications to allow aeration basin bio-augmentation with settled trickling filter sludge.

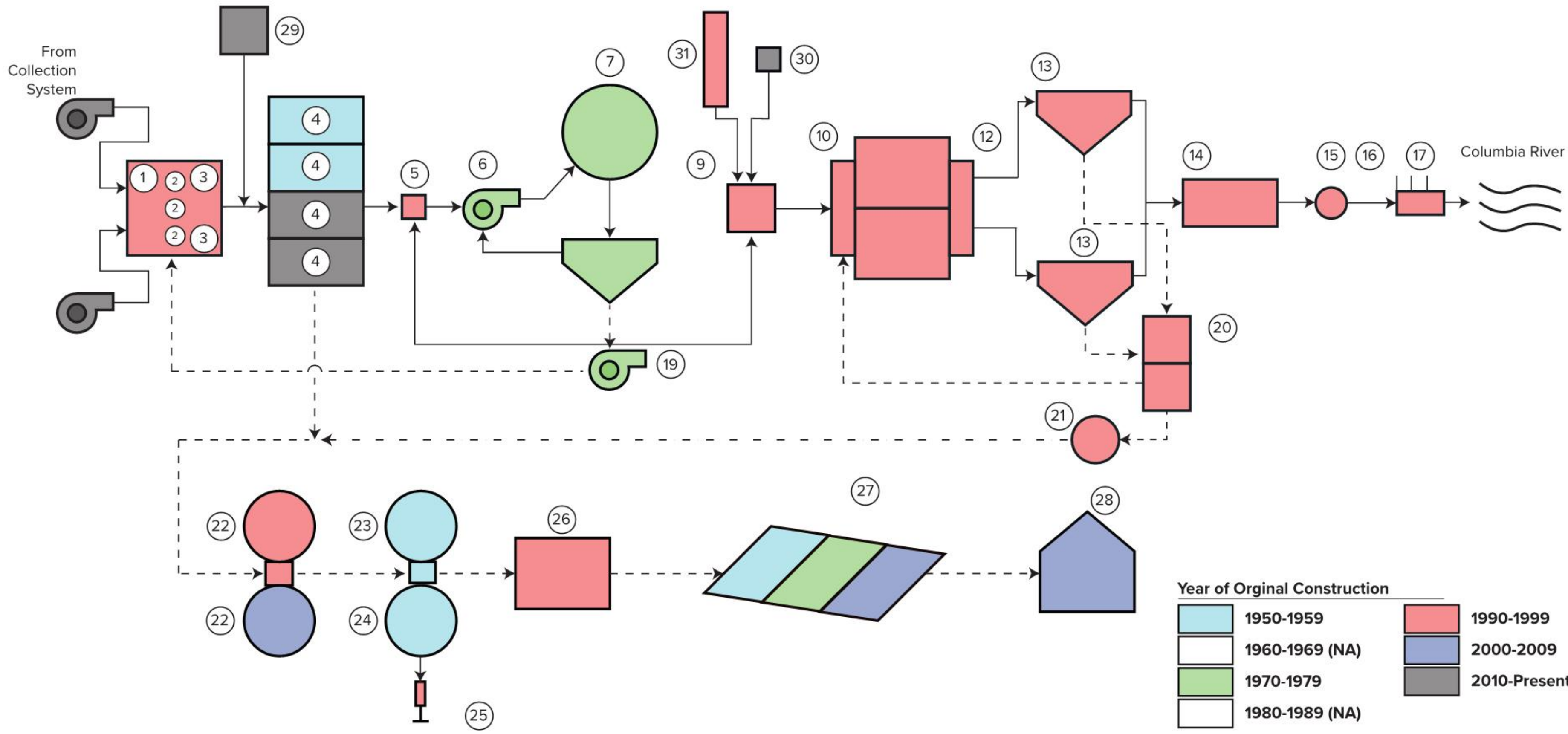
The City does not operate any Combined Sewer Overflows (CSOs) in the sewage collection system.

3.3 WWTP Unit Processes & Systems

The existing WWTP is comprised of several unit processes that perform four core functions: primary treatment, secondary treatment, effluent disinfection and reuse, and solids treatment and reuse. These four treatment plant functional categories and their associated unit processes carry out distinct roles necessary to treat the City’s raw wastewater to the required levels. The following paragraphs provide a brief description of the role of each treatment function and its associated unit processes. The plant’s main power distribution and instrumentation and control (I&C) systems are also summarized and discussed.

Figures 3-1 and 3-2 are a schematic representation of the various unit processes that make up the City's existing WWTP and their relative location on the site, respectively. Figures 3-3, 3-4, and 3-5 are schematic representations of the plant’s primary electrical power and I&C systems.

Figure 3-1
WWTP Schematic



Item	Description
1	Headworks
2	Screen
3	Grit Removal
4	Primary Clarifier
5	PC Effluent Box
6	Trickling Filter Recirculation Pump Station
7	Trickling Filter
8	Intermediate Clarifier
9	ICE Box

Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River
17	Columbia River Diffuser
18	Primary Sludge Pump Station (not pictured)

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
23	Sludge Storage
24	Gas Storage
25	Flare
26	Solids Thickening
27	Drying Bed

Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building (not pictured)
33	Laboratory (not pictured)
34	Blower Building (not pictured)
35	Machine Shop (not pictured)
36	Equipent Building (not pictured)

Figure 3-2
WWTP Site

Item	Description
1	Headworks
2	Screen
3	Grit Removal
4	Primary Clarifier
5	PC Effluent Box
6	Trickling Filter Recirculation Pump Station
7	Trickling Filter
8	Intermediate Clarifier
9	ICE Box

Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River (not pictured)
17	Columbia River Diffuser (not pictured)
18	Primary Sludge Pump Station

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
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24	Gas Storage
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Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building
33	Laboratory
34	Blower Building
35	Machine Shop (not pictured)
36	Equipent Building

Figure 3-3
WWTP Electrical Site Plan

Item	Description
1	MCC-1 at Old Digester Control Building
2	MCC-140A/B at Operations Building Lower Level
3	MCC-240 (a.k.a. 2) at Trickling Filter Building
4	MCC-640A/B at Blower Building Electrical Room
5	MCC-840A/B at UV Treatment Building Electrical Room
6	MCC-941A/B at New Digester Control Building
7	MCC-1100 at Biosolids / Thickening Building
8	Service Entrance - Switchgear

Figure 3-4
WWTP Electrical One-Line Diagram

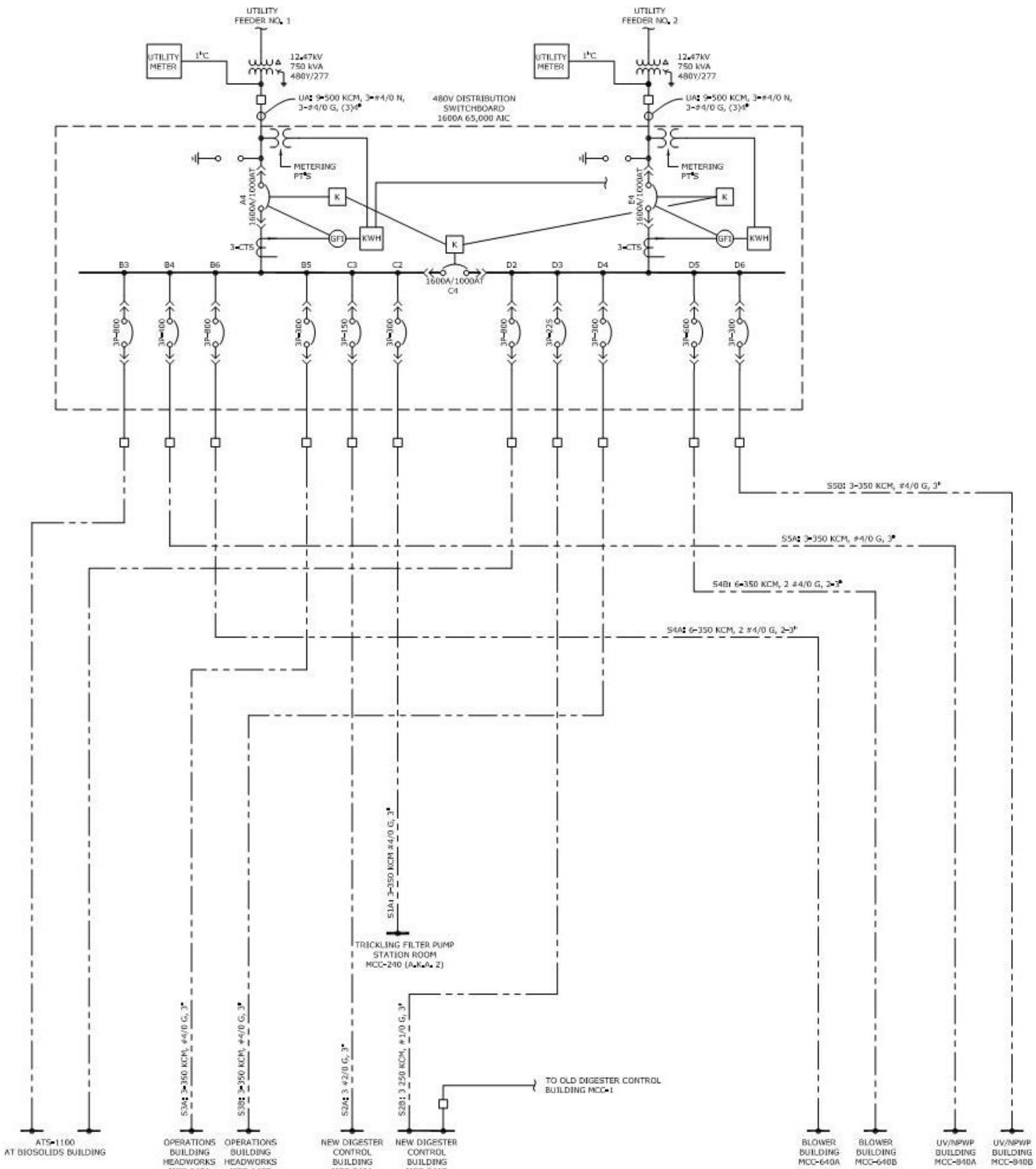
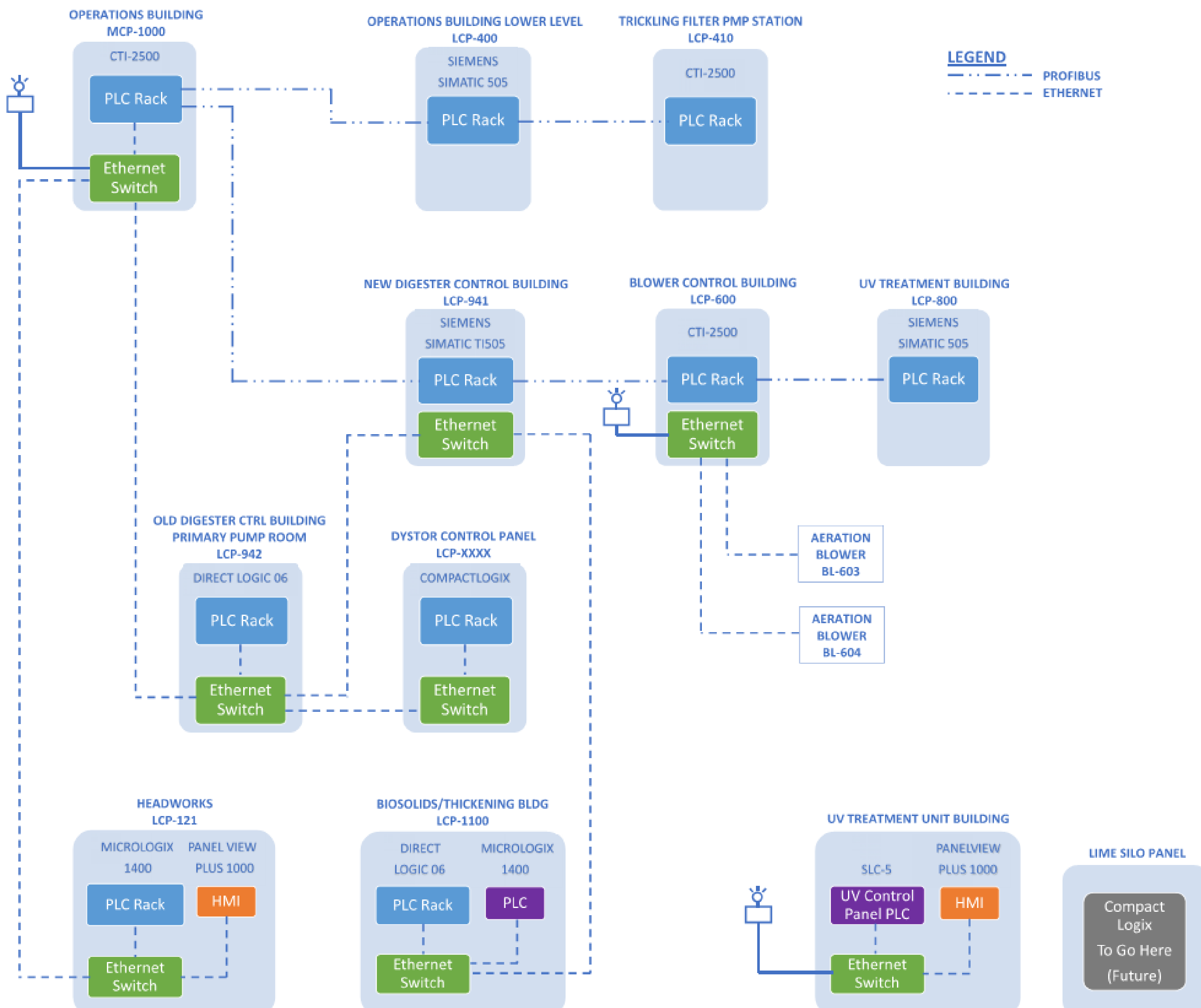


Figure 3-5
WWTP SCADA Network Diagram



3.3.1 Primary Treatment

The role of primary treatment is to remove solids from the waste stream through physical processes. Primary treatment at the WWTP consists of screening, grit removal and primary clarification. The major components used in primary treatment are summarized in **Table 3-1** at the end of this subsection.

3.3.1.1 Headworks Facility - Screening

The headworks facility houses three 36-inch wide mechanical influent screens, a screenings conveyance system, two washer/compactor units and a dumpster system for screening disposal. During normal operation, all the flow is directed to the two newest mechanical screens. When one of these perforated plate screens is offline or not functioning properly, all or some of the wastewater can be bypassed to a third reciprocating rake bar screen. The collected screenings are then washed, and the compactor auger transfers the solids from the screen room to dumpsters. Grit, rags, and screenings are disposed of as solid waste at the local landfill.

3.3.1.2 Grit Removal

After screening, the wastewater is conveyed to two 10-foot diameter grit chambers. Grit is removed in these chambers through the creation of a vortex flow pattern that allows the grit to settle out while the effluent exits at the top. Removal of sand and grit from the wastewater serves to protect downstream equipment from accelerated wear and prevent reduced digestion capacity due to grit accumulation.

3.3.1.3 Primary Clarifier

From the grit chambers, wastewater flows into four downstream primary clarifiers. Two of these clarifiers date back to the original plant and measure 148-foot long by 18.5-feet wide and are approximately eight feet deep. The remaining two clarifiers measure 102-foot long by 18-feet wide and are approximately 15-feet deep with internal baffling to compensate for the decreased clarifier length. The primary clarifiers are used to settle, concentrate, and remove settleable organic solids from the waste flow. Because biochemical oxygen demand (BOD) in wastewater exists in both soluble and particulate form, a substantial amount of BOD can be removed during this process. This reduction in total suspended solids (TSS) and BOD decreases the load to (and increases the capacity of) the downstream secondary treatment processes. The collected primary clarifier solids (sludge) are pumped directly to the digesters along with the waste solids produced in the secondary treatment process. The primary clarification process was modified in 2017 by the addition of ferric chloride to the influent feed to provide CEPT. This process enhancement increases the removal of BOD and TSS in the primary clarifier and thus the capacity of the clarifiers and the downstream secondary processes as well.

From the primary clarifiers, primary effluent flows through a junction box that splits flow between the trickling filter and the aeration basins for the start of secondary treatment. Between 2 to 3 million gallons per day (MGD) of primary effluent flow has historically been routed to the trickling filter on a continual basis.

Table 3-1
Primary Treatment Major Components

System	Data/Type
Primary Treatment	
Screens (NEW - 2012)	
Type	Perforated Plate
Quantity	2
Opening	8 millimeter (mm)
Capacity (Each)	10.3 MGD
Screens (OLD/REDUNDANT - 1995)	
Type	Reciprocating Rake
Quantity	1
Opening	1/2 inch
Capacity (Each)	7.5 MGD
Grit Removal (1995)	
Type	Vortex
Quantity	2
Diameter	10-foot
Maximum Capacity	7.2 MGD
Primary Clarifiers (OLD - 1954)	
Quantity	2
Length	148 Feet
Width	18.5 Feet
Sidewater Depth	8 Feet
Volume (Each)	0.164 Million Gallon (MG)
Total Surface Area	2,738 Square Feet (SF)
Total Weir Length	374 Feet
Primary Clarifiers (NEW - 2016)	
Quantity	2
Length	102 Feet
Width	18 Feet
Sidewater Depth	15 Feet
Volume (Each)	0.206 MG
Total Surface Area	1,836 SF
Total Weir Length	104 Feet
CEPT (2017)	
Ferric Storage	6,500 Gallon
Dosing Pump Type/Size	Motor Driven Diaphragm/ ⅓ horsepower (HP)
Pump Quantity	2
Pump Capacity (Each)	19 Gallons Per Hour (GPH)

3.3.2 Secondary Treatment

The secondary treatment process is the central part of the treatment facility and the most complex. Secondary treatment is defined by the degree of treatment achieved, rather than the actual processes employed. Secondary treatment involves the use of biological processes to capture small and the dissolved organic materials (i.e. - BOD) and nutrients that were not removed during primary treatment. The complexity of the process arises from the many different variables and parameters that separately, and jointly, affect system operation and the final effluent quality. The secondary process employed at the Pasco WWTP incorporates a trickling filter, intermediate clarifier, aeration basins, and secondary clarifiers.

Within the trickling filter and the aeration basins, microorganisms remove organic substrate from the wastewater. These microorganisms require oxygen to breakdown the organics within wastewater and grow new cell mass. When the majority of the BOD has been converted into cell mass, the wastewater flows to the intermediate and secondary clarifiers for the removal of these biological solids from the liquid waste stream.

The major components used for secondary treatment are summarized in **Table 3-2** at the end of this subsection.

3.3.2.1 Trickling Filter

The trickling filter is a 120-foot diameter, 8-foot deep, fixed-film biological reactor using rock as the substrate for biomass growth. A portion of the primary clarifier effluent and recycled trickling filter underflow is continuously distributed on the trickling filter by a hydraulically driven rotary distributor. Treatment occurs as the wastewater flows over the film of biomass on the rock. The trickling filter reduces BOD through the growth of the bacteria in the film. The bacterial biofilm grows on the rock, ultimately sloughs off and then regrows again. The trickling filter was modified in 2017 with the addition of blowers to provide forced air ventilation to increase the treatment consistency and capacity of the process. Effluent from the trickling filter is then routed to the intermediate clarifier.

3.3.2.2 Intermediate Clarifier

The 85-foot diameter circular intermediate clarifier is 8 feet deep and removes solids from the trickling filter effluent by gravity settling. The intermediate clarifier effluent mixes with the remaining primary clarifier effluent that was not diverted to the trickling filter before proceeding to the aeration basins. The solids removed in the intermediate clarifiers are pumped back to the front of the plant where they are removed in the primary clarifiers and then pumped to the anaerobic digesters.

In 2017, additional valving and piping was added to the intermediate clarifier sludge piping to allow diversion of a controlled portion of the settled trickling filter solids to the aeration basin influent. Trickling filter slough settles readily, and the City's aeration basin solids have traditionally not.

These changes were made in hopes that this augmentation would improve the secondary treatment system capacity by improving aeration basin solids settling.

3.3.2.3 Aeration Basins

Within the aeration basins, microorganisms grow in suspension and metabolize the BOD in the wastewater. The mass of microorganisms grown in suspension is typically called mixed liquor. The City's existing WWTP has two aeration basins that follow the primary clarifier and trickling filter and are each 50 feet wide, 100 feet long and 16 feet deep with a total combined volume of 1.2 MG. The first 9 feet of each aeration basin is described in the original design drawings as an aerobic selector zone. This zone and the subsequent three aeration zones per basin are provided with a grid of submerged 9-inch membrane disc fine bubble diffusers. Presently, both aeration basins are on-line during the City’s summer/fall peak load period. The use of only one aeration basin is only possible in the winter and spring lower load periods. The diffusers are supplied air by blowers located in an adjacent blower building.

The City upgraded these facilities in 2012 to improve energy efficiency and operations. Two new turbo blowers replaced two of the three existing multi-stage centrifugal blowers to improve the aeration system efficiency, capacity, and turn-down. In addition to the modifications to the blower building, the City installed modulating air zone control valves and dissolved oxygen (DO) monitoring equipment to allow automated and optimized DO control in the basins. As part of this work, the existing diffusers in the basins were provided with new membranes and retainer rings.

When the aeration basins are operated in a mode that also removes ammonia (nitrification), the Hydrogen Potential (pH) of the wastewater can be adversely impacted. To address this, a lime silo and feed system were installed at part of the 1990 improvements. In 2015, the lime feed system was augmented with a separate caustic soda storage and feed facility to provide redundancy and additional capacity. When needed, lime and/or caustic soda is added downstream of the primary clarifier for pH control.

In the past, the City intentionally tried to operate the plant to minimize nitrification. They were not required to remove ammonia and nitrifying required higher chemical usage and air supply. Since 2013, the WWTP operational philosophy has changed and now allows some level of nitrification to occur, especially in the warm summer months. While this is more costly, plant operations staff report that overall plant stability and permit compliance has improved.

3.3.2.4 Secondary Clarifier

Two 95-foot diameter, 14-foot deep circular secondary clarifiers are used to separate the microorganisms (typically referred to as mixed liquor, activated sludge, or biosolids) from the treated wastewater. Presently, one or both of the secondary clarifiers are used during the City’s summer/fall peak load period. Only one secondary clarifier is used in the winter and spring lower load periods. Both clarifiers contain center feed and suction withdrawal mechanisms and are equipped with an aluminum chlorohydrate (ACH) feed system used to improve settling and solids removal, when needed. The majority of the settled activated sludge is returned to the aeration basin to maintain a proper microorganism population in them. The rate of this return flow, the return activated sludge (RAS), is adjusted by City operations staff on a daily and seasonal basis to keep hydraulic residence time in the clarifier in an optimal range. The excess activated sludge, waste activated sludge (WAS), is conveyed to the dissolved air flotation thickener (DAFT) prior to solids treatment and reuse.

Table 3-2
Secondary Treatment Major Components

System	Data/Type
Secondary Treatment	
Trickling Filter Recirculation Pump Station (1970)	
Pump Type	Vertical Turbine
Quantity	2
HP (Each)	40 HP
Capacity	5.3 MGD
Trickling Filter (1970)	
Quantity	1
Diameter	120 Feet
Sidewater Depth	8 Feet
Volume (Each)	0.677 MG
Total Surface Area	11,309 SF
Trickling Filter Ventilation Fans (2017)	
Number	2
Size (Each)	1.5 HP
Capacity (Each)	5,000 Cubic Feet per Minute (CFM)
Intermediate Clarifier (1970)	
Quantity	1
Diameter	85 Feet
Sidewater Depth	8 Feet
Volume (Each)	0.34 MG
Total Surface Area	5,675 SF
Total Weir Length	267 Feet
Intermediate Clarifier Sludge Pump Station (1970)	
Pump Type	Piston Positive Displacement
Quantity	85 Gallons per Minute (GPM)
HP (Each)	5 HP
Aeration Basin (1995)	
Number of Trains	2
Length	100 Feet
Width	50 Feet
Basin Volume	0.6 MG
Average Sidewater Depth	16 Feet

System	Data/Type
Secondary Treatment	
Alkalinity Feed System (Lime - 1995)	
Storage	39 tons (2620 cubic feet)
Feed Type/Number	Slaker / 1
Feed Capacity (Each)	12 cubic feet per hour
Alkalinity Feed System (Caustic Solution - 2011)	
Storage	6,500 Gallon
Dosing Pump Type/Size	Peristaltic / ⅓ HP
Pump Quantity	1
Pump Capacity (Each)	78 GPH
Process Blowers (OLD - 1995)	
Type	Centrifugal
Quantity	2
HP (Each)	125 HP
Capacity (Each)	2,270 SCFM
Process Blowers (NEW - 2012)	
Type	Turbo
Quantity	2
HP (Each)	150 kW / 200 hp
Capacity (Each)	3,850 Standard Cubic Feet per Minute (SCFM)
Secondary Clarifiers (1995)	
Quantity	2
Diameter	95 Feet
Depth	14 Feet
Volume (Each)	0.742 MG
Total Surface Area	7088 SF
Total Weir Length	298 Feet
RAS Pump Station (1995)	
Pump Type	Centrifugal
Quantity	3
Capacity	2,300 GPM
HP (Each)	25 HP
WAS Pump Station (1995)	
WAS Pump	Centrifugal
Quantity	2
HP (Each)	3 HP
Capacity	120 GPM
Scum Pump	Positive Displacement
Quantity	1
HP (Each)	5 HP
Capacity	175 GPM

3.3.3 Effluent Disinfection and Reuse

After the wastewater has been treated by physical and biological means, it must be disinfected and conveyed back to the Columbia River. The major components used for Effluent Disinfection and Reuse are summarized in **Table 3-3** at the end of this subsection.

3.3.3.1 UV Disinfection

The City of Pasco presently uses UV radiation to disinfect the treated wastewater prior to discharge to the Columbia River. The UV disinfection system was originally installed in 1998 as a replacement for the chlorine disinfection system previously used. The UV disinfection system equipment was upgraded in 2009 to address system performance problems. The existing disinfection system is comprised of two UV channels with 24 vertical lamp modules arranged in six banks evenly distributed between the two channels. The facility has room for expansion with the addition of two additional banks of lamps (one per channel). The UV modules quartz sleeves were replaced in January 2018.

The UV system measures flow rate and transmittance to determine the number of UV modules that must be on. Since the UV equipment upgrades, wastewater effluent measurements for fecal coliform count have been consistently within permit limits.

3.3.3.2 Effluent Flow Measurement

A flow measurement manhole used for plant flow reporting is provided immediately downstream of the UV disinfection system. This facility was installed as part of the plant upgrades in the 1990s and originally used a 2-foot Parshall flume and ultrasonic flow measurement device connected to the plant Supervisory Control and Data Acquisition (SCADA) system to measure and record flow. The originally installed flume did not provide accurate flow measurement after it was put in use. To provide acceptable flow measurement, a stainless-steel weir plate was installed in the throat of the flume in 2003. The ultrasonic flow measurement device was recalibrated to the new flow versus head relationship. In 2015, this weir plate was replaced with a larger unit and the ultrasonic flow measurement device was recalibrated again to accommodate the increase in plant flows.

3.3.3.3 Discharge Outfall

The effluent is discharged from the facility via a 24-inch multiport diffuser outfall into the Columbia River. Leaving the plant site, the outfall follows a southerly line, defined by Grey Street, continuing approximately 900 feet offshore from the north bank and terminates at a diffuser that is approximately 30 feet below the water surface. The outfall pipe along the north-south alignment is 24-inches in diameter and was installed as part of the original facility in 1954. The outfall has three 8-inch diameter diffuser ports and is 50 feet long and was installed in the late 1990s. At this location the river flows west to east southeast.

Table 3-3
Effluent Disinfection and Reuse Major Components

System	Data/Type
Effluent Disinfection and Reuse	
UV Disinfection (1995 & 2005)	
Type	Aquaray 40HO
Channels	2
Banks per Channel	3
Lamp Modules per Bank	2
Bank expansion per Channel	1
Disinfection Capacity per Bank	3.75 MGD
Effluent Flow Measurement (1995)	
Type	Sharp crested weir in Parshall Flume throat
Level Measurement Type	Ultrasonic
Outfall Piping (1954) and Diffuser (1995)	
Piping type	Steel
Piping diameter	24 inch to 40 inch
Diffuser Length	50 Feet
Diffuser Port Number/Size	Three 8 inch

3.3.4 Solids Treatment and Reuse

The role of the solids treatment systems is to thicken, treat and dispose of the biological and waste solids produced at a WWTP as part of the overall wastewater treatment process. A summary of the unit processes used by the City for this function are described below. The major components used for solids treatment and reuse is summarized in **Table 3-4** at the end of this subsection.

3.3.4.1 Dissolved Air Flotation Thickener (DAFT)

WAS thickening is performed to optimize the capacity of the digesters by removing excess water from the waste flow. DAFT systems concentrate suspended matter in a wastewater stream by injecting dissolving air under pressure and then releasing the air at atmospheric pressure in a flotation tank basin. The released air forms tiny bubbles which adhere to the suspended matter causing the suspended matter to float to the surface of the water where it may then be removed by a skimming device. In Pasco, WAS from the secondary clarifiers is pumped to a 10-foot diameter DAFT prior to digestion in the anaerobic digesters. The WAS solids coming from the secondary clarifiers are thickened from a solids content concentration of a less than 1.0 percent to as much as 4.0 percent using the DAFT.

With only one DAFT unit, this system has no redundancy. The rotary drum thickener, described later, is plumbed and capable of thickening WAS also. However, this unit is used for two other plant functions and its ability to provide true redundancy is severely limited. WAS can be bypassed directly to the digesters without thickening, but at the expense of digester capacity. During the City's summer/fall peak load period in 2017, the City rented a portable drum screen style thickener unit to provide redundancy.

3.3.4.2 Anaerobic Digestion

In this treatment process, the organic material in the solids is digested and partially converted biologically under anaerobic conditions into methane and carbon dioxide gas (digester gas). The digester gas is then collected, and a portion is directed to the boilers to heat the digester to approximately 37 degrees Celsius (99 degrees Fahrenheit), which is in the mesophilic temperature range. Any unused gas is flared off to atmosphere.

The benefits of anaerobic solids digestion are the reduced volume of dewatered biosolids when compared to alternative digestion processes, potential use of methane for energy production, and a stabilized end product. Reduction in solids leads to decreased sludge handling costs. A stabilized product with reduced pathogen levels can be disposed of at properly permitted land application facilities or used in other beneficial ways.

The City's anaerobic digestion system has been added to, and modified, several times since initial construction. Currently, there are two 66-foot diameter primary anaerobic digesters that are actively used to treat the solids. The two original 42-foot diameter anaerobic digesters (1954) have been modified and no longer provide anaerobic treatment. One is used for digested sludge storage, and the second has been modified for gas storage. To accommodate gas storage, the original roof has been replaced with a two-membrane system. The outer member is held in place by cables and remains in a fixed position. The inner membrane moves with the digested gas and provides variable volume storage.

3.3.4.3 Rotary Drum Thickener

After digestion, the stabilized sludge is thickened in the rotary drum thickener from a concentration of approximately two to three percent to a range of eight to nine percent. Prior to thickening, a polymer is added to improve flocculation and thickening. The conditioned sludge flows over a rotating screen where excess water is removed from the flocculated solids by gravity screening. This thickened stabilized sludge is then pumped to the drying beds. This process is done to optimize the capacity of the City's existing sludge drying beds. Without this thickening step, the drying beds would not have sufficient capacity.

In 2015, the City started using the rotary drum thickener to also perform recuperative thickening to gain needed capacity in the digesters. When operated in recuperative thickening mode, a portion of the sludge from the digester is pumped to the rotary drum thickener as described above, but instead of then being pumped to the drying beds, the thickened sludge is pumped back into the digester. Digester capacity is based on the amount of time sludge solids are kept in the digester, so the removal of water from the sludge (volume) increases the digester capacity. Due to digester mixing and process limits, recuperative thickening does have it limits, which the City is approaching.

3.3.4.4 Solids Drying and Reuse

Thickened digested sludge is then spread and stored in onsite sludge drying beds. Drying beds are individual cells with an asphalt floor and a concrete containment wall around the perimeter. The City's permit includes a condition requiring the City to properly handle residual solids so that no leachate enters ground or surface water.

Sludge is pumped to the individual beds and then rotated on a regular basis to ensure consistent drying via evaporation. These beds provide just over 4 acres of available space for dewatering digested sludge to a high solids concentration prior to disposal. Drying bed dewatering significantly reduces the storage and transportation costs associated with putting the digested sludge to beneficial use. Dry solids are moved into the WWTP sludge storage building located on-site. Natural Selection Farms of Sunnyside, Washington (under a contract with the City) then picks up and trucks the dried solids to local private properties permitted for land application under a permit issued by Ecology's Waste 2 Resources Program.

Table 3-4
Solids Treatment and Reuse Major Components

System	Data/Type
Solids Treatment and Reuse	
Dissolved Air Floatation Thickener (1995)	
Quantity	1
Diameter	20 Feet
Depth	10 Feet
Volume	3,142 Cubic feet
Primary Digester (1995 and 2006)	
Quantity	2
Diameter	66 Feet
Depth	28.5 Feet
Volume	0.729 MG
Primary Digester Mixer (1995 and 2018)	
Quantity	2
Type	Centrifugal
HP	30 HP
Primary Digester Recirculation Pump (1995 and 2006)	
Type	Centrifugal
Quantity	3
Design Point	350 GPM
Primary Digester Heat Exchanger (1995 and 2006)	
Quantity	3
Capacity	Hot water side: 200 GPM Sludge side: 300 GPM

System	Data/Type
Solids Treatment and Reuse	
Anaerobic Digester Sludge Transfer Pump (2006)	
Type	Positive Displacement
Quantity	2
HP (Each)	5 HP
Capacity	170 GPM
Type	Centrifugal
Quantity	1
HP (Each)	7.5HP
Capacity	390 GPM @ 35’ Total Dynamic Head (TDH) 200 GPM @ 51” TDH
Gas Storage (2006)	
Quantity	1
Diameter	42 Feet
Depth	18 Feet
Volume (Total)	0.186 MG
Sludge Storage (1954)	
Quantity	1
Diameter	42 Feet
Depth	18 Feet
Volume (Total)	0.186 MG
Rotary Drum Thickener (2011)	
Type	Rotary Drum Thickener
Quantity	1
Flow Rate, Max	200 GPM
Motor HP	2 HP
Thickening Polymer System (2011)	
Quantity	1
Motor HP	5 HP
Thickened Sludge Transfer Pump (2011)	
Type	Positive Displacement
Quantity	1
Design Point	15-50 GPM
Biosolids Drying Bed (1954 through 2006)	
Drying Bed Area	4.05 acre
Depth	1.5 Feet
Volume	1.98 MG

3.3.5 Primary Power System

The facility power distribution system consists of two 12.47-kilovolt, 3-phase separate utility feeds from Franklin PUD; two 750KVA utility transformers that step down the voltage from 12.47-kilovolt to 480-volt, 3-phase, 4 wire power distribution, metering, main distribution switchgear with a main-tie-main breaker configuration; 11 motor control centers (MCC); 480-volt power panels; lighting transformers and 120/208-volt lighting panels. **Figure 3-3** shows the Electrical Site Plan with the location of the service entrance equipment and MCCs and **Figure 3-4** shows the One-Line diagram of the main power distribution system.

3.3.6 Instrumentation and Control (I&C) System

The facility SCADA system consists of a Main Control Panel (MCP-1000), eight Local Control Panels (LCPs), and two stand-alone vendor control panels located in different areas of the plant. The communication between MCP-1000, different LCPs, and stand-alone vendor control panels is achieved by using Profibus, Ethernet and radio communications. The panel identification, communication, and location in the plant are shown on **Figure 3-5** SCADA Network Diagram. During the finalization of this Facility Plan, the City initiated a comprehensive update to the I&C system. These improvements included upgrading the system hardware to modern standards.

3.4 Existing Treatment Plant Condition Assessment

Appendix 3.1 summarizes field evaluations of the existing condition of the WWTP that were performed on October 16, 2017 and March 8, 2018. The assessment included major equipment, pumps, buildings, electrical, instrumentation and control systems at the WWTP. The intent of this work was to not only identify facility components that are worn out and need replacement now, but to also identify other infrastructure that will need replacement in the planning window. These needed improvements, if not addressed via specific unit process upgrade alternatives that are selected in this plan, are included as separate projects in the capital improvements plan that is developed in **Section 8**.

3.5 Influent Wastewater Characteristics

Influent wastewater to the City of Pasco WWTP currently consists primarily of residential and commercial dischargers. Data from January 2012 through September 2017 were used for this analysis. Definitions and descriptions of the averaging periods used in this analysis are as follows:

- **Average Annual**: The average annual flow rate observed at the facility in a given year. (e.g., total flow for a year divided by 365 days). The average rate is used to estimate annual average pumping and chemical costs, solids production, and organic loading rates.
- **Maximum Month**: The expected flow or load for the peak month in a given year. This condition is typically used to design unit processes for permit compliance.

- **Maximum Week**: The flow or load corresponding to a peak week or continuous 7-day period in the year. This flow is typically used to design unit processes for permit compliance.
- **Peak Day**: The expected flow or load for the peak day in a given year. The peak day condition is used to size processes for peak events occurring over a 24-hour period.
- **Peak Hour**: The expected condition occurring during the peak hour in a given year. The peak hour conditions are used to size processes for peak events (e.g. pump stations, oxygen demand).
- **Peaking Factors (Peaking)**: Ratios of maximum events to average events (e.g., a maximum month peaking factor is obtained by dividing the maximum month value for a selected parameter by a baseline value, typically the average day value).

3.5.1 Flow

The historical flows and associated peaking factors for the influent are given in **Table 3-5** and presented graphically in **Figure 3-6**. Also included is the probable "existing" condition, i.e. the value considered representative of existing conditions. Further observations on the data include the following:

- The seasonal response of the WWTP flow is likely due to varying degrees of infiltration throughout the year. Higher infiltration rates in late summer and early fall are common in this area and are attributable to irrigation effects. However, the small peaking factors in **Tables 3-5**, **3-11** and **3-12** do not indicate infiltration or inflow as a problem. Additionally, the 78 gallons per day per capita flow identified in the Comprehensive Plan is well below the EPA recommended 120 gallon per day per person as a threshold for excessive infiltration/inflow as identified in the EPA "Guide for Estimating Infiltration and Inflow" (2014).

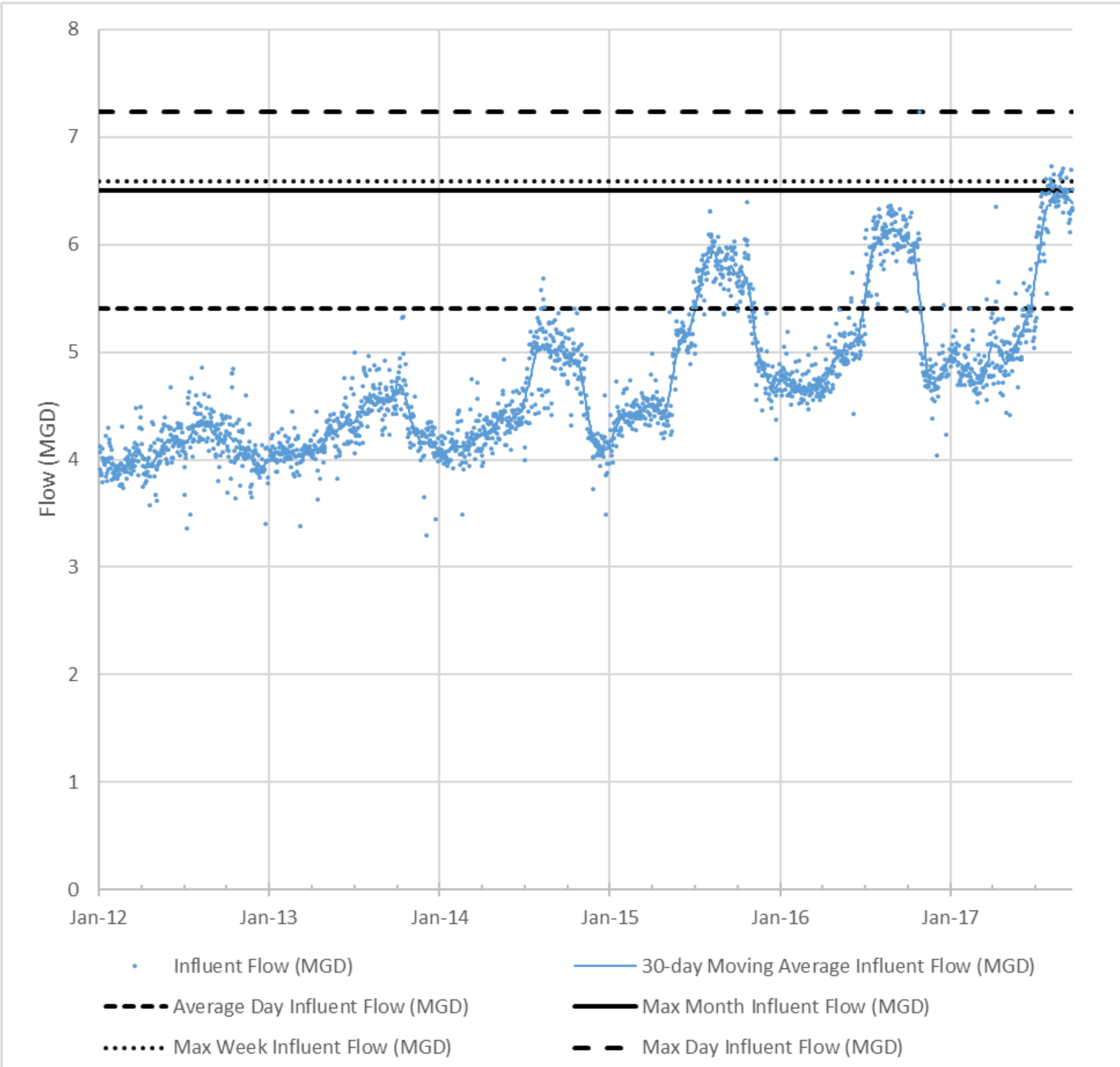
- Also contributing to the noticeable seasonal variation, is an industrial discharger which operates and discharges wastewater to the collection system each year since 2013 (mid-June through early December).

- Flow is on a noticeable upward trend caused by growth in the City.

Table 3-5
Flow Summary

Item	2012	2013	2014	2015	2016	2017	Existing
Average Day	4.1	4.3	4.5	5.0	5.2	5.4	5.4
Maximum Month	4.4	4.7	5.1	5.9	6.2	6.5	6.5
Peaking Factor	*1.15*	*1.07*	*1.10*	*1.13*	*1.18*	*1.18*	*1.20*
Maximum Week	4.5	4.9	2.2	6.1	6.3	6.6	6.6
Peaking Factor	*1.10*	*1.14*	*1.16*	*1.21*	*1.20*	*1.22*	*1.22*
Peak Day	4.9	5.3	5.7	6.4	7.2	6.7	7.2
Peaking Factor	*1.18*	*1.24*	*1.27*	*1.27*	*1.38*	*1.25*	*1.34*

Figure 3-6
Flow Summary



3.5.2 BOD

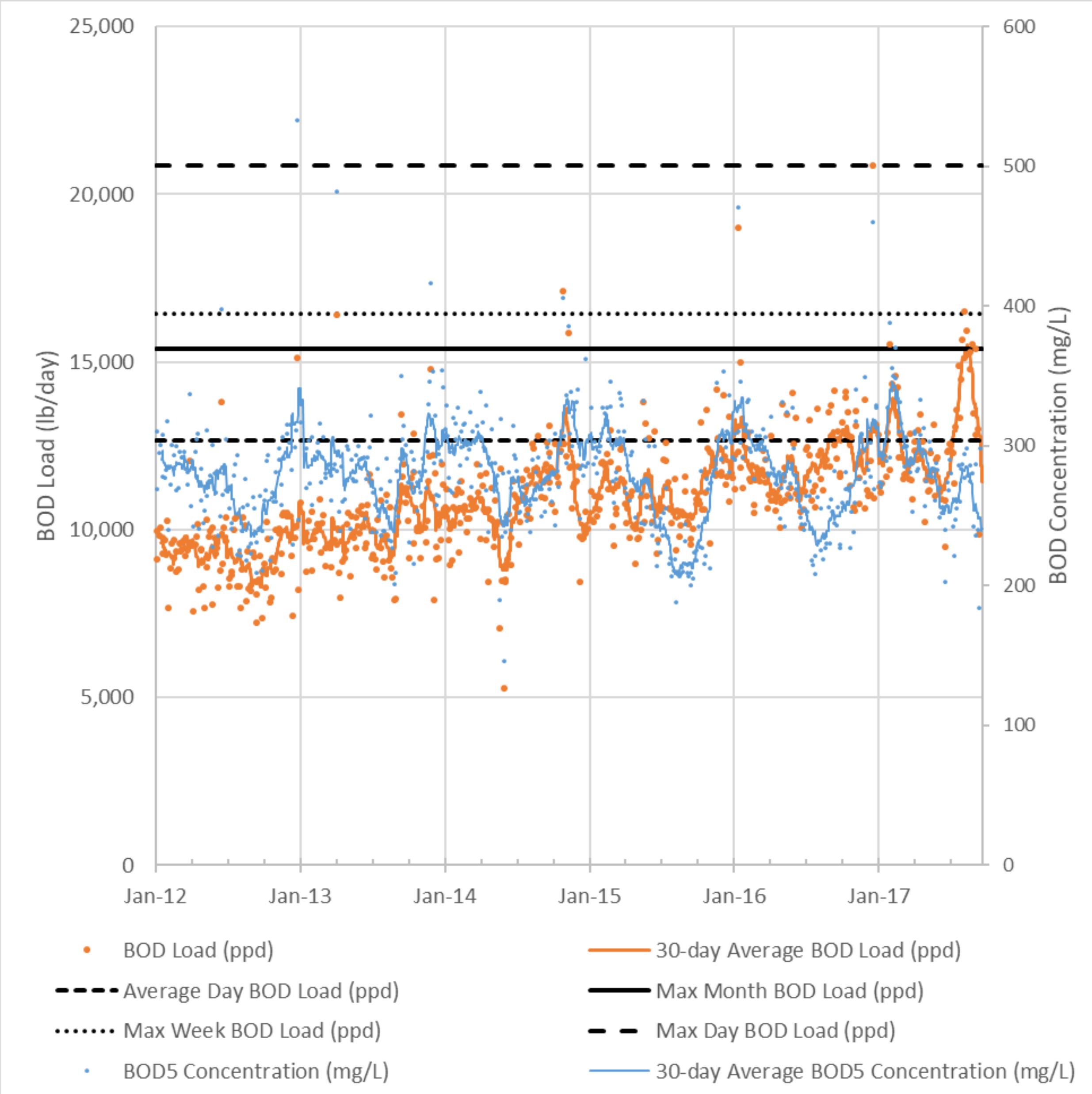
The biochemical oxygen demand (BOD) concentration, loading, peaking factor, and selected existing condition are provided in **Table 3-6**. **Figure 3-7** presents this information graphically. The data indicates a relatively consistent loading pattern throughout the year with contribution from the industrial discharge noticeable. Wastewater with influent BOD between 200 to 400 mg/L (milligrams per liter) is considered medium- to high-strength wastewater (Metcalf and Eddy, 2017).

Table 3-6
Influent BOD Summary

Item	2012	2013	2014	2015	2016	2017	Existing
Average Day (lb/day)[1] 9,325 10,140 10,864 11,155	9,325	10,140	10,864	11,155	12,101	12,678	12,678
Average Day (mg/L)	275	283	288	269	280	285	282
Maximum Month (lb/day)	10,313	11,413	13,505	12,469	13,344	15,396	15,396
Peaking Factor	*1.11*	*1.13*	*1.24*	*1.12*	*1.10*	*1.21*	*1.21*
Maximum Week (lb/day)	12,607	14,790	14,835	13,448	16,456	16,213	16,456
Peaking Factor	*1.35*	*1.46*	*1.37*	*1.21*	*1.36*	*1.28*	*1.30*
Peak Day (lb/day)	15,127	16,405	17,100	14,176	20,847	16,504	20,847
Peaking Factor	*1.62*	*1.62*	*1.57*	*1.27*	*1.72*	*1.30*	*1.64*

Note:
1. lb/day=pounds per day

Figure 3-7
BOD Summary



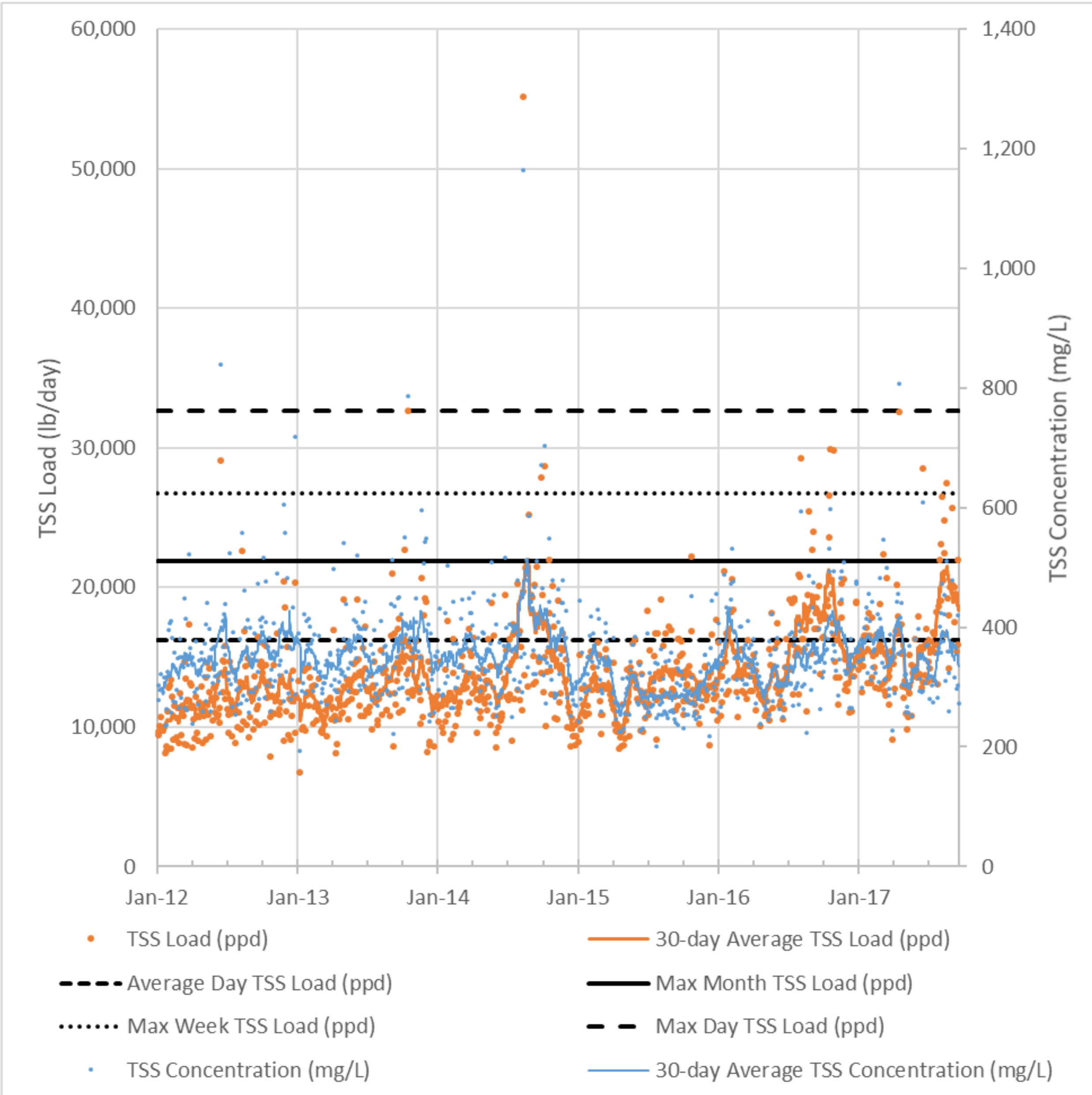
3.5.3 TSS

The TSS concentration, loading, peaking factor, and selected existing condition are provided in **Table 3-7**. **Figure 3-8** presents this information graphically. Like the influent BOD5, influent TSS loading data indicates a relatively consistent loading pattern throughout the year with contribution from the industrial discharge noticeable. Typical literature values for influent TSS are 195 to 389 mg/L for medium- to high-strength wastewater (Metcalf and Eddy, 2017).

Table 3-7
Influent TSS Summary

Item	2012	2013	2014	2015	2016	2017	Existing
Average Day (lb/day)	12,008	12,877	14,227	12,829	15,553	16,240	16,240
Average Day (mg/L)	352	357	374	305	353	359	350
Maximum Month	14,032	16,429	21,871	14,400	20,979	21,548	21,871
Peaking Factor	*1.17*	*1.28*	*1.54*	*1.12*	*1.35*	*1.33*	*1.35*
Maximum Week	20,812	20,585	30,090	17,624	24,714	23,373	24,714
Peaking Factor	*1.73*	*1.60*	*2.11*	*1.37*	*1.72*	*1.44*	*1.64*
Peak Day (lb/day)	29,130	32,684	55,140	22,241	29,934	32,575	32,684
Peaking Factor	*2.43*	*2.54*	*3.88*	*1.73*	*1.92*	*2.01*	*2.01*

Figure 3-8
TSS Summary



3.5.4 Ammonia

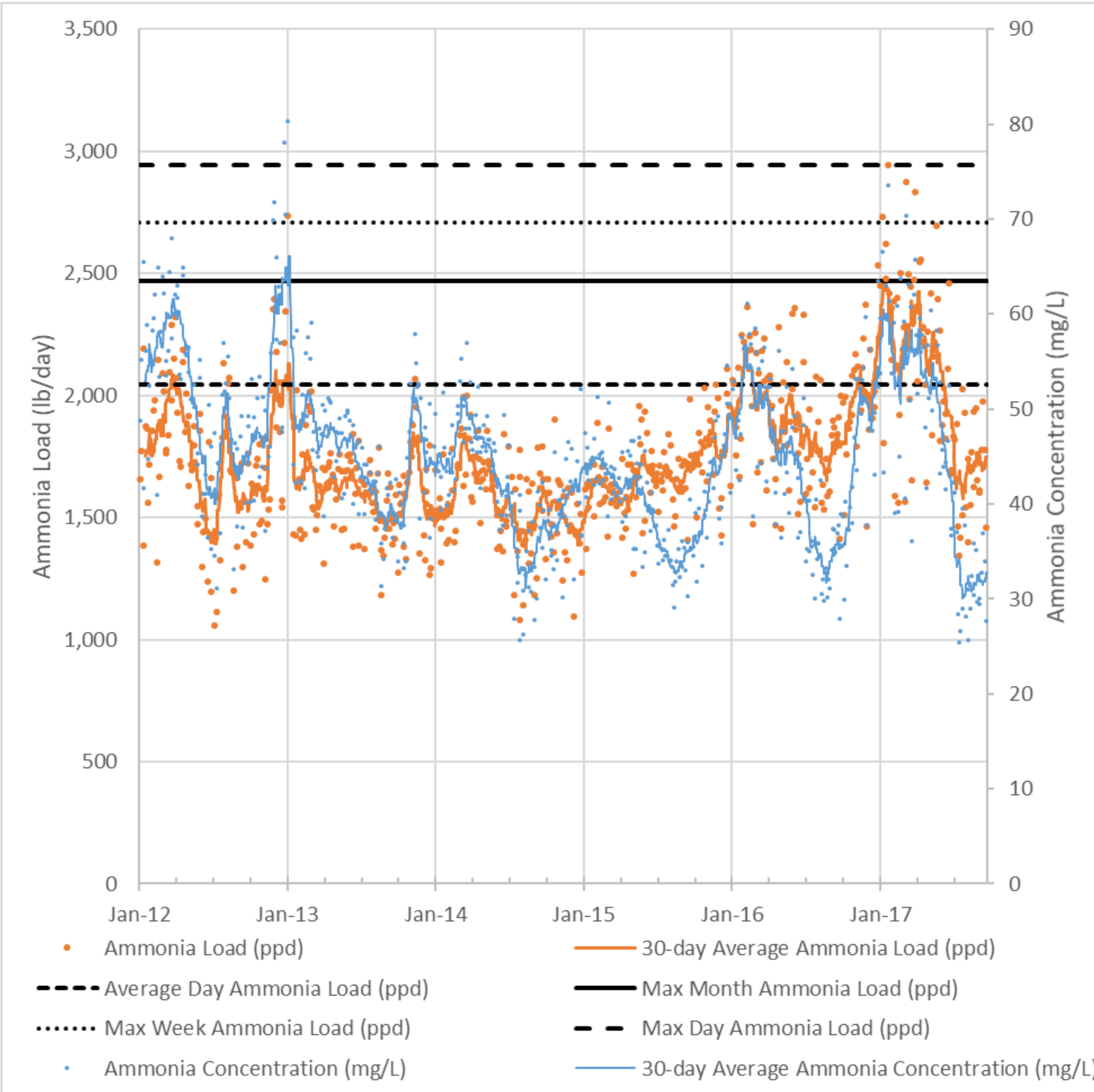
Sampling for influent ammonia occurs twice per week in accordance with the City's National Pollutant Discharge Elimination System (NPDES) permit. The ammonia concentration, loading, peaking factor, and selected existing condition are provided in **Table 3-8**. **Figure 3-9** presents this information graphically.

Typical literature values for influent ammonia are 20 to 41 mg/L for medium- to high-strength wastewater (Metcalf and Eddy, 2017). Pasco's recorded concentrations are above this level due to an internal recycle stream (rotary drum thickener filtrate). Prior to this equipment coming on-line in 2009, the recorded ammonia values were 10 to 15 mg/L lower.

Table 3-8
Influent Ammonia Summary

Item	2012	2013	2014	2015	2016	2017	Existing
Average Day (lb/day)	1,747	1,619	1,531	1,683	1,917	2,044	2,044
Average Day (mg/L)	51.4	45.3	41.6	40.3	44.7	46.7	45.0
Maximum Month (lb/day)	2,085	2,127	1,843	1,862	2,182	2,470	2,470
Peaking Factor	*1.19*	*1.31*	*1.18*	*1.11*	*1.14*	*1.21*	*1.21*
Maximum Week (lb/day)	2,374	2,734	1,929	2,058	2,371	2,710	2,710
Peaking Factor	*1.36*	*1.69*	*1.24*	*1.22*	*1.22*	*1.33*	*1.33*
Peak Day (lb/day)	2,392	2,734	1,998	2,107	2,531	2,944	2,944
Peaking Factor	*1.37*	*1.69*	*1.28*	*1.25*	*1.32*	*1.44*	*1.44*

Figure 3-9
Ammonia Summary



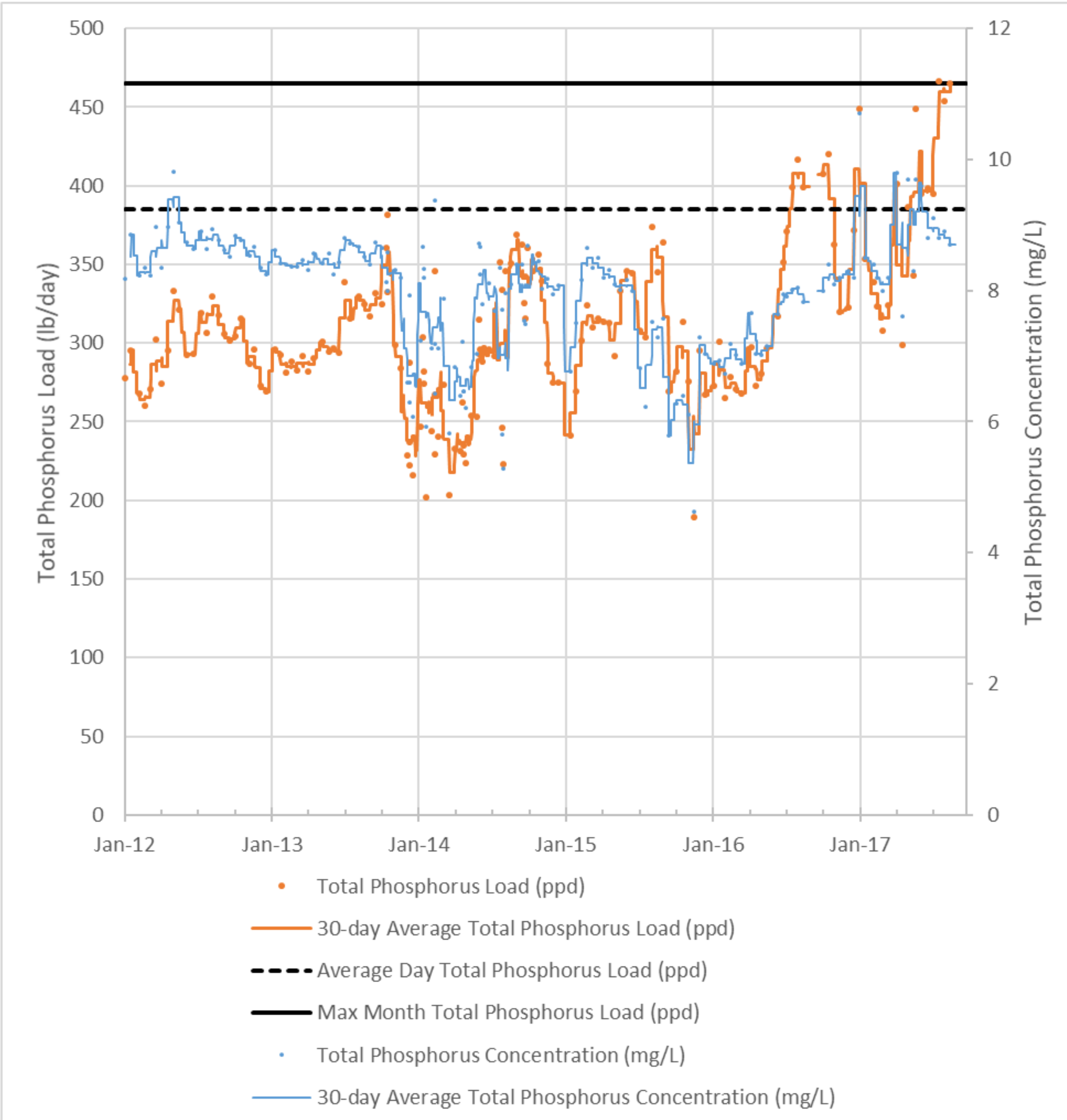
3.5.5 Total Phosphorus

Influent total phosphorus (TP) is collected roughly every other week and analyzed at the facility. Typical literature values for influent total phosphorus are 5.6 to 11.0 mg/L for medium- to high-strength wastewater (Metcalf and Eddy, 2017). The TP concentration, loading, peaking factor, and selected existing condition are provided in **Table 3-9**. **Figure 3-10** presents this information graphically.

Table 3-9
Influent Total Phosphorus Summary

Item	2012	2013	2014	2015	2016	2017	Existing
Average Day (lb/day)	296	297	287	304	330	385	385
Average Day (mg/L)	8.7	8.2	7.6	7.3	7.6	8.9	8.9
Maximum Month (lb/day)	327	358	366	361	414	465	465
Peaking Factor	*1.10*	*1.21*	*1.28*	*1.19*	*1.25*	*1.21*	*1.21*

Figure 3-10
Total Phosphorus Summary



3.6 NPDES Discharge Permit

The Federal Clean Water Act requires municipal facilities that discharge treated wastewater into waters of the United States to obtain a NPDES permit. The permit establishes maximum pollutant concentrations and loads allowed in the effluent discharge stream. The Pasco WWTP is regulated by NPDES Permit WA-004496-2, which allows discharge of treated wastewater to the Columbia River. **Table 3-10** summarizes the monthly effluent permit limitations but does not list other monitoring requirements included in the permit. This permit was scheduled to end on June 30, 2015 but has been administratively extended while the Department of Ecology works on drafting the next permit.

Table 3-10
NPDES Permit Limits and Requirements

Parameter	Average Monthly Limits	Average Weekly Limits	Comments
BOD	1,131 lb/day 30 mg/l 85% removal	1,696 lb/day 45 mg/l	-
TSS	1,131 lb/day 30 mg/l 85% removal	1,696 lb/day 45 mg/l	-
Fecal Coliform Bacteria	200 colonies/100 milliliter (ml)	400 colonies/100 ml	Geometric mean
pH	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0		Instantaneous

3.7 Plant Performance

The WWTP has consistently produces an excellent quality effluent over the last 5 years. The following discussion and figures summarize the WWTP's effluent quality since 2012 versus the permit limits. Each constituent is presented graphically with the permit limit as applicable.

3.7.1 BOD

The WWTP monthly BOD effluent load, concentration, and removal percent are summarized in **Figure 3-11**, **3-12** and **3-13**, respectively. The WWTP generally does a good job removing BOD.

In April of 2013, the plant effluent exceeded permit limits for Average Monthly BOD Load, Average Monthly BOD Concentration, Average Weekly BOD Load, and Average Weekly BOD Concentrations. While the BOD removal percentage dipped during this time, it stayed within permit limits. The violations were reported to Washington Department of Ecology (Ecology) and were noted by Ecology as, "Problems with QC in lab. Lab error on BOD, QA not met on seed blank

- effluent numbers not accurate Effluent TSS elevated by high SVI High SVI, filamentous growth washed out to final clarifier."

Figure 3-11
BOD Effluent Load Summary

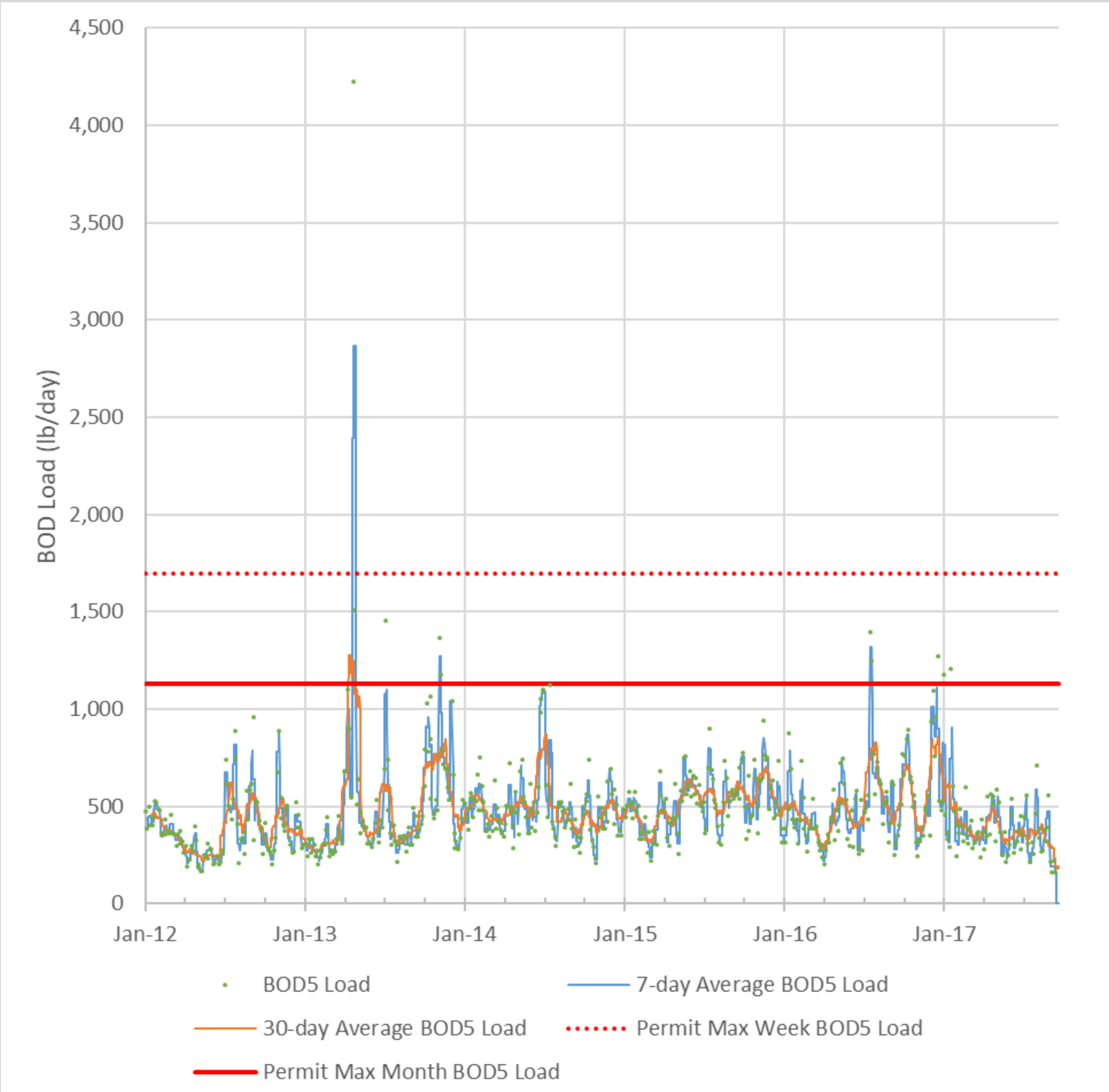


Figure 3-12
BOD Effluent Concentration Summary

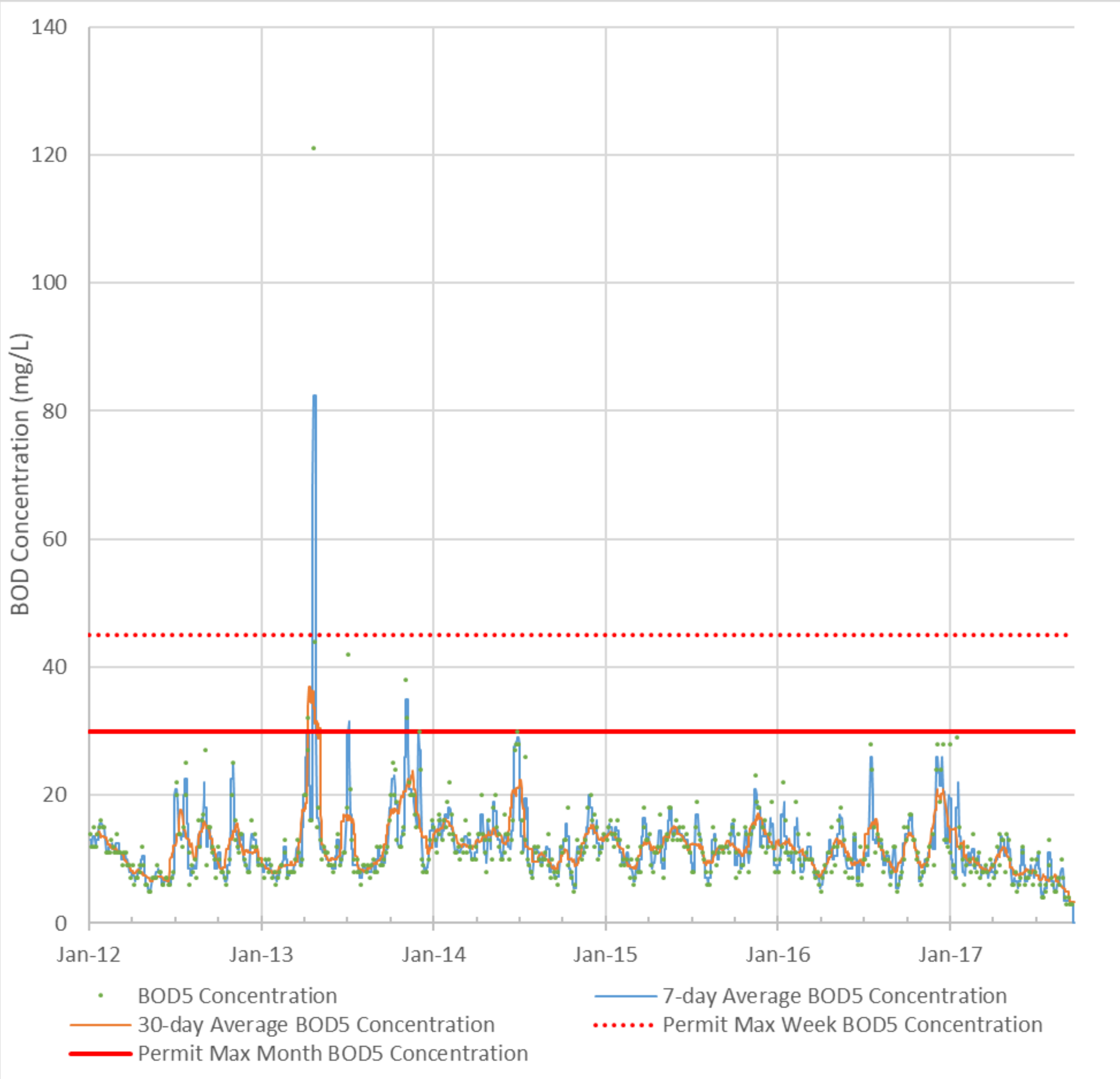


Figure 3-13
BOD Removal Summary

3.7.2 TSS

The WWTP TSS effluent load, concentration, and removal percent are summarized in **Figure 3-14**, **3-15** and **3-16**, respectively. The WWTP generally does a good job of removing suspended solids.

In April of 2013, the plant effluent exceeded permit limits for Average Weekly TSS Load and Average Weekly TSS Concentrations. While the Average Monthly TSS Load and Average Monthly TSS Concentration also spiked at this time, they stayed within permit limits. The violations were reported to Ecology and were noted by Ecology as, "Problems with QC in lab. Lab error on BOD, QA not met on seed blank - effluent numbers not accurate Effluent TSS elevated by high SVI High SVI, filamentous growth washed out to final clarifier."

Figure 3-14
TSS Effluent Load Summary

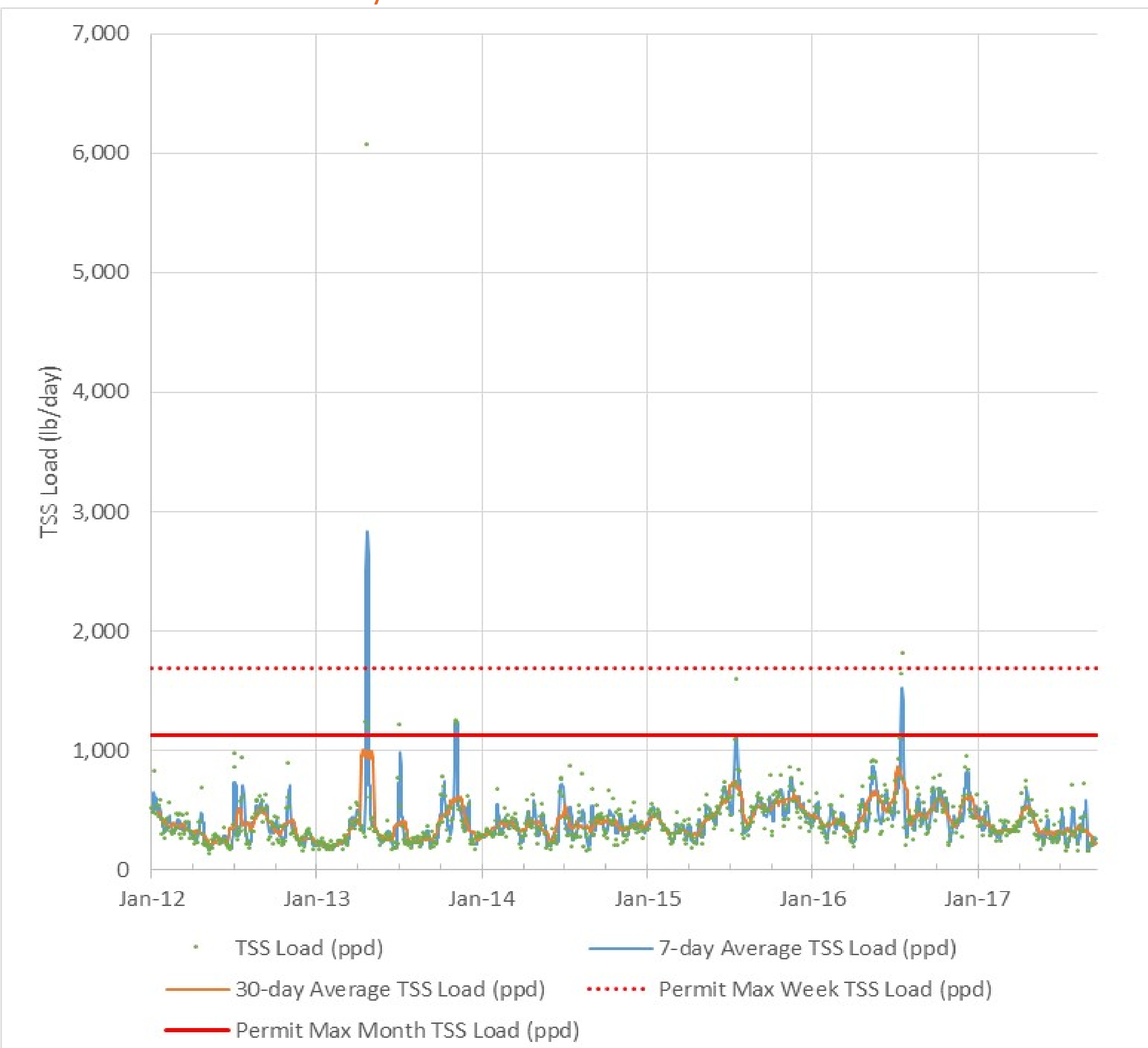


Figure 3-15
TSS Effluent Concentration Summary

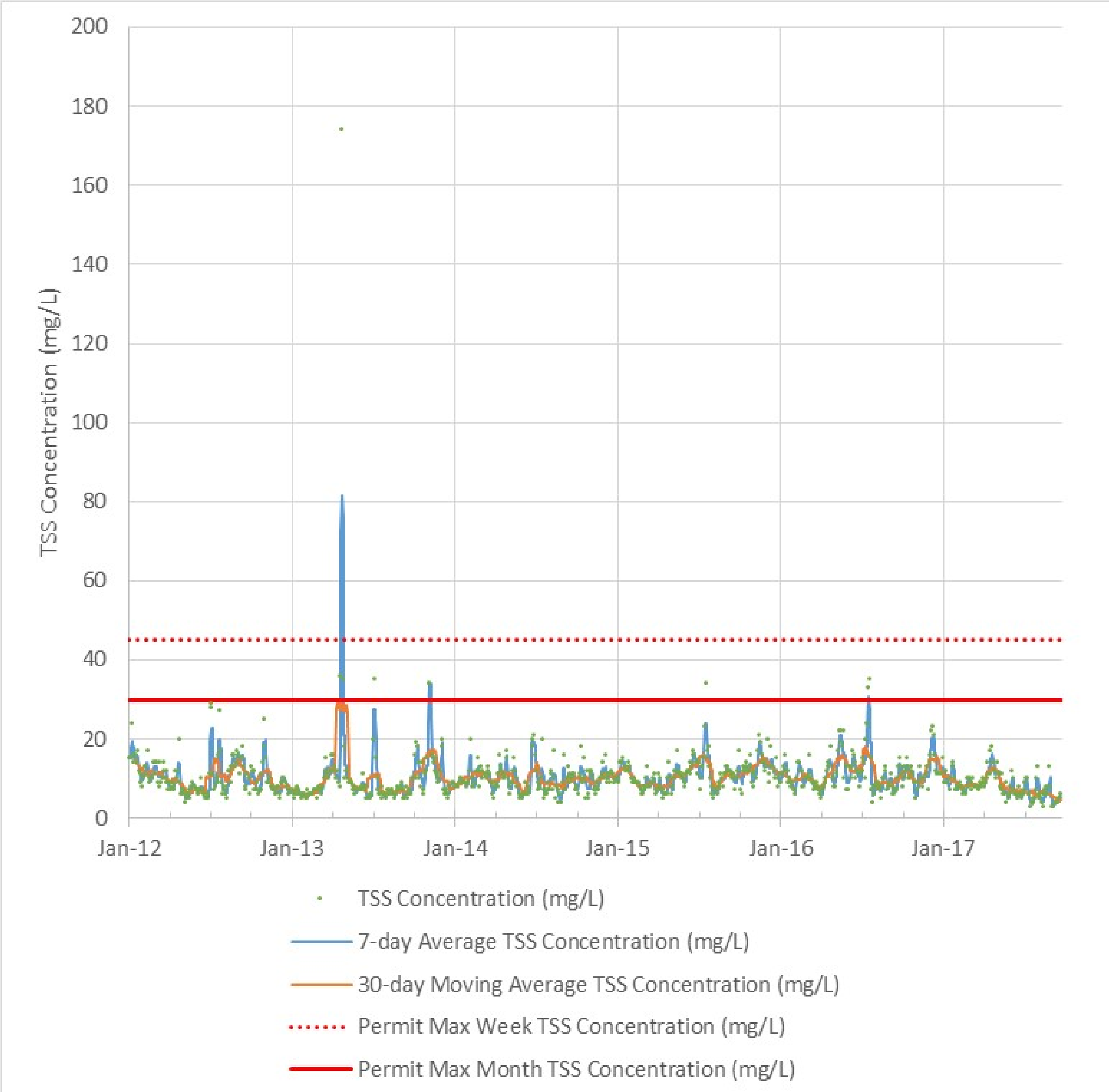


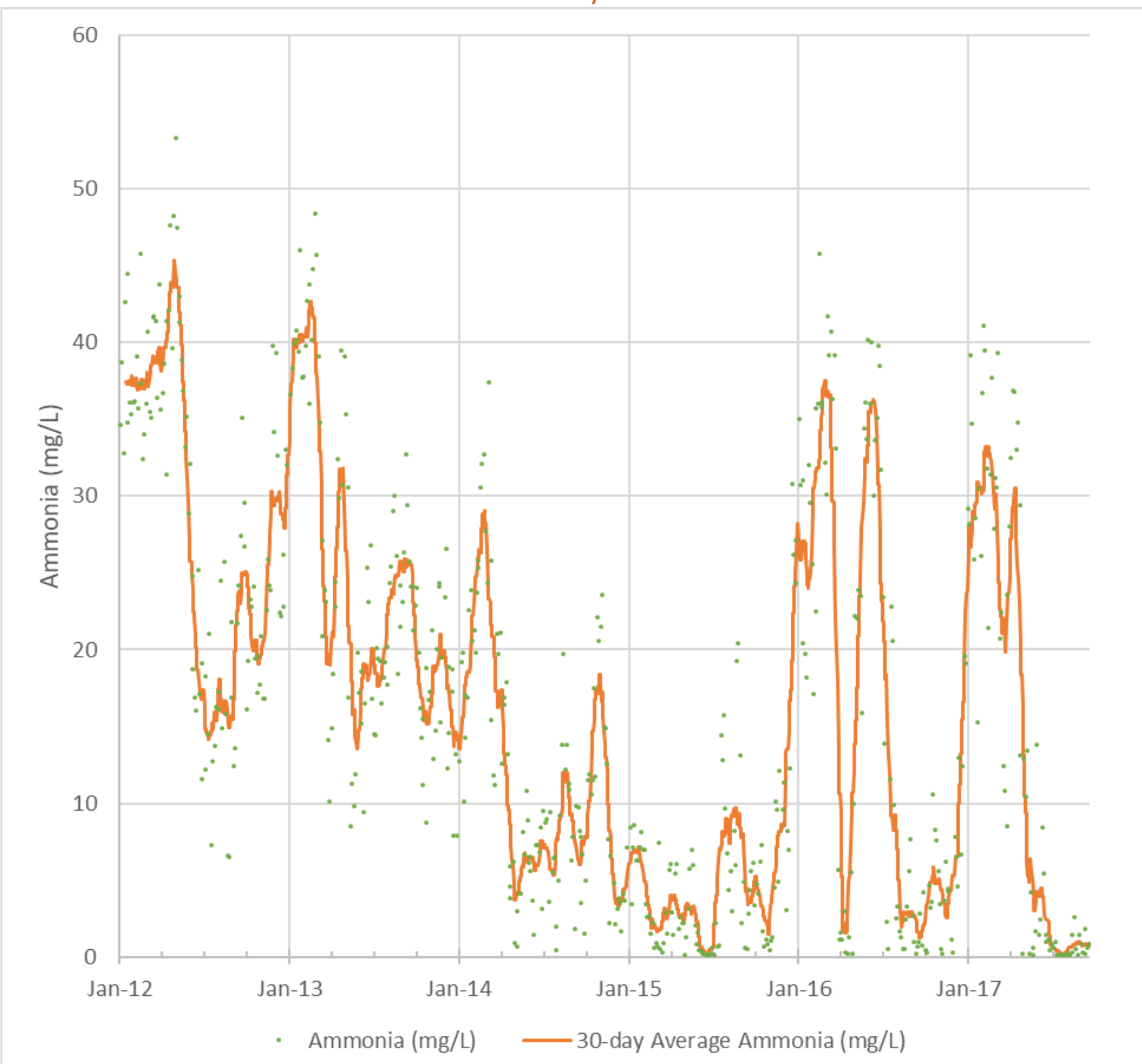
Figure 3-16
TSS Removal Summary

3.7.3 Ammonia

The WWTP ammonia effluent concentration is summarized in **Figure 3-17**. As can be seen in the figure, the WWTP does partially nitrify at times based on the season and operational control.

The WWTP does not currently have an ammonia effluent limit.

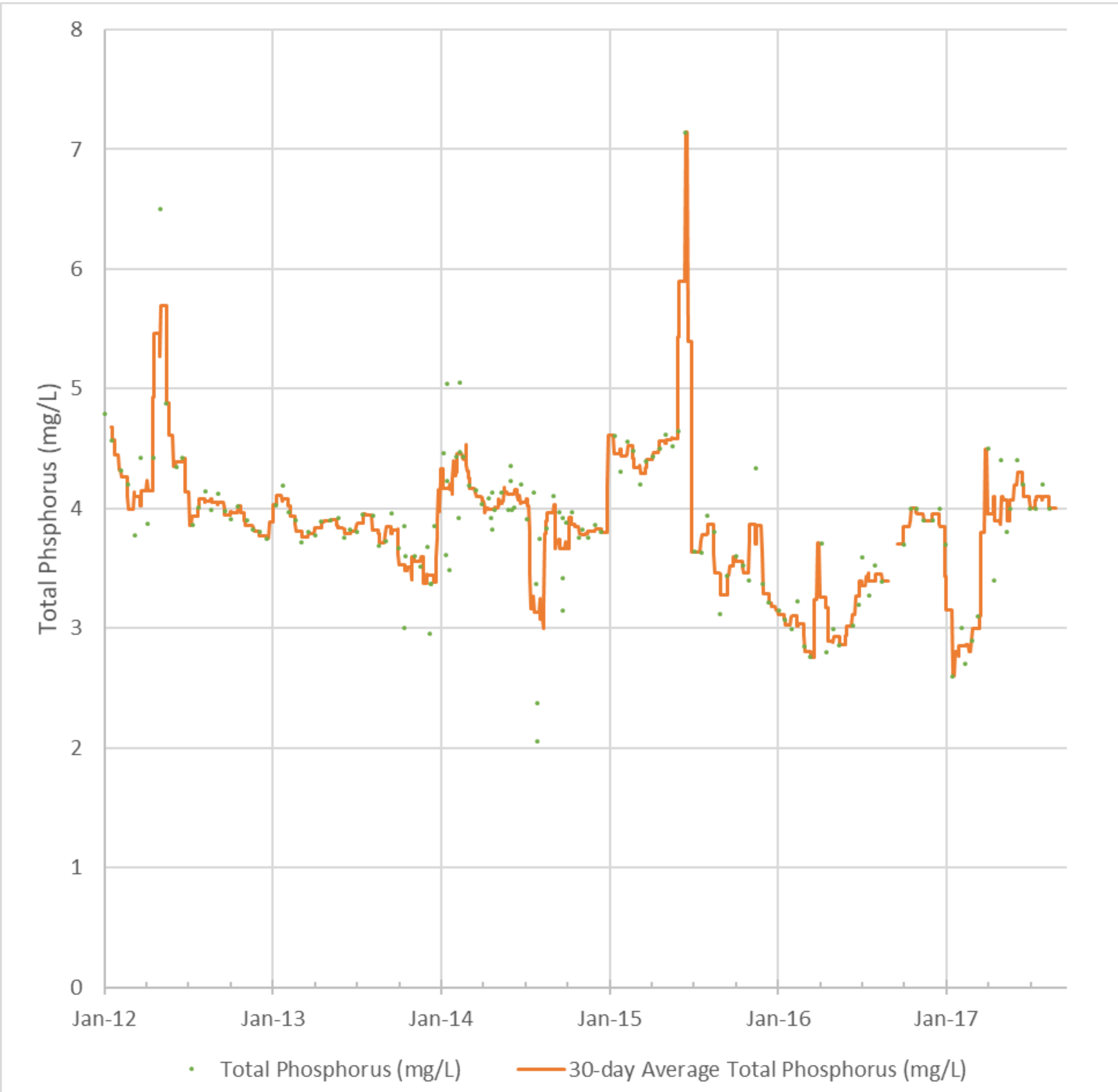
Figure 3-17
Ammonia Effluent Concentration Summary



3.7.4 Total Phosphorus

The WWTP total phosphorus effluent concentration is summarized in **Figure 3-18**. The WWTP does not have a phosphorus limit and is not designed to remove phosphorus beyond that needed for biological growth in the secondary treatment system. The Permit does not currently have a phosphors limit.

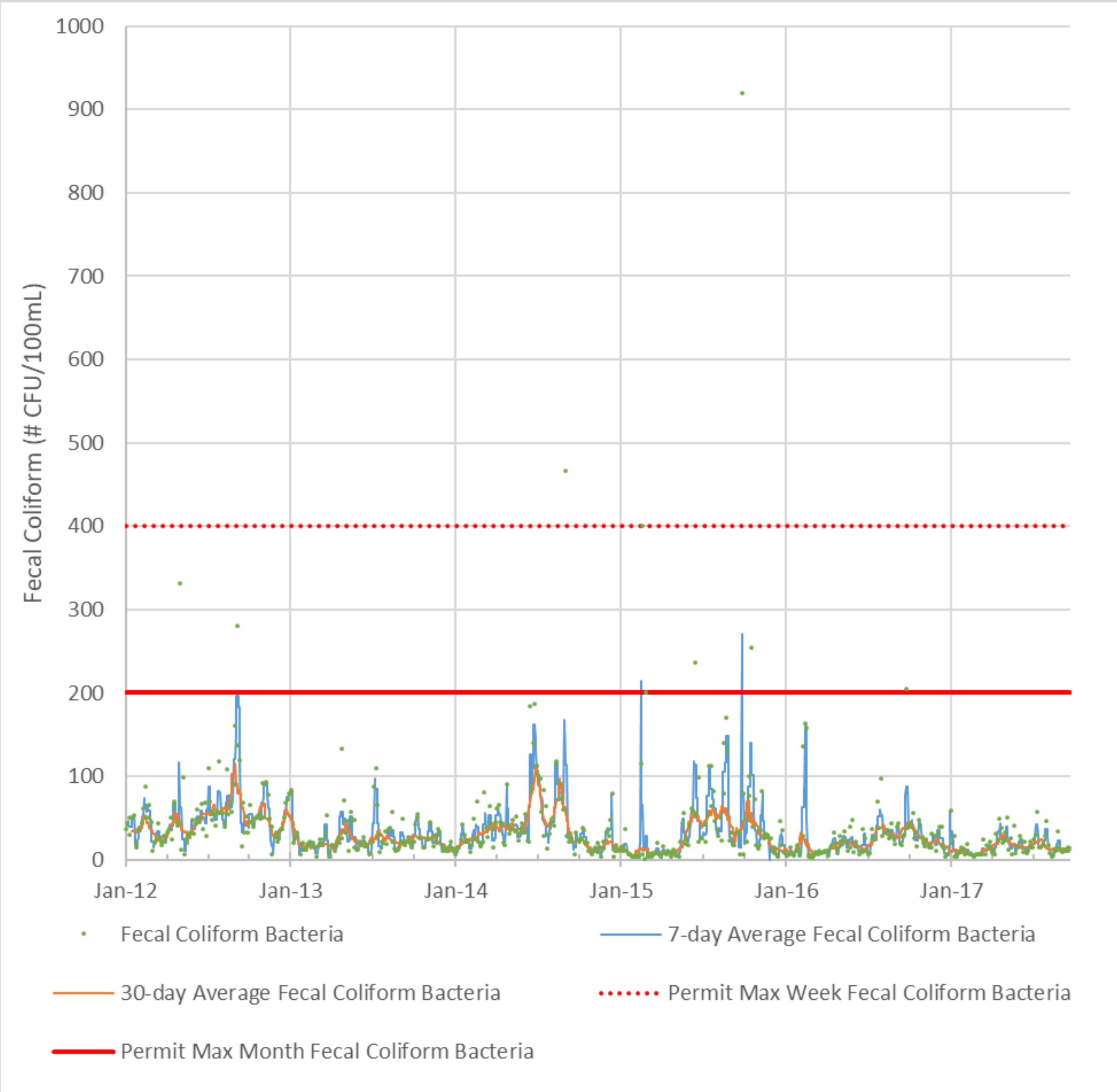
Figure 3-18
Effluent Total Phosphorus Concentration Summary



3.7.5 Fecal Coliform

The WWTP monthly and weekly fecal coliform are summarized in **Figure 3-19**. The disinfection system at the WWTP does a good job neutralizing the fecal coliforms in the WWTP effluent and has no reported violations in the last 5 years.

Figure 3-19
Fecal Coliform Effluent Summary

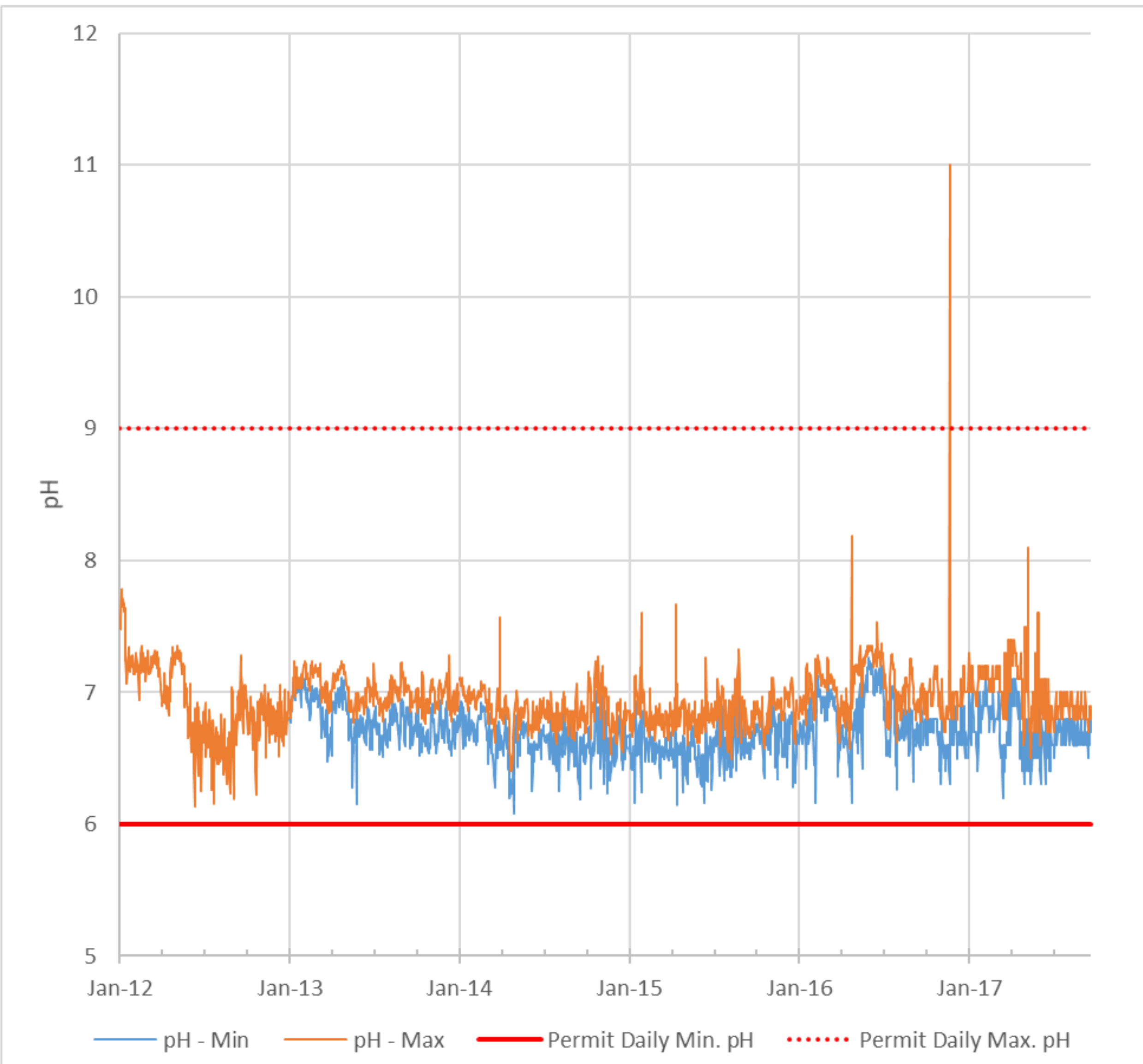


3.7.6 pH

The instantaneous WWTP effluent minimum and maximum pH levels are summarized in **Figure 3-20**. The WWTP generally keeps a good control on the pH of the wastewater and includes a lime and caustic feed system for pH control. This is necessary because the incoming wastewater does not have a high enough alkalinity level to cover the demands from both nitrification and the addition of ferric for CEPT.

The only permit exceedance in the last 5 years for pH was on November of 2016. This violation was reported to Ecology and were noted by Ecology as, "Operator error on pH adjust".

Figure 3-20
pH Effluent Summary



3.8 Summary of Current Flows and Load

The City's current annual dry weather industrial flow contribution to the wastewater system is approximately 15 percent of the total flow. The remainder of the flow consists of residential and commercial wastewater which together comprise a fairly typical residential wastewater. In the summer and fall since 2013, a large industrial discharger of wastewater has operated and discharged wastewater to the collection system and WWTP. The City is presently working on making lift station, force main, and Reuse Wastewater Facility system improvements that will allow for this discharger to reroute their discharge away from the municipal collection and treatment system in the next few years. When this discharger discontinues discharging to the collection system, the industrial component of the wastewater flow will decrease to approximately 5 percent For this reason, the influent characteristics have been determined with and without the large discharger, as summarized in **Table 3-11** and **3-12**, respectively. Future projections of wastewater flow and loads will be calculated based on **Table 3-12** without the large discharger. Section 2 and 3 of the City's Comprehensive Sewer Plan includes additional information on the City's industrial discharges.

In the future, the City's pretreatment program will gather additional information on industrial users through an industrial user survey which will be performed by the City's pretreatment program. This information will help to characterize the flows and loads from industrial users. The City will then be able to compare the collected data to this Plan and future planning documents to verify that planned upgrades meet the treatment needs of the City.

3.9 Summary of Current Population

The 2010 census placed the City population at 59,781. The US Census Bureau 2016 estimate of the City population was 71,618.

Table 3-11
2012 to 2017 Influent Wastewater Characterization – All Data

Load	Units	Annual Average	Max. Month	Max. Week	Max Day	Peak Hour[1]	Peak Instant.[1]
Flow	MGD	5.4	6.5	6.6	7.2	9.1	10.9
	Peaking	1.0	1.20	1.22	1.33	1.69	2.02
BOD	lb/day	12,678 *(282 mg/L)*	15,396	16,456	20,847	-	-
	Peaking Factor	*1.0*	*1.21*	*1.30*	*1.64*	-	-
TSS	lb/day	16,240 *(361 mg/L)*	21,871	26,714	32,684	-	-
	Peaking Factor	*1.0*	*1.35*	*1.64*	*2.01*	-	-
Ammonia	lb/day	2,044 *(45.4 mg/L)*	2,470	2,710	2,944	-	-
	Peaking Factor	*1.0*	*1.21*	*1.33*	*1.44*	-	-
Total Phosphorus	lb/day	385 *(8.5 mg/L)*	465	-	-	-	-
	Peaking Factor	*1.0*	*1.21*	-	-	-	-
Temperature	High °C[2]	19.9	24.6	25.8	26.1	-	-
	Low °C	19.9	13.0	12.8	12.7	-	-

Note:
Based on peak hourly and instantaneous flow data from the 2014 Comprehensive Sewer Plan
°C= Degrees Celsius

Table 3-12
2012 to 2017 Influent Wastewater Characterization – Without Industrial Discharger

Load	Units	Annual Average	Max. Month	Max. Week	Max Day	Peak Hour[1]	Peak Instant.[1]
Flow	MGD	4.8	5.3	5.4	6.3	9.1	10.9
	Peaking	1.0	1.11	1.13	1.31	1.90	2.27
BOD	lb/day	12,316 *(308 mg/L)*	14,147	15,656	18,993	-	-
	Peaking Factor	*1.0*	*1.15*	*1.27*	*1.54*	-	-
TSS	lb/day	14,994 *(375 mg/L)*	17,115	19,494	20,854	-	-
	Peaking Factor	*1.0*	*1.14*	*1.30*	*1.39*	-	-
Ammonia	lb/day	2,255 *(56.3 mg/L)*	2,470	2,710	2,944	-	-
	Peaking Factor	*1.0*	*1.10*	*1.20*	*1.31*	-	-
Total Phosphorus	lb/day	361 *(9.0 mg/L)*	449	-	-	-	-
	Peaking Factor	*1.0*	*1.24*	-	-	-	-
Temperature	High °C	17.0	20.7	21.2	21.4	-	-
	Low °C	17.0	13.0	12.8	12.7	-	-

Note:
1. Based on peak hourly and instantaneous flow data from the 2014 Comprehensive Sewer Plan

murraysmith

Section 4

Section 4

Existing Capacity Analysis

This section presents the methodology and results of the capacity evaluation completed for the City of Pasco's (City) existing Wastewater Treatment Plant (WWTP). Individual unit processes and overall treatment systems were evaluated using state and industry standard criteria as well as process and hydraulic modelling to identify capacity limits.

4.1 Design Criteria

The design criteria used in the treatment capacity analysis are summarized in **Table 4-1.** Ecology's Criteria for Sewage Works Design (Orange Book) sets the design standards for unit processes and operations at WWTPs in the State of Washington. The Design Condition Summary table from the Orange Book (Table G2-1) was used as the primary reference to determine the operational "Condition" that the various unit processes should be rated for. The Orange Book was also used as the primary reference to evaluate the "Capacity Limits" of the various unit processes under these conditions. Design criteria used that are either in addition to or different from the Orange Book are identified in the table and are based on:

- Stated capacity limits from existing equipment manufacturers
- Process modeling results.
- Field testing results.
- Capacity limits based on existing facility operational experience.
- Capacity based on original design documents.
- Washington Administrative Code (WAC)

Table 4-1
Unit Process Design Criteria

Unit Process	Parameter	Condition	Capacity Limit	Capacity Source
Screens	Flow Rate	Peak Inst.[1]	2 - 10.3 MGD & 1 - 7.5 MGD	Manufacturer Limit
Grit Chamber	Flow Rate	Max Day[2]	7.5 MGD per unit	Manufacturer Limit
Primary Clarifiers	Flow Rate	Peak Hour	Field Testing	HDR February 28, 2018[3]
Trickling Filter	BOD Loading	Max Week	40 lb /1K ft^3/day	Plant Operations[4]
Intermediate Clarifier	Overflow Rate	Peak Hour[5]	1,200 gpd/SF	Orange Book, Table T3-2
Aeration Basins	Solids Retention Time (SRT)	Weekly Avg	SRT ≥ 4 days	Plant Operations[6]
	Biochemical Oxygen Demand (BOD) Loading	Max Week	40 lb/ 1K ft^3/day	Original Plant Design and Process Modelling[7]
Aeration System	Blower Capacity	Peak Hour	14,550 Standard Cubic Feet per Minute (scfm)	Manufacturer Limit
	Diffuser Capacity	Peak Hour	13,376 scfm	Manufacturer Limit
Secondary Clarifiers	Solids Loading Rate	Peak Hour	22.9 lb/ SF/day	Orange Book p. G1-45, p. T3-16 & Process Modelling[8]
	Overflow Rate	Peak Hour	1,200 gpd/SF	Orange Book, Table T3-2
Ultraviolet (UV) Disinfection	Disinfection	Peak Day	3.75 MGD per bank	Manufacturer Limit
Hydraulic Backbone	Flow Rate	Peak Inst.	Containment loss or process upset	Hydraulic Modelling
Dissolved Air Floatation Thickener (DAFT)	Solids Loading Rate	Max Day	1.0 pounds per hour per square foot	Plant Operations[9]
Anaerobic Digestion	Solids Residence Time	Max Day	15-day minimum	WAC 173-308-170
Rotary Drum Thickener	Flow Rate	Max Day	200 gallons per minute (gpm) per unit	Manufacturer Limit
Drying Bed	Solids Loading Rate	Max Month[10]	15 pounds per square foot per year	Orange Book, Table S-3

Notes:

1. Not included in Orange Book Table G2-1. Treated the same as a conveyance channel or structure.
2. Not included in Orange Book Table G2-1. Max Day criteria conservatively selected.
3. Performance testing performed and documented by HDR in in February 28, 2018 Report (**Appendix 4-1**).
4. Original design capacity was 50 to 70 lb/1,000 ft^3/day. Plant staff have experienced odors and operational problems at loadings above 40 lb/1,000 ft^3/day. lb/ft^3/day = pounds per cubic feet per day.
5. Not included in Orange Book Table G2-1. Treated as a secondary clarifier due biological nature of solids.
6. Historical solids retention time has varied from less than 2 to up to over 8 days. Plant operations at SRTs less than approximately 3.5 days have resulted in unstable solids settling and plant performance.
7. Original design capacity was 6,110 lb/day (36 lb/1,000t ft^3/day) which is consistent with facilities designed to nitrify (20 to 40 lb/1,000 ft^3/day per Metcalf and Eddy, 2017). The plant seasonally nitrifies and operates dependably in this mode. The modelled 40 lb/1,000 ft^3/day is lower than typical for complete mix carbonaceous BOD removal only plants (50 to 100 lb/1,000 ft^3/day per Metcalf and Eddy, 2017).
8. Based on process modelling using 80 percent of loading from Daigger (1995) with 95 percentile sludge volume index (SVI) from the last year (150).
9. Orange Book Table S-2 gives solids loading rates in the 0.42 to 2.5 pounds per hour per square foot (lb/hr/SF) range. 1.0 lb/hr/ SF based on plant operational experience.
10. Orange Book Table G2-1 lists max day for "sludge digestion and dewatering equipment" which was used for the rotary drum thickener. Max month used for drying beds due to the duration of dewatering associated with this technology. The plant is in an arid climate which aids drying. The biosolids are also prethickened prior to sending to the drying beds.

4.2 Treatment Capacity

An analysis of the City's existing operational scheme was used to evaluate the potential capacity of the existing WWTP, along with the process criteria in **Table 4-2**, and the future flow and load peaking factors in **Table 3-8**. The WWTP treatment capacity analysis was performed with all unit processes online.

Table 4-2
Unit Process Capacity Criteria

Unit Process	Units	Operating Assumption
Screens	3	-
Grit Chamber	2	-
Primary Clarifiers	4	With Chemically Enhanced Primary Treatment (CEPT) (50 percent BOD Removal 80 percent Total Suspended Solids (TSS) Removal)
Trickling Filter	1	BOD Load 40 lb/1000 ft^3/day
Intermediate Clarifier	1	-
Aeration Basins	2	SRT is 4 days
Secondary Clarifiers	2	150 SVI
UV Disinfection	6 banks	-
DAFT	1	-
Anaerobic Digestion	2	Feed solids at 4.5 percent TS average Max VS Loading 0.15 lb/1000 ft^3/day 55 percent VS Reduction SRT is 20 days
Rotary Drum Thickener	1	-
Drying Bed	All	-

The results of the capacity analysis are summarized in **Table 4-3**. Each treatment process capacity was evaluated under flow/load conditions, average annual (AA), maximum month (MM), maximum week (MW), maximum day (MD), peak hour (PH), peak instantaneous (PI) flow, consistent with the capacity parameters listed in **Table 4-1**. Since different flow/load conditions are used to determine the capacity of the various unit processes, the peaking factors listed in **Table 3-2** were then used to adjust the results to common flow measure of MM for comparison purposes.

The hydraulic backbone analysis performed as part of the 2014 Comprehensive Sewer Plan determined that the only limiting WWTP conveyance hydraulic capacity of the WWTP up to 11.2 million gallons per day (MGD) Average Annual flow basis, was the outfall. Additional WWTP hydraulic analysis is summarized in **Appendix 4-2**. The hydraulic analysis of the WWTP outfall is summarized in **Appendix 4-3**.

Table 4-3
Unit Process Capacity Results in million gallons per day (MGD)

Unit Process	Parameter	MM	Capacity Limit
Screens	Flow	13.7	28.1 PI
Grit Chambers	Flow	12.7	15.0 MD
Primary Clarifier with CEPT	Flow	19.7	33.1 PH
Primary Clarifiers without CEPT	Flow	13.8	23.6 PH
Trickling Filter System	BOD Loading	2.7	2.7 MW
Intermediate Clarifier	Overflow Rate, Average	6.8	6.8 PH
Tricking Filter Pump Station	Flow	16.0	16.0 PI
Aeration Basins	BOD Loading	6.8	6.9 MW
Aeration System	Blower Capacity	7.6	13.0 PH
	Diffuser Capacity	7.0	12.0 PH
Secondary Clarifiers	Solids Loading Rate	6.5	11.2 PH
	Overflow Rate	9.9	17.0 PH
UV Disinfection	Disinfection	19.1	22.5 MD
Hydraulic Backbone (Outfall)	Flow	5.9	12.0 PI
DAFT	Solids Loading Rate	6.7	7.9 MD
Anaerobic Digestion with Recuperative Thickening	Solids Retention Time	7.2*	8.5 MD*
Anaerobic Digestion without Recuperative Thickening	Solids Retention Time	6.4*	7.6 MD*
Rotary Drum Thickener	Solids Loading Rate	8.0	9.5 MD
Drying Beds	Solids Loading Rate	9.2	9.2 MM

*After this Plan was essentially complete, the City discovered that the digester feed flowmeter was overestimating flows by 30 to 40 percent. Due to the late nature of this discovery and the fact that the addition of a third digester had been postponed beyond these capacity limit triggers due to the ability to obtain Class B biosolids with the use of the existing drying beds and the addition of mechanical dewatering; this Plan was not modified to account for this new information. The next facility plan that is scheduled prior to the addition of a third digester should evaluate existing digester capacity and expansion in more detail.

The trickling filter, intermediate clarifier and trickling filter pump station operate together essentially as a sidestream treatment process. Operations can change the amount of flow that is diverted to the system to modify the partial offload of the aeration basins. But, the pump station hydraulically base loads the system and therefore, no change occurs to the capacity based on peaking factors.

4.3 Reliability/Redundancy Review

This section of the technical memorandum presents the results of the reliability and redundancy evaluation that was completed for the City's WWTP. As defined by Ecology's *Criteria for Sewage Works Design Table G2-8*, the City's WWTP must meet Class II reliability requirements due to its effluent discharge to the Columbia River.

Table 4-4
Ecology's *Criteria for Sewage Works Design Table G2-8*

Reliability Class	General Requirements
I	These are works whose discharge, or potential discharge, (1) is into public water supply, shellfish, or primary contact recreation waters, or (2) as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted. Examples of Reliability Class I works are those with a discharge or potential discharge near drinking water intakes, into shellfish waters, near areas used for water contact sports, or in dense residential areas.
II	These are works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days). Examples of a Reliability Class II works are works with a discharge or potential discharge moderately distant from shellfish areas, drinking water intakes, areas used for water contact sports, and residential areas.
III	These are works not otherwise classified as Reliability Class I or Class II.

The Reliability Class II requirements listed in Section G2-9 of the Orange Book and the associated unit process and equipment loading reliability requirements are summarized in **Table 4-5** below, specific to the City's facilities.

Table 4-5
Redundancy and Reliability Capacity Results

Flow Basis	Redundancy and Reliability Requirements	Orange Book Source	Existing City WWTP Status
Mechanical Bar Screen	A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.	Table G2-9	Pass – The facility has three mechanically cleaned screens. Based on this criterion, the corresponding MM capacity is 10.1 MGD
Grit	None listed	None	NA
Primary Clarifier	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.	Table G2-9 & T2-2.2.9	Pass - City has four primary clarifiers.
Trickling Filter	The units shall be sufficient in number and size so that, with the largest- flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.	Table G2-9	Pass - With Trickling Filter offline, Aeration Basins become the remaining secondary treatment process.
Trickling Filter Recycle PS	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Table G2-9	Pass – The pump station has two identical pumps.
Intermediate Clarifier	None listed	None	NA
Aeration Basin	A backup basin will not be required; however, at least two equal-volume basins shall be provided. (For the purpose of this criterion, the two zones of a contact stabilization process are considered as only one basin.)	Table G2-9	Pass - The facility has two, equally-sized aeration basins.
Aeration Blowers	There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed.	Table G2-9	Pass – The system includes four installed blower units. Based on this criterion, the corresponding MM capacity is 5.7 MGD.
Air Diffusers	The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.	Table G2-9	Pass – The system has multiple diffuser zones that can be independently controlled. Based on this criterion, the corresponding MM capacity is 6.1 MGD.
Secondary Clarifier	The units shall be sufficient in number and size so that, with the largest- flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.	Table G2-9	Pass - The facility has two, equally-sized clarifiers.
UV Disinfection	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the total design flow.	Table G2-9 & T5-2.2.3	Pass - The UV system has multiple modules that can be independently controlled in two trains.
Primary Sludge Pumps	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Table G2-9	Pass – The pump station has two pairs of identical pumps and with largest out of service can handle peak flow.
Intermediate Sludge Pumps	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Table G2-9	Pass – The pump station has two identical pumps and with largest out of service can handle peak flow.
RAS Pumps	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Table G2-9	Pass – The pump station has three identical pumps and with largest out of service can handle peak flow.
WAS Pumps	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Table G2-9	Pass – The pump station has two identical pumps with an additional scum pump for redundancy. With the largest out of service, the system can handle peak flow
DAFT	None listed	NA	NA
Rotary Drum Thickener	None listed	NA	NA
Anaerobic Digesters	None listed	NA	NA
Sludge Holding Tank	None listed	NA	NA
Drying Beds	None listed	S-2.1.6 & Table S-3	NA
Electrical Power	Two separate sources or works-based generators.	G2-8.3 &Table G2-10	Pass - Two separate power grids are available to power the WWTP.

4.4 Existing WWTP Capacity Limits

Based on these results, with all unit processes online, the secondary clarifiers (6. 5 MGD MM Flow) were determined to be the most limiting portion of the WWTP due to treatment. The outfall (5.9 MGD MM Flow) is considered the limiting WWTP process due to hydraulics. The aeration system diffusers (5.7 MGD MM) are also limited based on reliability and redundancy. Other unit processes were shown to have a lower capacity but were not considered to control the overall WWTP treatment performance as discussed below.

- Trickling Filter - The trickling filter is only one part of the WWTP's existing secondary treatment system as its effluent is further treated in the aeration basin. The capacity listed for the trickling filter system is not considered limiting in and of itself because the trickling filter is a side stream secondary treatment process that only treats a portion of the total plant flow. All flow (that passed over the trickling filter and that portion bypassed around it) go through the aeration basins and the two unit processes work together to complete secondary treatment. The capacity listed in **Table 4-3** for the trickling filter is the side stream treatment capacity associated with BOD loading limits for the trickling filter. The ultimate secondary treatment capacity of the WWTP is based on the combined treatment capabilities of the trickling filter and the aeration basins.

Table 4-6 provides the WWTP design capacity flow, BOD and TSS associated with this capacity limit.

Table 4-6
WWTP Design Capacity

Constituent	Units	MM
Flow	MGD	5.7
BOD	lb/day	14,630
TSS	lb/day	17,810

Section 5

Section 5

Future Conditions

5.1 Introduction

This section reviews the conditions that will impact the development and management of the City of Pasco's (City) wastewater treatment plant (WWTP) systems over the next 20 plus years. These conditions include future population projections, associated wastewater flows and loading projections, as well as future regulatory requirements and permit limitations.

5.2 Service Population

Pasco is the county seat of Franklin County. The historical population for the City according to the US Census is shown in **Table 5-1**. The population of the City from 1890 to present is shown in **Figure 5-1**. Over the past 100 years, since 1910, the population has grown by an average of 3.4 percent per year. Between 2000 and 2016, the population has grown by an average of 5.1 percent per year and between 2010 and 2016 the growth was 3.1 percent.

Table 5-1
City of Pasco Population

Year	WWTP Service Area Population Estimate	Average Yearly Percent Growth
1890	320	-
1900	254	-2.3
1910	2,083	23.4
1920	3,362	4.9
1930	3,496	0.4
1940	3,913	1.1
1950	10,228	10.1
1960	14,522	3.6
1970	13,920	-0.4
1980	18,428	2.9
1990	20,337	1.0
2000	32,066	4.7
2010	59,781	6.4
2016 (estimate)	71,934	3.1

The development of future population growth and associated wastewater flow projections are a fundamental building block for WWTP facility planning efforts. To develop future population growth estimates, the following information were reviewed:

- Current and future service area boundaries
- Benton-Franklin Council of Governments regional planning information - estimates of how economic factors, socio-economic factors and regulatory mandates might impact where future growth might occur
- US Census Data and projections
- Other City planning documents: Comprehensive Sewer Plan (2014), Comprehensive Water System Plan (2017), Park, Recreation, & Forestry Plan (2016), Comprehensive Plan Update (2018)

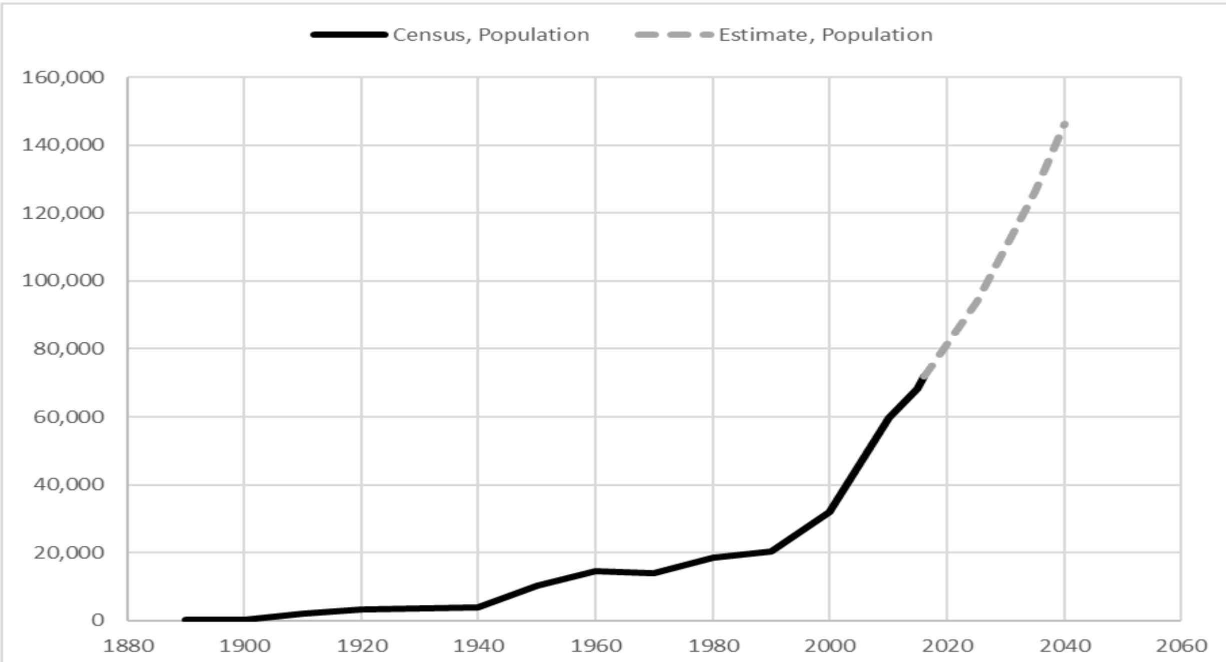
The City of Pasco has been one of the fastest, if not the fastest, growing city in the State of Washington for the past several years. After review and discussion with City staff, a population growth rate of 3 percent per year was selected by the City for planning purposes for this Plan.

Table 5-2 summarizes the population projections for the WWTP through year 2040. **Figure 5-1** graphically represents the historical and resulting projected population growth within the planning area. These population projections vary only slightly from the other documents listed above. In particular, the latest Comprehensive Plan Update (MF # CPA 2018-001) estimates a marginally slower population growth rate until 2039 when the Comprehensive Plan Update projection passes this Plan's projection. For comparison, the City's Comprehensive Plan include three overall population growth rate scenarios for a low, medium and high at 1.4 percent 3.5 percent and 3.2 percent. The minor differences in the various population projections have negligible impact on the timing of the needed facility improvements discussed in later sections of this Plan.

Table 5-2
City of Pasco Population Projection

Year	WWTP Service Area Population Estimate	Average Yearly Percent Growth
2016	71,934	-
2025	93,858	3.0
2035	126,137	3.0
2040	146,228	3.0

Figure 5-1
Population Projection



Intermediate yearly WWTP service area population estimates are used in this WWTP facility plan to calculate when WWTP unit process and operations are deficient. These values were calculated by use of a constant growth rate to interpolate between planning horizons.

5.3 Wastewater Flow and Load Projection

Projected future wastewater flows are used to determine the amount of remaining capacity, if any, in the WWTP's infrastructure as growth occurs as well as when facility improvements are needed. In addition to wastewater flows from City residents, other flow sources also must be considered.

The City presently has one significant industrial user (Grimmway Foods) that discharged up to 1.2 million gallons per day (MGD) of flow to the WWTP in the fall of 2017. The City's industrial reuse wastewater treatment facility is currently planned to be expanded and Grimmway and all future significant industrial user wastewater is planned to be sent to that facility. For planning purposes, no wastewater from significant industrial users is assumed to be treated at the WWTP and Grimmway's flow is shown as being removed from the system in 2021.

Other sources of wastewater flow (infiltration, inflow, light industrial, and commercial) are anticipated to grow proportional to residential growth with one exception, the Port of Walla Walla. The Port of Walla Walla presently has an agreement with the City of Pasco to discharge up to 0.3 MGD of wastewater to the City's sewage collection system. Their existing discharge is fairly small, so the entire 0.3 MGD flow is included in the projected wastewater flows and loads on top of the population-based projections.

Using these assumptions, the projected population in **Table 5-1**, and the existing influent flow and the load assumptions from **Table 3-2**; the wastewater flow and loads for the future was calculated. **Table 5-3 and 5-4** presents the projected flow and load to the WWTP for current and future conditions. **Figure 5-2** graphically presents the projected flows.

Table 5-3
Projected Wastewater Flow

Timeframe	Annual Average (MGD)	Maximum Month (MGD)	Max Week (MGD)	Peak Day (MGD)	Peak Hour (MGD)	Peak Instantaneous (MGD)
Existing (2017)	5.4	6.5	6.6	7.2	9.1	10.9
2025	6.4	7.0	7.2	8.3	11.9	14.1
2035	8.5	9.4	9.5	11.0	15.8	18.8
2040	9.8	10.8	11.0	12.7	18.3	21.8

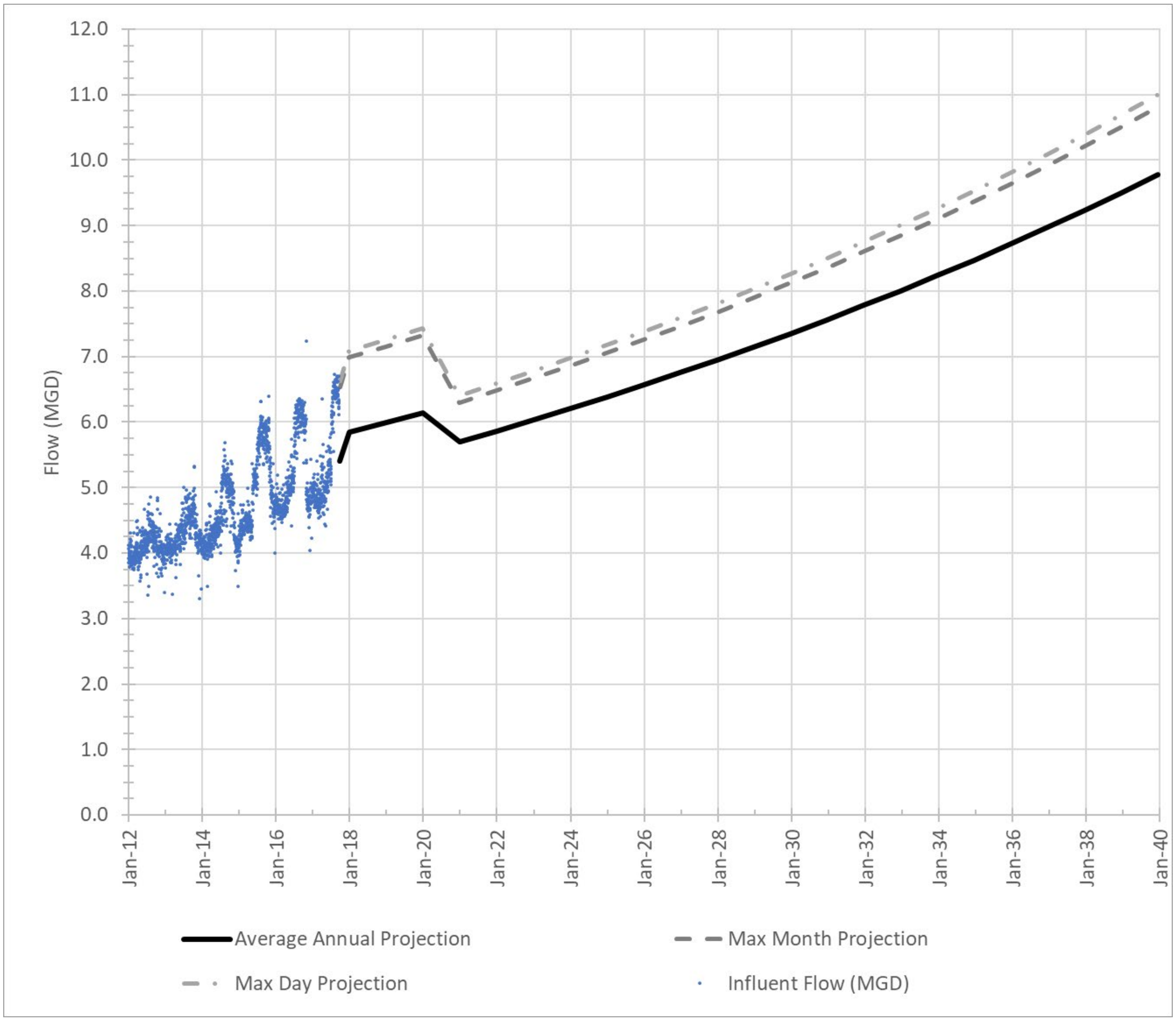
Table 5-4
Projected Year 2040 Wastewater Characteristics

Load	Units	Annual Average	Max Month	Max Week	Peak Day	Peak Hour	Peak Instantaneous
Flow	MGD	9.8	10.8	11.0	12.7	18.3	22.3
Flow Peaking Factor	--	1.0	1.11	1.13	1.30	1.87	2.23
BOD	lb/day	25,105 *308 (mg/L)*	28,805	31,877	38,672	-	-
	Peaking Factor	1.0	1.15	1.27	1.54	-	-
TSS	lb/day	30,566 *375 (mg/L)*	34,848	39,692	42,461	-	-
	Peaking Factor	1.0	1.14	1.30	1.39	-	-
Ammonia	lb/day	4,589 *56.3 (mg/L)*	5,045	5,518	5,994	-	-
	Peaking Factor	1.0	1.10	1.20	1.31	-	-
Total Phosphorus	lb/day	734 *9.0 (mg/L)*	914	-	-	-	-
	Peaking Factor	1.0	1.24	-	-	-	-
Temperature - High	High °C	19.9	24.6	25.8	26.1	-	-
Temperature – Low	Low °C	19.9	13.0	12.8	12.7	-	-

General Notes:

1. lb/day= pounds per day
2. mg/L= milligrams per liter
3. °C= degrees Celsius

Figure 5-2
Flow Projection



5.4 Future Regulatory Conditions

The basis for planning, analysis and design of wastewater facilities must include anticipated future regulatory requirements and trends facing the City for operating a wastewater collection and treatment system. This includes potential regulations with respect to collection, treatment and discharge requirements, the status of water quality in the Columbia River, regulatory trends, and discussions with the Washington State Department of Ecology (Ecology).

5.4.1 Federal Water Quality Standards

The Clean Water Act (CWA), 33 U.S.C. §1251 et seq. (1972), establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Under the CWA, The Environmental Protection Agency (EPA) has implemented pollution control programs for setting wastewater standards and water quality standards for all contaminants in surface waters. The aim of the act is to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." The act provides EPA and states with provisions for permitting, administrative and enforcement aspects to controls point and nonpoint pollution sources.

5.4.2 NPDES Permit Requirements

The CWA, and later amendments, provides the basis for the National Pollutant Discharge Elimination System (NPDES) permit program and the structure for regulating discharge pollutants from point sources to waters of the United States. The CWA can regulate pollutants through technology and water quality based effluent limits. Additionally, the CWA defines the establishment of pretreatment programs. Other regulations that can also apply to the NPDES program include Endangered Species Act, National Environmental Policy Act, National Historic Preservation Act, Coastal Zone Management Act, Wild and Scenic Rivers Act, Fish and Wildlife Coordination Act and Essential Fish Habitat Provisions.

The City operates its wastewater collection and treatment system under Ecology NPDES Waste Discharge Permit No. WA-004496-2 issued on June 29, 2010. The permit's written effective date is from July 1, 2010 to June 30, 2015 and is presently administratively extended pending a new permit. The permit includes wastewater discharge limits, monitoring requirements, reporting and record keeping requirements and other conditions to maintain in-stream water quality. A copy of the permit is included in **Appendix 2.1**. A fact sheet, explaining and documenting the decisions Ecology made in drafting the permit, is also included in **Appendix 2.2**.

5.4.3 Washington State Surface Water Quality Standards

The State of Washington's surface water quality standards are given in the Washington Administrative Code (WAC) Chapter 173-201A, the Water Quality Standards for Surface Waters of the State of Washington, and WAC Chapter 173-204, Sediment Management Standards.

WAC 173-201A establishes water quality criteria for surface waters of the State of Washington consistent with public health, public enjoyment, and the propagation and protection of fish, shellfish, and wildlife, pursuant to the provisions of chapter 90.48 of the Revised Code of Washington (RCW). The surface water quality standards establish specific numeric and narrative water quality criteria to protect existing and designated uses. Use designations for the Columbia River (from Washington-Oregon border, river mile 309.3, to Grand Coulee Dam, river mile 596.6), which includes the City's outfall, are defined in WAC 173-201A Table 602 as follows:

- Aquatic Life Uses: Salmonid spawning, rearing, and migration
- Recreational Uses: Primary Contact
- Water Supply Uses: Domestic Water, Industrial Water, Agricultural Water, and Stock Water

- Miscellaneous Uses: Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, and Aesthetics

Water Quality Standards submitted to EPA are not effective for CWA purposes until EPA reviews and approves them. In November 2016, EPA updated the Washington Water Quality Standards (WQS). The approved WQS include:

- 45 human health criteria contained in Table 240
- Narrative revisions at WAC 173-201A-240
- Revisions to the variance provision at WAC 173-201A-420
- Revisions to the compliance schedule provision at WAC 173-201A-510(4)

The Disapproved Water Quality Standards include:

- 143 human health criteria contained in Table 240 and associated footnotes
- Narrative language WAC 173-201A-240(3)
- Part of the variance provision at WAC 173-201A-420(5)(a)

The Table of Human Health Criteria Effective for Clean Water Act Purposes in Washington is included in **Appendix 5-1**.

5.4.4 Receiving Water Conditions – 303(d) List

The City's WWTP discharges to the Columbia River at river mile 327.6 of the McNary Pool reach of the river, typically referred to as Lake Wallula. The Federal Clean Water Act (Section 303(d)) and federal regulation 40 CFR Part 130.7 require states to develop a 303(d) list. The primary purpose of the 303(d) listing is to describe the health of rivers, coastal waters, estuaries and lakes. Per the CWA all states, every two years, are to perform a water quality assessment and develop lists of impaired waters that do not meet water quality standards. Section 303(d) of the CWA establishes a process to identify and clean up polluted waters.

A review of the current Water Quality Assessment (2016 EPA approval) identified 52 assessment listings for the Columbia River from northwest of the City to the McNary Dam in the seven assessment unit IDs in the vicinity of the WWTP. Due to their proximity to the City's current and potential future treated wastewater outfalls, these areas of impaired water have the potential to impact the discharge limits in the City's NPDES permit. Detailed 303(d) information in the area of the WWTP discharge is provided as part of the Water Quality and Tier II Antidegradation Study provided in **Appendix 5-2.** A summary is provided below.

5.4.5 Category 4a – Has a Total Maximum Daily Load (TMDL)

The Ecology 303(d) listed water quality assessment includes Category 4a polluted waters that already have a TMDL. The Mid-Columbia River in the area of the WWTP has two TMDLs: Dioxin (1991) and Total Dissolved Gas (2004).

The Dioxin TMDL for the Columbia River Basin was approved in 1991. The area covered by this TMDL includes the Columbia River from the Pacific Ocean to the Canadian border. The primary source of dioxin is from manufacture of chlorinated herbicide, the combustion of domestic and industrial wastes, and the production of chlorine-bleach wood pulp. The TMDL did not assign waste load allocations to the municipal discharges. The WWTP is not required to test for dioxin. Dioxin is not typically present in municipal wastewater and therefore not likely to be present in the City's municipal wastewater effluent.

The EPA approved Washington's Department of Ecology submittal of the Total Dissolved Gas (TDG) TMDL for the Mid-Columbia River in 2004. The area covered by this TMDL includes the Columbia River Mainstem from the Canadian border to the Oregon/Washington border. The primary source of TDG pollution is hydroelectric dams and this TMDL has minimal impact on municipal wastewater discharges such as the City of Pasco's.

5.4.6 Category 5 – Polluted Waters That Require a TMDL

The Ecology 303(d) listed water quality assessment includes Category 5 Polluted waters that require a TMDL for Temperature, 4,4-DDE and Polychlorinated Biphenyls.

The Columbia River Temperature TMDL was initiated by EPA in 2002 and was expected to be finalized by May 2003. However, due to public concerns regarding the EPA's conclusions regarding the impacts of hydroelectric dams and other technical issues, the TMDL has been delayed indefinitely. The schedule for completing the TMDL has not been established. However, if this TMDL is finalized, it could impact the City's discharge by limiting the allowable temperature over various periods of the year.

4,4-DDE is one of the breakdown products of DDT and is toxic, bioaccumulates, and harmful at low concentrations. 4,4-DDE is not expected to be in sewer collection systems or WWTP effluents because it has been banned from production and use in the United States to various extents since 1973. As a persistent organic pollutant, 4,4-DDE is typically found as a residual in the natural environment. 4,4-DDE is not likely to be present in the City's municipal WWTP effluent.

Polychlorinated biphenyl (PCBs) are a group of organic chlorinated compounds that are very persistent in the environment, bioaccumulate, are toxic and move between air, water and land. Ecology finalized its Chemical Action Plan for PCBs in 2015 which identifies, characterizes and evaluates PCBs in Washington. If PCBs are found in WWTP effluent, it is typically due to industrial dischargers. The City should review their existing pretreatment and source control programs with an eye towards reducing the compliance effort to meet future discharge limits for toxics as future TMDLs are written.

Ecology does not appear to have immediate plans to develop the 4,4-DDE or Polychlorinated Biphenyls TMDLs, but this process could be completed in the next five years. After the TMDL is established, it typically takes two permit cycles to gather effluent data, update facility plans, obtain necessary financing authority, design, and construct new treatment facilities to meet the TMDL allocated effluent limits for the wastewater treatment plants. Although the entire process could take three or more permit cycles before it is realized as an effluent limit, any changes required in the WWTP effluent due to the TMDLs could meaningfully impact the City's pretreatment program and/or the type and level of treatment at the City's WWTP. The development of future toxics TMDLs and rulemaking is one the City should follow closely.

5.4.7 Category 2 – Waters of Concern

The 303(d) listed Category 2 waters of concern are waters where there is some evidence of a water quality problem, but not enough to require production of a water quality improvement project (i.e. TMDL) at this time. The items listed in Category 2 are discussed below.

2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD TEQ) is a dioxin-like compound with a toxic equivalency similar to dioxin. Major contributors of dioxin and dioxin like compounds to the environment do not include WWTPs. Dioxin is also identified as Category 4A and the existing TMDL is discussed earlier in this section.

Aldrin – Aldrin is a persistent organochloride insecticide and is no longer manufactured in the United States and with most uses being banned in 1975. Aldrin is not expected to be in WWTP effluent.

Chlordane – is a chlorinated pesticide and was banned in 1988. Chlordane is a persistent organic pollutant that adheres to soil particles and enters groundwater slowly. It is not expected to be in WWTP effluent.

Hexachlorobenzene – is an organochloride that has been used as a fungicide and was banned globally under the Stockholm Convention on Persistent Organic Pollutants (signed in 2001 and effective on May 2004). Hexachlorobenzene has been listed as a pollutant of concern to EPA's Great Waters Program due to its persistence in the environment, potential to bioaccumulate, and toxicity to humans and the environment. It is not expected to be in WWTP effluent.

pH (Hydrogen potential) - pH is a measure of the acidity, and conversely the basicity, of the water. Natural variations in pH can come from photosynthesis and respiration. Carbon dioxide (CO_2) forms carbonic acid in water and is a major source of acid in the water. pH can vary throughout the day as CO_2 is absorbed during photosynthesis (occurring during the day) and emitted during respiration (occurring at night). Direct inputs from point sources can also influence pH as well. The WWTP typically has very good pH control and the effluent remains close to neutral.

Temperature, 4,4'-DDE and Polychlorinated Biphenyls (PCBs) are identified as both Category 2 and Category 5 near the area of the WWTP. The future Temperature TMDL, 4,4-DDE TMDL and PCB TMDL are discussed earlier in this section.

5.4.8 Antidegradation Analysis

The expanded discharge of this Plan requires authorization through NPDES and must comply with antidegradation standards. **Appendix 5-2** has been prepared to address the Tier II Antidegradation requirements. The upgrades to the process wastewater treatment train for the facility expansion are detailed later in this Plan.

The modeling and calculations in Appendix 5-2 show that the estimated future discharges in this Plan will not cause a "measurable change" in water quality at the chronic mixing zone boundary, as defined by WAC 173-201A-320(3) or will improve water quality. In addition, the proposed treated effluent discharge will not violate the water quality standards for acute or chronic conditions. This Study demonstrates that the proposed expanded discharge along with the improved wastewater treatment train, as described, complies with the intent of the antidegradation standards regulations and will not cause measurable degradation and will improve water quality of the Columbia River.

5.4.9 Anticipated Future Regulatory Conditions

Based on discussion with Ecology staff and email communication from Diana Washington, Ecology on September 26th, 2017, future regulatory condition factors to consider are summarized below.

1) Water Quality Policy 1-11 is the guiding policy that Ecology uses to assess water quality data, determine if water bodies are polluted, and decide if further action is needed. Ecology is conducting a public review and comment period to Draft Policy 1-11 Revisions with revisions to the draft available for a public review and comment from February 12th through March 28th, 2018. The future schedule is not known. Revision to the Water Quality Policy 1-11 will have to be finalized before the new assessment moves forward and this policy is one the City should follow closely.

2) The projected increase in flow over the next 20 years and the expanded WWTP capacity, will require a Tier II Antidegradation evaluation as part of this WFP. This is analyzed further in this section.

3) The EPA prepared the Total Maximum Daily Loading to Limit Discharge of 2,3,4,8-TCDD (Dioxin) to the Columbia River Basin in 1991. The TMDL did not assign Waste Load Allocation (WLA) to the municipal discharges but makes recommendations for setting allocations from the remaining unassigned available load. It is not yet known how this will be applied to the City's new NPDES permit. When Ecology begins writing the new permit, the writers will review the TMDL and will incorporate any TMDL requirements into the permit.

4) There are several category 1 and 2 water quality listings identified in the area of the WWTP discharge. These are analyzed and discussed further in this section and associated appendices.

5) The Category 5 listings for the Columbia River at the outfall and downstream of the outfall include Temperature, 4,4-DDE, and Polychlorinated Biphenyls. These are analyzed and discussed further in this section and associated appendices.

6) Both Dioxin and PCBs are known to exist in some wastewaters. While these chemicals have not been in the City's WWTP effluent and the City is not currently required to treat for them, there is potential for them to be included in wastewater treatment plant permits in the future. Neither of these chemicals are used or generated at treatment plants. Rather, they can occur in wastewater due to discharges into sewer collection systems which ultimately make their way to WWTPs. If these constituents are added to future discharge permits, then the City should look to update its pretreatment and source control program. It also may need to modify and update its capital improvement plan if advanced treatment techniques are required.

7) Changes due to the new water quality standards promulgated by the EPA November 2016.

5.4.10 Expected Future Discharge Standards

Based upon a review of the Ecology 303(d) listed water quality assessment, the Tier II Antidegradation Evaluation, and discussions with Ecology Staff; the new discharge permit is expected to be issued in 2019/2020. Treatment level will remain largely unchanged.

It should be noted that statewide trending for discharge permits includes various levels of water quality and source control testing beyond what existing permit holders have experienced in the past. The City should review its pretreatment program and source control programs with an eye towards reducing the compliance effort to meet future discharge limits for toxics. While the permit conditions that will result from current rulemaking efforts are far from clear, the evidence points toward more stringent standards. Involvement with the rulemaking process will help the City achieve compliance flexibility and reasonable compliance schedules for any required pretreatment program, source control program, or WWTP facility changes that may become necessary in the future.

5.5 Expected Deficiencies During the Planning Horizon

Table 5-5 provides a summary of the WWTP unit processes and operations that are expected to be deficient within the planning horizon. This table combines the analysis completed in Section 4 and earlier in this section to determine the reason for a deficiency (either capacity or reliability and redundancy) and what maximum month flow the deficiency will present itself.

Table 5-5
Overall Capacity Results

Unit Process	Reason	MM Flow at Deficiency (MGD) [1]
Aeration System (Blowers)	R&R	5.7
River Outfall	Capacity	5.9
Aeration System (Diffusers)	R&R	6.1
Secondary Clarifiers	Capacity	6.5
DAFT	Capacity	6.7
Aeration Basins (BOD Load)	Capacity	6.8
Anaerobic Digestion with recuperative thickening	Capacity	7.2[2]
Rotary Drum Thickener	Capacity	8.0
Drying Beds	Capacity	9.2
Influent Screens	R&R	10.1

Note:

1. Actual timing of projects is shown in **Section 8** and may vary in timing due to project organization of improvements, City redundancy concerns, and/or changes in capacity as each improvement is completed.
2. After this Plan was essentially complete, the City discovered that the digester feed flowmeter was overestimating flows by 30 to 40 percent. Due to the late nature of this discovery and the fact that the addition of a third digester had been postponed beyond these capacity limit triggers due to the ability to obtain Class B biosolids with the use of the existing drying beds and the addition of mechanical dewatering; this Plan was not modified to account for this new information. The next facility plan that is scheduled prior to the addition of a third digester should evaluate existing digester capacity and expansion in more detail.

5.6 Reserve Capacity

The City plans to build and increase the WWTP reserve capacity by implementing the capital improvements projects as documented in **Section 6**, **7** and **8** of this Plan. Further, the City intends to provide Orangebook reliability and redundancy WWTP as a minimum and oftentimes more conservative criteria for the WWTP as documented in **Section 6**, specification **Appendix 6-2**.

Section **6**

Section 6

Liquid Stream Alternatives

This section reviews the City of Pasco (City) Wastewater Treatment Plant (WWTP) liquid stream improvement alternatives considered to improve and expand the plant through the 20-year planning period. Previous sections of this Facility Plan detail the City's existing WWTP processes, capacities, and their condition. Projected increases in flow and loading to the WWTP will impose additional stresses on the WWTP and one day will affect the City's ability to consistently achieve the required effluent quality. This section evaluates the expected treatment performance, improvements, upgrades, operations and develops potential alternatives to sustain the facility.

6.1 Upgrades and Alternatives

The deficiencies noted in Table 5-6, Pasco specific reliability and redundancy requirements, and potential upgrades and alternatives were reviewed with City staff in workshops to determine the scope of work needed at the WWTP and which upgrade alternatives were favored. Appendix 6-1 summarizes the complete list of alternatives considered in the process. Appendix 6-2 summarizes the City's desired reliability and redundancy for components at the WWTP. The alternative workshops are included in Appendix 6-3 and Appendix 6-4, for reference. Although the components associated with some of the alternatives may be dependent on each other, for simplicity they were considered separately. Each alternative was developed for the 2040 planning horizon flow and load to the WWTP.

Table 6-1 provides a summary of the liquid treatment process alternatives, deemed viable after the initial screening effort by the City and project team.

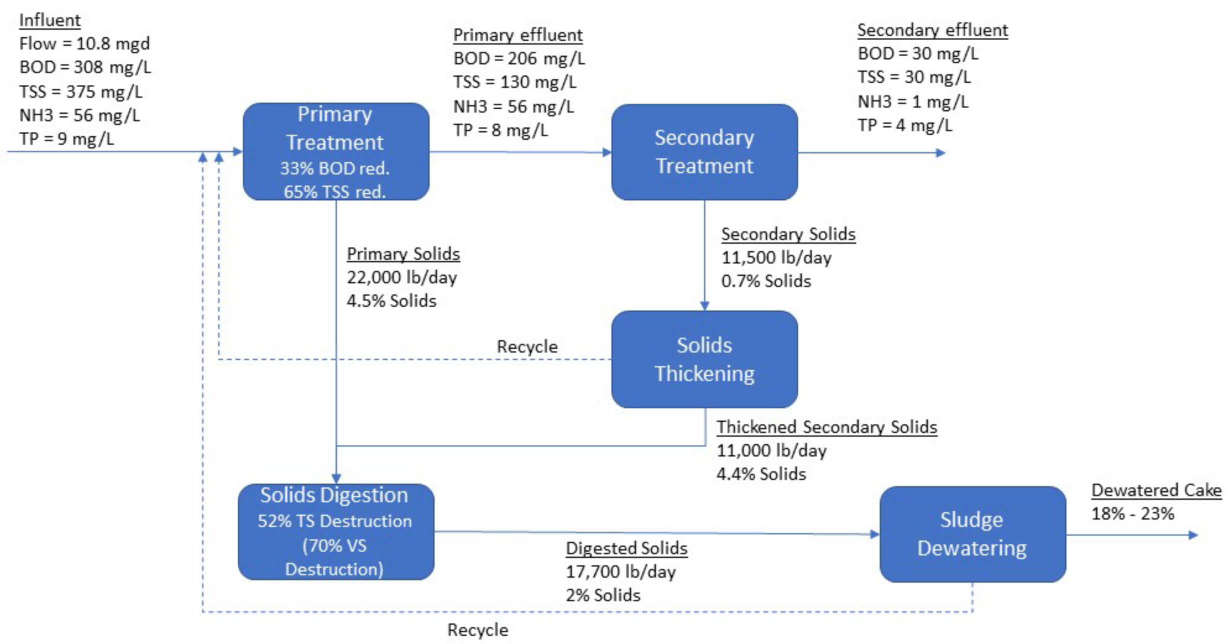
Table 6-1
Liquid Treatment Alternatives

Alternative Number	Alternative Name	Alternative Description	Deficiency Addressed
PRE-1	Screening No Action	Continued use of existing screens	None
PRE-2	Expand Screening	Expand headworks and with fourth perforated plate screen	Screen
SEC-1	Secondary Treatment No Action	Continued use of existing aeration basins	None
SEC-2	Activated Sludge - Plug Flow	Activated sludge with aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages	Secondary Treatment - Aeration Basin, Aeration System
SEC-3	Membrane Bioreactor (MBR)	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent	Aeration Basin Secondary Clarifier
SEC-4	Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth	Conventional activated sludge type basin with addition of suspended plastic media with biological growth to generate a higher total microbiological mass.	Secondary Treatment - Aeration Basin, Aeration System
SEC-5	Zee lung membrane aeration bioreactor – Fixed Growth	Conventional activated sludge type basin with submerged gas permeable membranes that support fixed film growth	Secondary Treatment - Aeration Basin, Aeration System
SEC-6	Trickling Filter/Activated Sludge	Plant flow treated over fixed film based trickling filter followed by conventional activated sludge	Secondary Treatment - Aeration Basin, Aeration System
SEC-7	BioMag Activated Sludge	Ballasted activated sludge	Secondary Treatment - Aeration Basin, Aeration System
SC-1	Secondary Clarifier No Action	Continued use of existing secondary clarifiers	None
SC-2	Secondary Clarifier 3 and 4	Expand secondary sedimentation with Secondary Clarifier 3 and 4-Gravity separation in quiescent tank	Secondary Clarifier
DIS-1	UV Disinfection No Action	Continued use of existing UV system	None
DIS-2	UV Disinfection Expansion	Expand UV system	Disinfection
OUT-1	Outfall No Action	Continued use of existing gravity outfall	None
OUT-2	Gravity Outfall	Effluent discharge through gravity pipeline and diffuser	Outfall

6.2 Design Criteria

The design criteria are the set of expected operational criteria used to develop and evaluate future improvements at the WWTP. These estimated criteria are based on WWTP operations to meet existing regulations, expected regulatory trends, and future changes in plant influent as discussed in **Section 5**. All references to future conditions refer to conditions up to the year 2040. **Figure 6-1** is a graphical summary of the design criteria, relative to the major treatment unit process areas. For planning purposes, nitrification is included in the process for operational stability but is not required by permit. Also, phosphorus removal is not required by permit but assumed to occur during growth of mixed liquor biomass.

Figure 6-1
Design Criteria Summary



6.3 No Action

The No Action alternative assumes the City continues to operate a unit process diligently and fund necessary maintenance and replacement through the study period. However, no significant changes or improvements to the existing unit process would be undertaken. Under this alternative, the WWTP would essentially remain unchanged and this alternative would not include any capacity expansion. Previous sections of this Facility Plan identified a number of areas of the treatment plant that will become capacity limited in the near and long term. As a result, secondary treatment would not consistently or reliability treat the incoming wastewater, hindering the treatment facility's ability to meet National Pollutant Discharge Elimination System (NPDES) permit requirements leading to fines and likely litigation. Therefore, the no action alternative for the treatment system over the planning period is not feasible due to capacity issues associated with the existing infrastructure. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

6.4 Cost Estimates

The probable costs for each alternative are based on average costs estimated by the 2018 RSMeans Heavy Construction Cost Data, recent City of Pasco (City) project bid tabs, City input, engineer experience, and local contractor and supplier costs. All costs were developed in 2018 dollars based on an ENR Construction 20-City Cost Index (CCI) of 11186 and should be escalated with the future CCI for use in project budgeting.

Project cost estimates were prepared in accordance with the guidelines of American Association of Cost Engineers (AACE) International, the Association for the Advancement of Cost Engineering. (*AACE International Recommended Practice No. 56R-08 Cost Estimate Classification System - As Applied for the Building and General Construction Industries - TCM Framework: 7.3 - Cost Estimating and Budgeting Rev. December 31, 2011*). AACE International's description of a Class 5 Estimate is quoted as follows:

> *Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. As such, some companies and organizations have elected to determine that due to the inherent inaccuracies, such estimates cannot be classified in a conventional and systemic manner.*
>
> *Class 5 estimates are prepared for any number of strategic business planning purposes, such as but not limited to market studies, assessment of initial viability, evaluation of alternate schemes, project screening, project location studies, evaluation of resource needs and budgeting, long-range capital planning, etc.*
>
> *Typical accuracy ranges for Class 5 estimates are -20% to -30% on the low side, and +30% to +50% on the high side, depending on the construction complexity of the project, appropriate reference information and other risks (after inclusion of an appropriate contingency determination). Ranges could exceed those shown if there are unusual risks.*

The true cost and resulting feasibility of a planned project will depend on the actual labor and material costs, competitive market conditions, site conditions, final project scope, implementation schedule, continuity of personnel, and other variable factors. Therefore, the actual unit project costs will vary from the estimates presented here. Because of these factors, project feasibility, benefit-to-cost ratios, risks and funding must be carefully reviewed prior to making specific financial decisions or establishing project-specific budgets.

The project costs presented in this Facility Plan include estimated construction costs and allowance for contingencies, permitting, legal, administration and engineering fees. Project costs are based on the preliminary concepts and layouts of the system components. The construction cost basis for each alternative includes the sum of materials, labor, equipment, mobilization, contractor's overhead and profit, tax, and contingency for each project. At the planning level of an engineering project, a contingency should be applied to cover the cost of uncertainties in the estimate. These uncertainties include unknown details of the project not covered in other costs, changes in site conditions and variability in the bidding climate. A state and local sales tax was also included as part of the construction cost.

The present worth of the 20-year present worth of differential Operations and Maintenance (O&M) costs are included for each alternative. This cost includes differential O&M costs compared against a baseline alternative to determine relative increased or decreased O&M cost. This includes costs for items such as electricity (pumps, fans, and blowers), consumable chemicals, supplies, and repainting components. Detailed capital cost opinions of the alternatives are included in **Appendix 6-5**.

6.5 Water Reclamation and Reuse

Water reclamation and reuse is a concept gaining considerable recognition in Washington as both a treated wastewater discharge and a water supply option alternative. Reclaimed water can provide an alternative water source for non-potable applications that would otherwise be limited by traditional water supplies. Wastewater effluent reuse can also provide opportunities for an overall decrease in pollution and the ability to meet more stringent water quality requirements when it reduces or removes treated wastewater discharges to sensitive surface waters.

The Washington State Department of Health and Ecology oversee the state's reclaimed water use. In 1992, the State passed the Reclaimed Water Act (Revised Code of Washington (RCW) 90.46 Reclaimed Water Use). Reclaimed water is also covered by WAC 173-219 Reclaimed Water. In 1997 Washington State Department of Health and Ecology published the Water Reclamation and Reuse Standards. This act ensures that reclaimed water supplies are adequate, save and readily available to supplement existing water supplies.

The cities of Pasco, Kennewick, Richland and West Richland use their effluent flow from their wastewater plants to the Columbia River as a mitigation factor for their Quad City Water Right S4-30976. Their mitigation efforts are subject to the 1990 Federal Biological Opinion of one gallon of water withdrawn to one gallon of water returned. To remove the City from that process and use their effluent flow elsewhere would require an approval from the other three cities and possibly jeopardize the mitigation requirements for the water right. This could also jeopardize their use of the Quad City Water Right in that the City is a major user of the water right due to the demands on their system for potable water. Large land areas for agricultural use are several miles from the WWTP site and the land is either currently not irrigated or is irrigated with untreated surface water delivered from local irrigation districts or treated wastewater from local industries. Although substituting WWTP effluent for untreated surface water for irrigation would result in a reduction of water diverted from the Columbia River, the potential restrictions to crop production, potential public access limitations, impact on the Quad City Water right, and estimated cost of treatment/transport/ pumping of water would make this alternative infeasible. As such, water reclamation and reuse was not considered a viable alternative for evaluation in this plan.

6.6 Preliminary Treatment Alternatives

6.6.1 PRE-1 Screening No Action

Under this alternative, the existing screening system would remain unchanged: two perforated plate screens and one reciprocating rake screen in operation. The screening system will reach capacity near the end of the planning horizon of this facility plan. As the screening process reaches capacity, loss of containment and spilling could occur. Additionally, carryover of material will likely occur and buildup further in the WWTP causing increased O&M time and cost. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with continued use of the existing infrastructure and negative impacts on dependent unit processes.

6.6.2 PRE-2 Headworks Expansion

Expanding the existing headworks with a fourth perforated plate screen, similar to the two existing perforated plate screens, will increase the capacity of the screenings process beyond the planning horizon requirement. The replacement will also provide the WWTP staff with additional operational options. The fourth screen is included in an individual channel south of the existing headworks within a building expansion to the south.

Table 6-2
Preliminary Treatment Alternatives Cost Estimate

Alternative Number	Alternative Name	Total Project Cost	20-year Differential Operation and
PRE-1	Screening No Action	$0	Not Quantifiable[1]
PRE-2	Headworks Expansion	$3,270,000	$0 (baseline)

Note
1. Operation and Maintenance costs are Not Quantifiable because the no action alternative will lead to permit violations, fines and litigation which are not definable in cost at this time but would be a significant cost to the WWTP budget. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

6.6.3 Grit Removal No Action

The grit removal system has sufficient capacity through the planning period. No significant changes from existing conditions are expected.

6.7 Primary Treatment Alternatives

Under this alternative, the existing primary treatment plant operations would remain unchanged. The primary treatment system has sufficient capacity through the planning period. No significant changes from existing conditions are expected.

6.8 Secondary Treatment Alternatives

There are many alternatives available to expand the secondary treatment capacity of the WWTP. The following alternatives were developed for consideration for this facility plan.

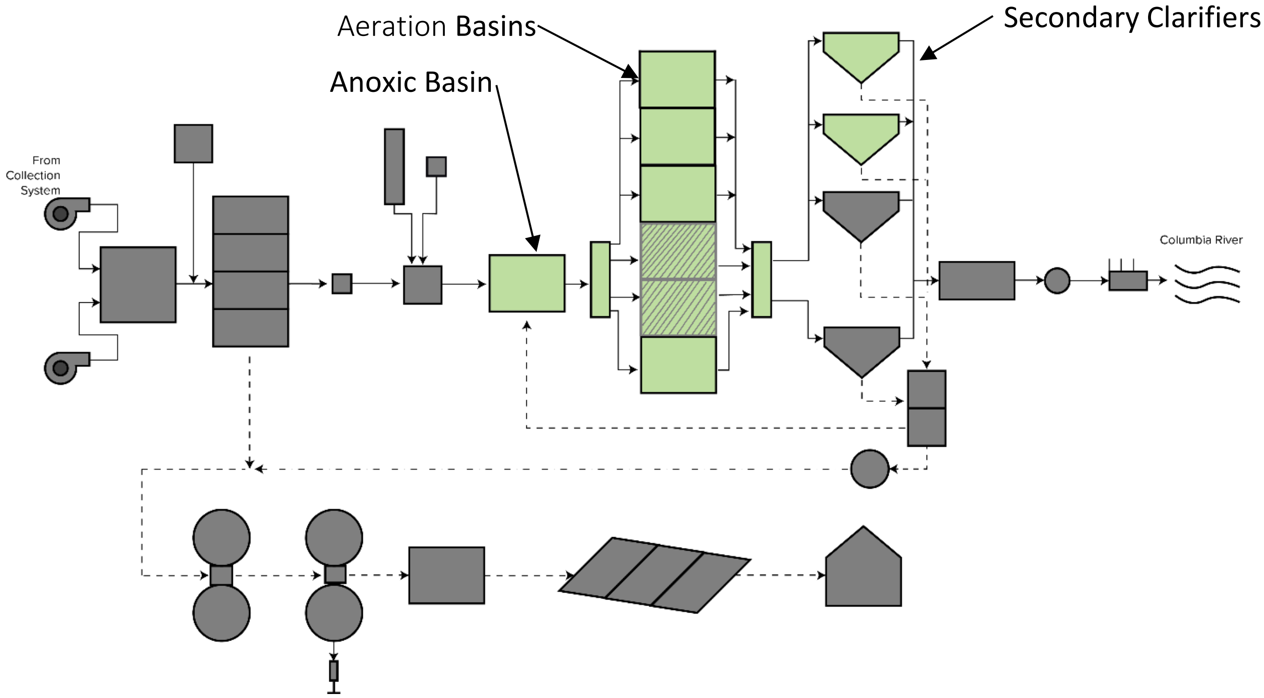
6.8.1 SEC-1 Secondary Treatment No Action

Under this alternative, existing secondary treatment plant operations would remain unchanged: the trickling filter and aerations basins provide the secondary treatment. The combination of the trickling filter and aeration basins have reached their capacity. Plant staff are only able to take an aeration basin offline during the summer months to maintain equipment and appurtenances. If an aeration basin or the trickling filter had to be taken offline in the winter, the plant would have difficulty meeting treatment permit conditions. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with continued use of the existing infrastructure and negative impacts on dependent unit processes.

6.8.2 SEC-2 Activated Sludge - Plug Flow

This alternative builds on the existing activated sludge process at the WWTP. It includes four new aeration basins (2.4 million gallons (MG) total new volume), two new anoxic selector basins (0.6 MG total new volume), a new blower building and blowers, process control systems, sensors, probes, dewatering pumps, foam skimming equipment, mixed liquor recycle pumps, and site piping improvements. The existing aeration basins will be rehabilitated and refurbished with new baffle wall system and aeration diffuser system. The new aeration basins are planned to be similar to the existing two aeration basins for consistency. The new anoxic basins can be extensions of the existing aeration basins or standalone basins. The existing trickling filter and intermediate clarifier will also be demolished as part of this alternative. A major benefit of this alternative is the ability to add similar process elements to what is already constructed at the WWTP and operation staff's familiarity with the process. This alternative could also be phased into multiple construction projects over the planning horizon. The schematic is of this alternative is included in **Figure 6-2**.

Figure 6-2
Activated Sludge - Plug Flow Schematic



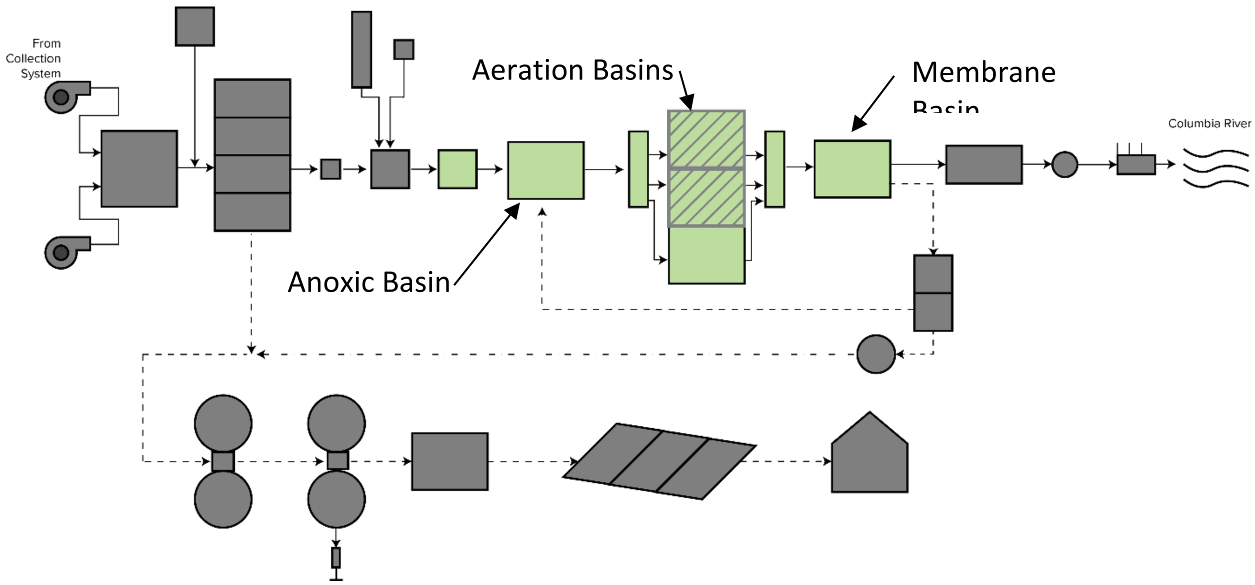
6.8.3 SEC-3 Membrane Bioreactor (MBR)

Membrane Bioreactor (MBR) technology builds on secondary treatment where the membrane (microfiltration) replaces the secondary clarifiers for solids separation. This physical treatment relies on the membrane removal of water with exclusion of particles larger than the membranes pore size. A benefit of the membrane is reduced footprint because the mixed liquor suspended solids concentration can be increased, the physical space required for the facility is reduced, and secondary clarifiers are no longer needed.

Converting the existing aeration basins to a membrane bioreactor or constructing a parallel MBR train would allow both expanding the capacity of the existing aeration basins as well as freeing up space for more basins by eliminating the need for secondary clarifiers.

This alternative requires the addition of a fine screen facility, an additional aeration basin, new anoxic selector basins, membrane bioreactor basins with support building, a new blower building and blowers, process control systems, sensors, probes, dewatering pumps, foam skimming equipment and site piping improvements. The schematic is of this alternative is included in **Figure 6-3**. The existing trickling filter and intermediate clarifier will also be demolished as part of this alternative. A major benefit of this alternative is the elimination of secondary clarification from the process, a higher level of treatment and the reduction in the number of aeration basins. Disadvantages include high cost to operate, maintain and replace units in the membrane process.

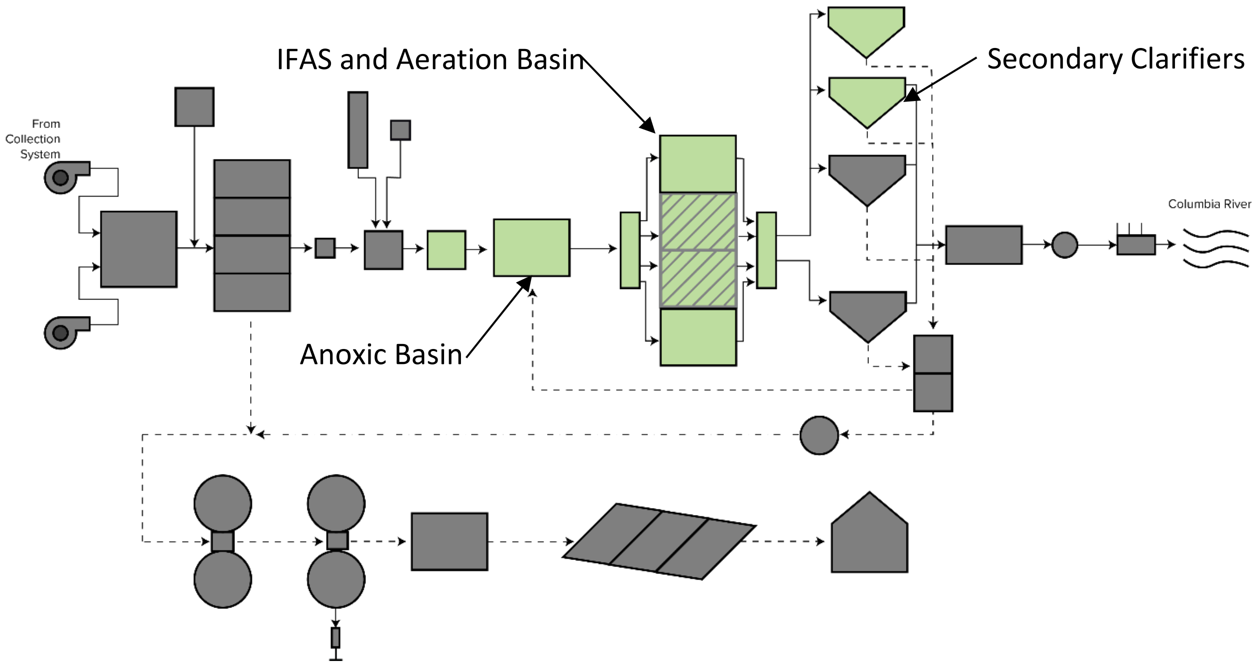
Figure 6-3
Membrane Bioreactor Schematic



6.8.4 SEC-4 Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth

Integrated Fixed-Film Activated Sludge (IFAS) process builds on traditional activated sludge and adds plastic media to the aeration basins. A biofilm grows on the media which increases the biomass in the aeration basins and supports nitrification. Traditionally, IFAS has allowed nitrification to be maintained through cold winter months. Additionally, the IFAS Process allows a smaller footprint when compared to activated sludge alone. The WWTP does not have either of the drivers that cause other municipalities to add IFAS to their process: strict nitrification limits or space limitation. An advantage of this alternative is fewer new basins are required. However, a disadvantage for this alternative is a high upfront capital cost. Multiple IFAS vendors were consulted for process sizing and vendor package budget solicitation. Each potential IFAS process included a mix of reusing existing basins and new basins. This alternative includes a fine screen facility, expanded aeration basin trains with aerobic stages, anoxic selector stages and IFAS media stages. It also includes a new blower building and blowers, process control systems, sensors, probes, dewatering pumps, foam skimming equipment and site piping improvements. The existing trickling filter and intermediate clarifier will also be demolished as part of this alternative. The schematic is of this alternative is included in **Figure 6-4**.

Figure 6-4
Internal Fixed Film Activated Sludge Schematic



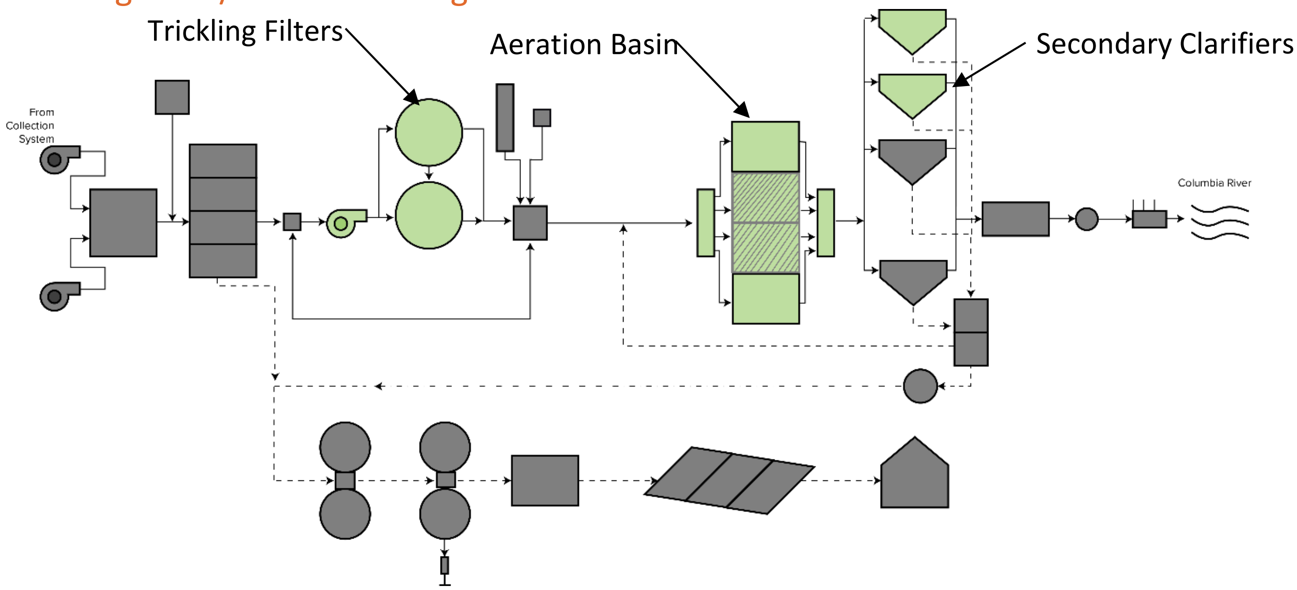
6.8.5 SEC-5 Zee Lung Membrane Aeration Bioreactor – Fixed Growth

The Zee Lung process include a membrane facility, but rather than pulling water through the membrane, a portion of the aeration basins is aerated through the membrane. A biofilm then grows on the membrane and achieves high efficiency aeration and simultaneous nitrification and denitrification. This process very efficiently utilizes the energy invested in the membrane aeration. This alternative was initially considered by the City but was eliminated during initial screening due to process complexity, added unit processes/operations, known high capital cost and recommendation of equipment supplier.

6.8.6 SEC-6 Trickling Filter/Activated Sludge

This alternative is essentially an expansion of the existing operational scheme of the WWTP with increased trickling filter and aeration basins capacity. This alternative could be phased into multiple small projects. It includes two new trickling filters with engineered media, three new aeration basins (1.8 MG total new volume), a new blower building and blowers, process control systems, sensors, probes, dewatering pumps, foam skimming equipment and site piping improvements. The existing trickling filter and intermediate clarifier will also be demolished as part of this alternative. The proposed trickling filters would be smaller in diameter but much taller than the existing trickling filter and more highly loaded. The schematic is of this alternative is included in **Figure 6-5**. This alternative has the highest potential for investing in what one day could be a lost asset if a trickling filter is not compatible with new NPDES permit requirements. This alternative provides less operational flexibility in the future to modify the process for nutrient removal: denitrification may not be feasible and enhanced biological phosphorus removal is not compatible with this process.

Figure 6-5
Trickling Filter/Activated Sludge Schematic

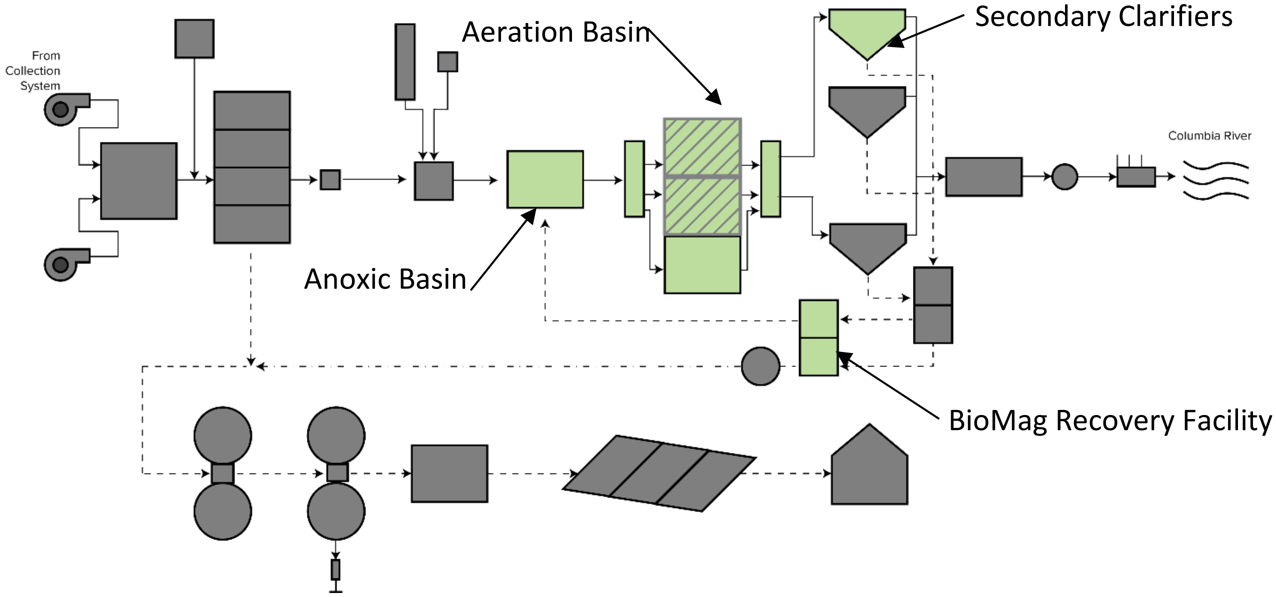


6.8.7 SEC-7 BioMag Activated Sludge

BioMag technology builds on the existing secondary treatment process with a magnetic ballasting agent (magnetite, Fe_3O_4) added to the mixed liquor of the activated sludge system. The ballasting agent provides enhanced settling in the secondary clarifiers and allows for much higher mixed liquor concentration and capacity of the aeration basins and secondary clarifiers. The ballasting agent is recoverable from WAS prior to WAS thickening in a shear mill and magnetic drum separator. However, some of the ballasting agent is lost and must be replaced leading to an ongoing operation cost. A major advantage for this process is reduction in the number of clarifiers and aeration basins. Disadvantages include additional number of processes and ongoing cost of ballasting agent. This alternative will also have a high upfront capital cost to construct a number of processes.

This alternative includes one new aeration basins (0.6 MG total new volume), two new anoxic selector basins (0.6 MG total new volume), BioMag process equipment and building, a new blower building and blowers, process control systems, sensors, probes, dewatering pumps, foam skimming equipment and site piping improvements. The existing trickling filter and intermediate clarifier will also be demolished as part of this alternative. The schematic is of this alternative is included in **Figure 6-6**.

Figure 6-6
BioMag Activated Sludge Schematic



6.8.8 SC-1 Secondary Clarifier No Action

Under this alternative, existing secondary clarifier operations would remain unchanged. The clarifier process is nearly at capacity. If the plant continues to operate with only the existing clarifiers, solids will begin to pass through the clarifiers into the effluent as flows increase. This will lead to difficulty meeting treatment permit conditions. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with the existing infrastructure.

6.8.9 SC-2 & SC-3 Secondary Clarifier 3 & 4

The previously discussed alternatives include the addition of a third and fourth secondary clarifier with the exception of the MBR and BioMag alternatives, which include zero and one new clarifier, respectively. The clarifiers considered are similar to the existing 95-foot secondary clarifiers. The secondary clarifier expansion will also include an expansion of the Return Activated Sludge (RAS) / Waste Activated Sludge (WAS) pump station to accommodate the clarifier addition.

6.8.10 Secondary Treatment Alternatives Composite Summary

The secondary treatment activated sludge process is a system that includes aeration basins, aeration system, secondary clarifiers, return activated sludge pumping, and waste activated sludge pumping. All parts are interrelated and must be evaluated together as composite solutions. Each alternative was analyzed independently to size processes and determine number of units. The results of this analysis were presented and discussed with the City at a workshop and a copy of the presentation is included in **Appendix 6-3**. **Table 6-3** summarizes the composite alternatives for secondary treatment at the WWTP. **Table 6-4** summarizes the estimate total project cost and differential life-cycle O&M cost for each composite secondary treatment alternative.

Table 6-3
Secondary Treatment Alternatives Summary

Alternative Number	Alternative Name	Aerobic Basin Volume (MG)	Anoxic Basin Volume (NG)	Secondary Clarifiers	Unique Elements
SEC-1	Secondary Treatment No Action	1.2	0	2	-
SEC-2	Activated Sludge - Plug Flow	3.6	0.6	4	Aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages
SEC-3	Membrane Bioreactor (MBR)	1.8	0.6	0	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent
SEC-4	Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth	2.5	0	4	Conventional activated sludge type basin with addition of suspended plastic media with biological growth to generate a higher total microbiological mass.
SEC-5	Zee Lung Membrane Aeration Bioreactor – Fixed Growth	2.29	0.25	4	Conventional activated sludge type basin with submerged gas permeable membranes that support fixed film growth
SEC-6	Trickling Filter/Activated Sludge ➢ Nitrification Only ➢ Nitrification and Denitrification	➢ 2.4 ➢ 3.0	➢ 0 ➢ 0.6	➢ 4 ➢ 4	Biological growth covered media filled tower with natural or force ventilated pore space that is dosed with wastewater on regular basis.
SEC-7	BioMag Activated Sludge	1.8	0.6	3	Magnetite added and bound to mixed liquor to create a rapidly settling sludge that allows increased MLSS concentration similar to MBR and IFAS options

Table 6-4
Secondary Treatment Alternatives Cost Estimate

Alternative Number	Alternative Name	Total Project Cost	20-year Differential Operation and Maintenance Cost
SEC-1	Secondary Treatment No Action	$0	Not Quantifiable[1]
SEC-2	Activated Sludge - Plug Flow	$33,720,000	$0 (baseline)
SEC-3	Membrane Bioreactor (MBR)	$45,830,000	$2,200,000
SEC-4	Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth	$43,380,000	$2,100,000
SEC-5	Zee lung membrane aeration bioreactor – Fixed Growth	Not determined	Not determined
SEC-6	Trickling Filter/Activated Sludge ➢ Nitrification Only ➢ Nitrification and Denitrification	➢ $26,570,000 ➢ $28,240,000	➢ $6,500,000 ➢ $885,000
SEC-7	BioMag Activated Sludge	$33,740,000	$5,400,000

Note
1. Operation and Maintenance costs are Not Quantifiable because the no action alternative will lead to permit violations, fines and litigation which are not definable in cost at this time but would be a significant cost to the WWTP budget. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

6.9 Disinfection Alternatives

6.9.1 DIS-1 UV System No Action

Under this alternative, the existing Ultraviolet (UV) system operations would remain unchanged. WWTP staff have had to operate with all UV modules online in the recent past to meet permit disinfection requirements. While the existing system has capacity based on nameplate rating, the installed system is nearing capacity due to actual conditions and operations. If the plant continues to operate with only the existing UV modules, disinfection may not meet permit requirements. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with continued use of the existing infrastructure and negative impacts on dependent unit processes.

6.9.2 DIS-2 Expand UV System

The replacement of the existing twelve UV modules and addition of a four more UV modules will be needed to meet the WWTP disinfection requirements with the City's desired reliability and redundancy. This project will also include extensive electrical, instrumentation and control modifications to support the expanded UV system. The original design concept of the UV system included space for future expansion inside the disinfection channels with additional modules. However, in consultation with the equipment vendor, the existing disinfection channels will need to be modified to provide a stepped profile due to hydraulics and head loss through the channels/modules.

Table 6-5
Disinfection Alternatives Cost Estimate

Alternative Number	Alternative Name	Total Project Cost	20-year Differential Operation and Maintenance Cost
DIS-1	UV Disinfection No Action	$0	Not Quantifiable[1]
DIS-2	UV Disinfection Expansion	$2,815,000	$0 (baseline)

Note
1. Operation and Maintenance costs are Not Quantifiable because the no action alternative will lead to permit violations, fines and litigation which are not definable in cost at this time but would be a significant cost to the WWTP budget. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

6.10 Outfall Alternatives

6.10.1 OUT-1 Outfall No Action

Under this alternative, the existing outfall system would remain unchanged. The existing gravity pipeline and in river diffuser have been analyzed and are at or near capacity due to hydraulic constraint. If the outfall in not upsized, effluent water will eventually buildup in the pipeline and overtop manholes or the UV system. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with continued use of the existing infrastructure and negative impacts on dependent unit processes.

6.10.2 OUT-2 Gravity Outfall Replacement

Expanding the gravity outfall with a larger in-land pipeline, in-water pipeline and in-river diffuser will increase the capacity of the outfall beyond the planning horizon requirement. The City conceptually considered a pumped outfall but removed this from consideration due to increased process complexity, operations, maintenance, and dependability of a gravity system.

Table 6-6
Outfall Alternatives Cost Estimate

Alternative Number	Alternative Name	Total Project Cost	20-year Differential Operation and Maintenance Cost
OUT-1	Outfall No Action	$0	Not Quantifiable[1]
OUT-2	Gravity Outfall Replacement	$6,464,000	$0 (baseline)

Note
1. Operation and Maintenance costs are Not Quantifiable because the no action alternative will lead to permit violations, fines and litigation which are not definable in cost at this time but would be a significant cost to the WWTP budget. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

Section 7

Section 7

Biosolids Handling Alternatives

This section summarizes the City of Pasco (City) Wastewater Treatment Plant (WWTP) biosolids stream improvement alternatives considered to improve and expand the plant through the 20-year planning period. Previous sections of this Facility Plan detail the City's existing WWTP processes, capacities, and their condition. As discussed in the previous sections, the City's WWTP utilizes biological treatment processes to convert most of the incoming organic carbon-matter and nutrients into biosolids, methane and carbon dioxide. To maintain an active biological population for effective treatment, a portion of the biosolids must be removed from the treatment process each day. To achieve this, biosolids are removed from the activated sludge treatment process by wasting after clarification. This portion of the solids that are routinely wasted is termed Waste Activated Sludge (WAS). Biosolids are also removed after primary clarification and intermediate clarification. These biosolids are treated at the WWTP anaerobically, thickened and dried. Projected increases in flow and loading to the WWTP will impose additional stresses on the WWTP and one day will affect the City's ability to consistently treat biosolids prior to offsite use. This chapter evaluates the expected treatment performance, improvements, upgrades, operations and develops potential alternatives to sustain the facility.

7.1 Upgrades and Alternatives

The deficiencies noted in **Table 5-6**, Pasco specific reliability and redundancy requirements, and potential upgrades and alternatives were reviewed with City staff in workshops to determine the scope of work needed at the WWTP and which upgrade alternatives were favored. **Appendix 6-1** summarizes the complete list of alternatives considered in the process. **Appendix 6-2** summarizes the City's desired reliability and redundancy for components at the WWTP. The alternative workshops are included in **Appendix 6-3** and **Appendix 6-4**, for reference. Although the components associated with some of the alternatives may be dependent on each other, for simplicity they were considered separately. Each alternative was developed for the 2040 planning horizon flow and load to the WWTP.

Table 7-1 provides a summary of the biosolids process alternatives, deemed viable through the initial screening effort by the City and project team, for the solids stream unit processes located at the WWTP site. Detailed capital cost opinions of the alternatives are included in **Appendix 7-1**.

Table 7-1
Biosolids Handling Alternatives

Alternative Number	Alternative Name	Alternative Description	Deficiency Addressed
WAS-1	WAS Thickening No Action	Continued use of single Dissolved Air Flotation Thickener (DAFT)	None
WAS-2	Mechanical Thickening	Thickening of waste activated sludge through mechanical process prior to stabilization.	DAFT
STA-1	Anaerobic Digestion No Action	Continued use of two anaerobic digesters	None
STA-2	Anaerobic Digestion Expansion	Anaerobic digestion system to stabilize biosolids.	Anaerobic Digester
STA-3	Chemical Hydrolysis	Breakdown of sludge into smaller chemical compounds prior to stabilization process.	Anaerobic Digester
STA-4	Thermal Drying	Drying WAS biosolids through application of heat to dry through evaporation of water. Other treatment of primary sludge biosolids will still be required.	Anaerobic Digester
FIN-1	Biosolids Finishing No Action	Continued use of single RDT and drying beds	None
FIN-2	Mechanical Dewatering	Mechanically dewater stabilized sludge to remove water and produce a "cake".	Rotary Drum Thickener Drying Beds

General Note:
RDT= rotary drum thickener

7.2 No Action

The No Action alternative assumes the City continues to operate the unit process diligently and fund necessary maintenance and replacement through the study period. However, no significant changes or improvements to the existing unit process would be undertaken. Under this alternative, the WWTP would essentially remain unchanged and this alternative would not include any capacity expansion. Previous sections of this Facility Plan identified a number of areas of the treatment plant that will become capacity limited in the near and long term. As a result, biosolids handling and the treatment system as a whole would not consistently or reliably treat the biosolids, hindering the treatment facility’s operations. Therefore, the no action alternative for the treatment system over the planning period is not feasible due to capacity issues associated with the existing infrastructure.

7.3 Cost Estimates

All costs presented in this section were generated consistent with the description in Section 6, part 6.4.

7.4 WAS Thickening Alternatives

The existing WAS thickening process includes one Dissolved Air Flotation Thickener (DAFT) which is nearing capacity, has no redundancy, is beyond its typical useful life, and is difficult to maintain. WAS thickening capacity and performance improvements, coupled with system redundancy, will enable the City to reduce impacts to the secondary process from dewatering activities, increase secondary digestion solids retention time (digester capacity) and reduce the amount of digested biosolids to be directed to biosolids dewatering. One viable WAS thickening alternative was identified in addition to continuing the use of the existing DAFT.

7.4.1 WAS-1 WAS Thickening No Action

Under this alternative, WAS thickening operations would remain unchanged with the DAFT. The DAFT is nearing capacity and typically operates continuously. The DAFT is troublesome to maintain, is 22 years old, and some components have not been serviced in over a decade. If it is removed from service for maintenance operations or due to component failure, staff will need to direct dilute waste activated sludge to the secondary digestion process. This severely impacts the capacity and operation of the digestion process. If the DAFT fails or does reach capacity limitations, it will severely hinder the solids stabilization process. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with continued use of the existing infrastructure and negative impacts on dependent unit processes.

Expanding the DAFT system was eliminated from consideration due to lower performance when compared to other WAS thickening technologies, City experience and City preference.

7.4.2 WAS-2 Mechanical System WAS Thickening

Mechanical WAS thickening prior to stabilization options considered the most viable were Rotary Drum Thickener, Gravity Belt Thickener, and Centrifuge. Each of these thickeners can be operated on a 24-hour basis which is ideal for process continuity, stability and performance. During predesign efforts, the City will identify the preferred technology. For this analysis, the thickening technologies were not differentiated.

For this alternative, the City plans to have 24-hour operation with a completely redundant unit. The process is sized for approximately 9,800 pounds per day (lbs/day) solids loading. The system would be located in a separate dewatering room located southeast of the of the existing Solids Thickening Building. It may be possible to locate the units in the Solids Thickening Building to eliminate the need for a new building; however, it is conservatively assumed the unit would be installed in a separate at grade structure. Pumping unthickened WAS to the headworks where it will co-settle with the primary sludge is a possible backup for mechanical thickening that the City could also easily implement for added reliability and redundancy.

Figure 7-1
Mechanical System WAS Thickening Schematic

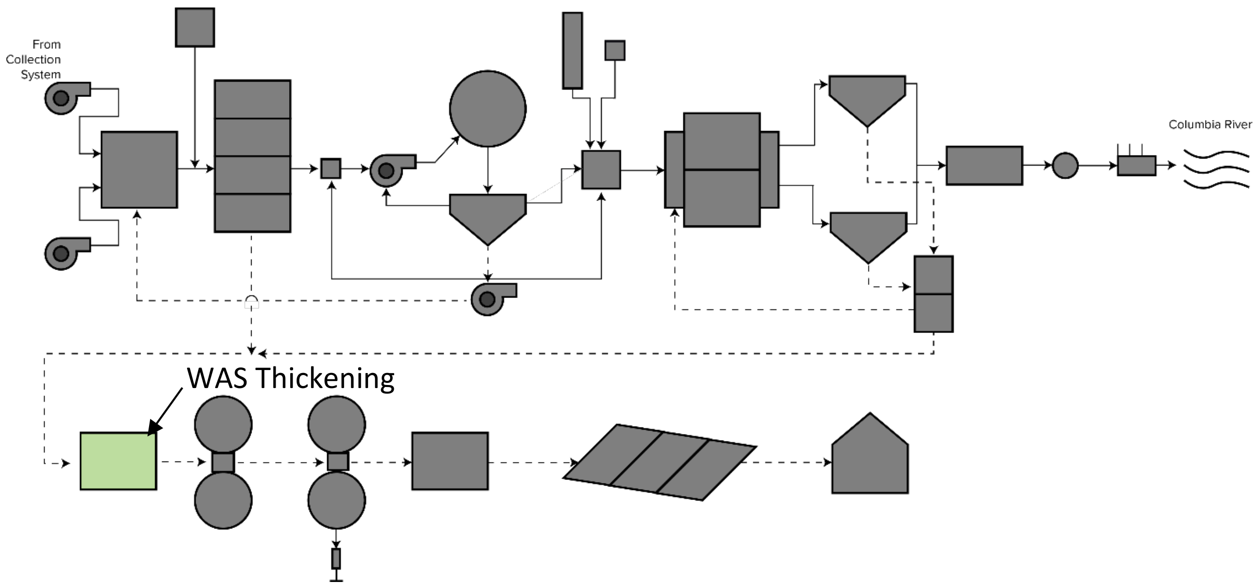


Table 7-2
WAS Thickening Alternatives Cost Estimate

Alternative Number	Alternative Name	Total Project Cost	Annual Operation and Maintenance Cots
WAS-1	WAS Thickening No Action	$0	ND[1]
WAS-2	Mechanical Thickening	$4,350,000	$0 (baseline)

Note:

1. Operation and Maintenance costs are Not Quantifiable because the no action alternative will lead to permit violations, fines and litigation which are not definable in cost at this time but would be a significant cost to the WWTP budget. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

7.5 Solids Stabilization Alternatives

Sludge digestion processes are used to produce a biologically stable product, to reduce pathogen concentrations to acceptable levels and to condition the sludge prior to disposal or beneficial reuse. The existing solids stabilization process includes two primary anaerobic digesters, one sludge storage basin and one biogas storage basin. The anaerobic digestion system is nearing capacity.

Three viable solids stabilization alternatives were identified in addition to continuing the use of the existing anaerobic digesters.

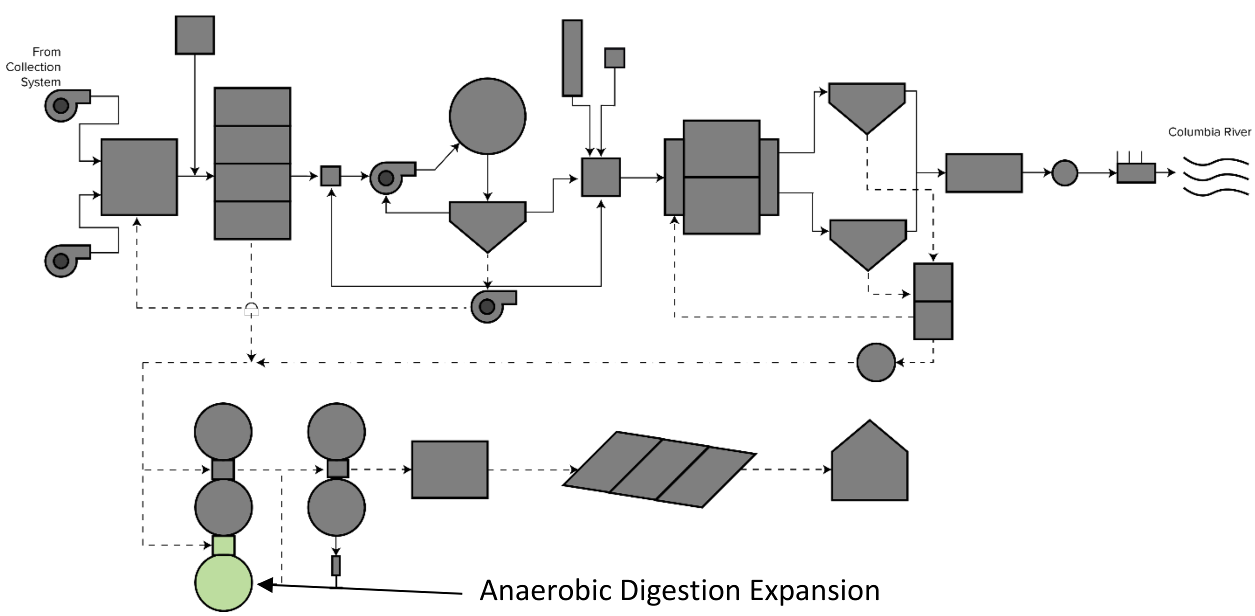
7.5.1 STA-1 Anaerobic Digestion No Action

Under this alternative, anaerobic digestion operations would remain unchanged. The anaerobic digester system is nearing capacity to continue treating to Class B Biosolids requirements. If the City were to no longer treat to those requirements, biosolids disposal will become much more troublesome, expensive and require a much greater degree of administrative, operations and maintenance time and effort. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with continued use of the existing infrastructure and negative impacts on dependent unit processes.

7.5.2 STA-2 Anaerobic Digestion Expansion

Additional digester capacity, provided through a third anaerobic digester, will enable the City to continue treating to Class B biosolids solids residence time requirements in the digesters. Under this alternative, a third primary digester would be constructed for added digester capacity and redundancy. The digester would be sized to match the size of digesters 1 and 2. The digester would be installed to the east of the existing digesters and would be supported by construction of new Solids Handling Building #2 between the existing and new digester. The alternative includes enhancements to digester heating, gas and sludge pumping systems. For the purposes of this evaluation, it is assumed that the digester will be a fixed cover digester with roof mounted shaft mixer to match the existing digester system.

Figure 7-2
Anaerobic Digestion Expansion Schematic



7.5.3 STA-3 Chemical Hydrolysis

Hydrolysis of anaerobic digester feed involves hydrolysis and lysing cell walls in thickened WAS. This process can be completed through chemical means, thermal means, or a combination of the two: The City chose chemical hydrolysis for evaluation. The process uses a chemical to break down the cell membranes prior to stabilization. The lysed cells and their contents are easier to mix and are consumed more quickly in the anaerobic digester compared to the original thickened WAS. The process also leads to more digester gas and easier biosolids dewatering. This alternative was initially considered by the City but was eliminated during initial screening due to process complexity, added unit processes/operations, and known high cost, both capital and operations.

7.5.4 STA-4 Biosolids Thermal Drying

This biosolids alternative includes drying biosolids through application of heat to dry through evaporation of water. In this alternative, the anaerobic digesters will be maintained and utilized to aid biosolids dewaterability, but no additional digesters will be included in the planning horizon which is a major benefit of this alternative. One of the main benefits is that the dryer achieves the pathogen and vector reduction requirements for Class A biosolids. This alternative has a very high capital cost and would lead to high operation and maintenance costs as well.

Figure 7-3
Biosolids Thermal Drying Schematic

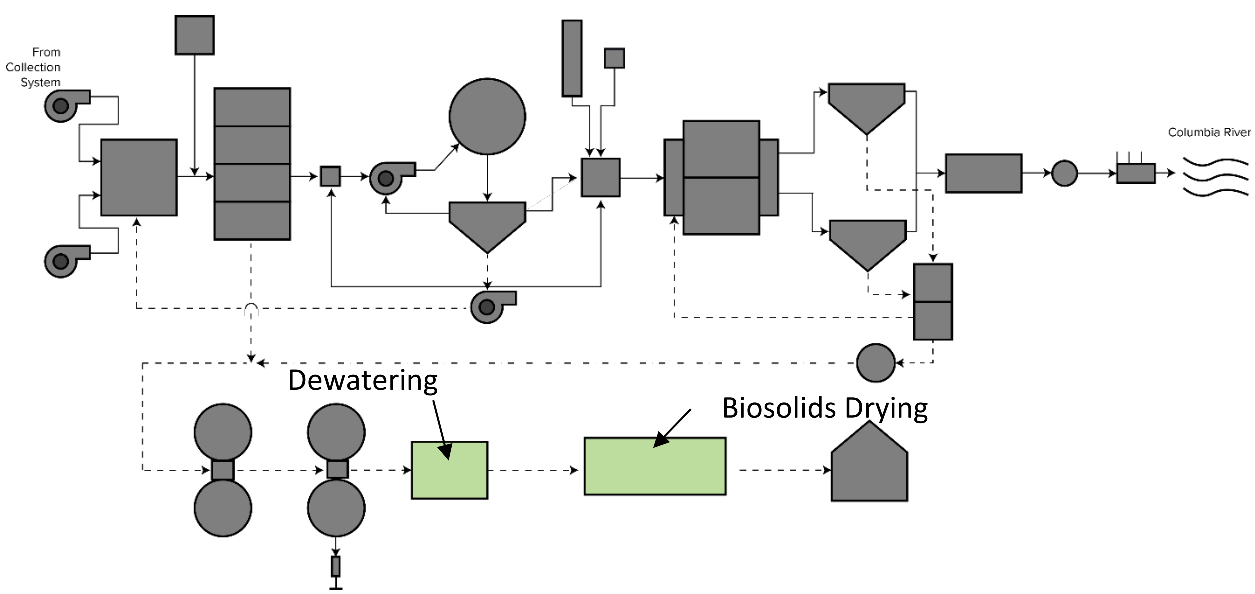


Table 7-3
Solids Stabilization Alternatives Cost Estimate

Alternative Number	Alternative Name	Total Project Cost	Annual Operation and Maintenance Cots
STA-1	Anaerobic Digestion No Action	$0	ND[1]
STA-2	Anaerobic Digestion Expansion	$8,140,000	$0 (baseline)
STA-3	Chemical Hydrolysis	Not determined	Not determined
STA-4	Thermal Drying	$13,490,000	$3,500,000

Note:
1. Operation and Maintenance costs are Not Quantifiable because the no action alternative will lead to permit violations, fines and litigation which are not definable in cost at this time but would be a significant cost to the WWTP budget. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

7.6 Solids Finishing Alternatives

The current WWTP solids finishing consists of a single rotary drum thickener (RDT) that thickens digested sludge prior to dewatering in multiple drying beds. Sludge is drawn from the digesters and combined in a sludge blend tank immediately upstream of the RDT. Polymer is added to the sludge feed just prior to entering the RDT for thickening. The RDT achieves approximately 9 percent solids content in the thickened sludge. The sludge is then pumped by a piston pump out to the drying beds where it is turned by plant staff and dries naturally. The dewatering solids (typically greater than 90 percent solids content) are then placed in the biosolids storage building prior to removal offsite by a contracted service.

7.6.1 FIN-1 Solids Finishing No Action

Under this alternative, the solids finishing process consisting of the RDT and drying bed operations would remain unchanged. The RDT and drying beds are nearing capacity to produce the dry solids that the WWTP typically produces. When the RDT and drying beds reach capacity limitations, this will hinder the solids finishing process. Therefore, the no action alternative for this unit process over the planning period is not feasible due to capacity issues associated with continued use of the existing infrastructure. Without capacity upgrades, the cost of solids disposal will increase and the beneficial reuse and sustainability of the process would be very negatively impacted.

7.6.2 FIN-1 Mechanical Dewatering

Under this alternative, a new mechanical dewatering system would be installed with a fully redundant unit to remove water and produce a "cake". Mechanical dewatering technologies considered the most viable were Screw Press and Centrifuge. Each of these dewatering systems can be operated on a 24-hour basis which is ideal for process continuity, stability and performance. During predesign efforts, the City will identify the preferred technology. For this analysis, the dewatering technologies were not differentiated. At this time the City does not want to consider belt filter presses for dewatering due to past experiences and preference.

For this alternative, the City plans to have 24-hour operation with a completely redundancy unit. The process is sized for approximately 15,000 pounds per day (lb/day) solids loading. The system would be located in a separate dewatering room located southeast of the of the existing Solids Thickening Building.

There is insufficient space available in the Solids Thickening Building to accommodate installation of dewatering units and associated sludge conditioning systems. Therefore, it is assumed these facilities would be installed in a separate at grade structure. The dewatering room would be constructed southeast of the existing Solids Thickening Building. The room would include the dewatering units associated support equipment at ground level. Dewatered biosolids from this dewatering unit would be conveyed via vertical and horizontal conveyors to a loading bay. The existing drying beds would be used for further natural drying prior to removal from the WWTP site.

Figure 7-4
Mechanical Dewatering Schematic

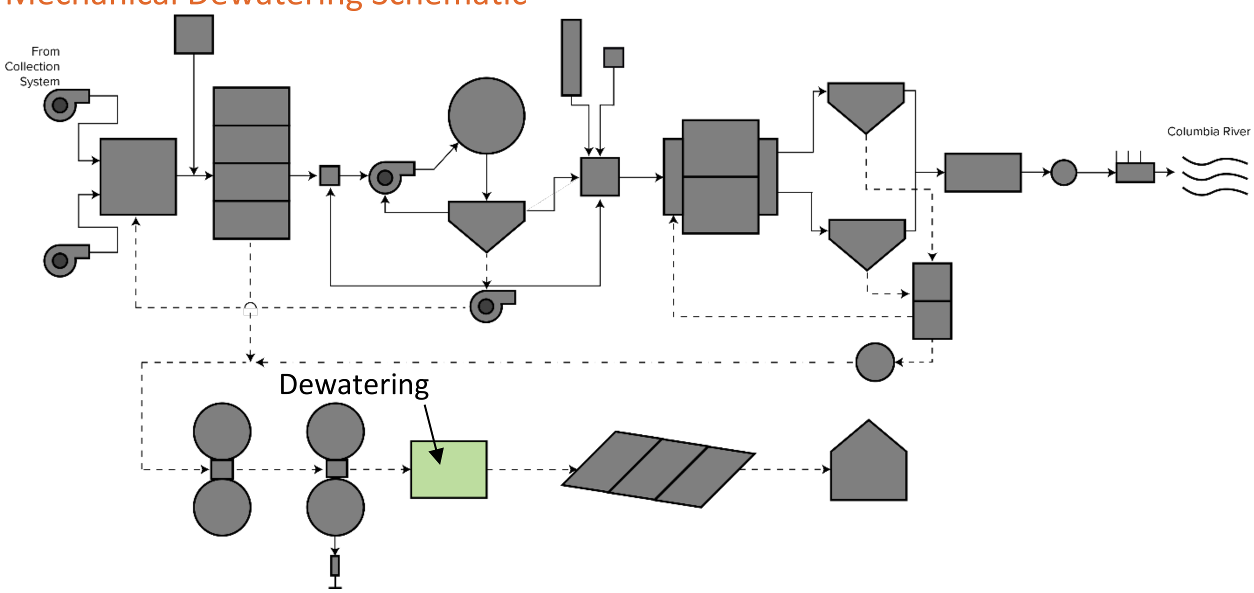


Table 7-4
Solids Finishing Alternatives Cost Estimate

Alternative Number	Alternative Name	Total Project Cost	Annual Operation and Maintenance Cots
FIN-1	Biosolids Finishing No Action	$0	ND[1]
FIN-2	Mechanical Dewatering	$8,650,000	$0 (baseline)

Note:

1. Operation and Maintenance costs are Not Quantifiable because the no action alternative will lead to permit violations, fines and litigation which are not definable in cost at this time but would be a significant cost to the WWTP budget. Additionally, repeated permit violations are not acceptable to the City and this alternative was not further developed.

7.7 Biosolids Reuse

Biosolids at the plant are currently biologically digested (stabilized) thickened, dried and a contract operator takes them off the WWTP Site. The contract operator ultimately applies the dried biosolids to land. The biosolids are considered Class B.

Continuing to treat biosolids to Class B standards is the City's desire for level of treatment by utilizing the anaerobic digesters, dewatering and drying beds. Options to achieve Class A biosolids were discussed during the development of the Facility Plan. However, due to the magnitude of improvements needed to maintain compliance with NPDES permits discharge limits, transitioning to a Class A biosolids system was not looked at in detail.

7.8 Odor Control

While not presently a concern, the City expressed a desire during the facility planning process to gain a better understanding of odor control cost impacts at the WWTP in the event that future development near the WWTP site is sensitive to odors. Methods to control odor at the WWTP typically center around solids treatment, building air space evacuation with exhaust air treatment, covering primary clarifiers with exhaust air treatment, elimination of the drying beds, and/or removing biosolids more quickly from the WWTP site.

Areas within the WWTP (existing and within the 20-year plan) that have the highest potential to contribute to off-site odor concerns include the headworks building, the existing/proposed thickening building, proposed dewatering biosolids building, and the existing primary clarifiers. The capital project total cost for odor control at these facilities in the WWTP is likely to fall in the $4,000,000 to $6,000,000 range, depending on project specifics. While the sludge drying beds are also a significant odor generator, eliminating odors by covering the them and treating vapors coming off the beds will be exceptionally costly and therefore were not considered further. Rather, when odors become a concern the biosolids should be removed from the WWTP site while still meeting Class B requirements in other processes at the WWTP.

There is no recommended timing for odor control improvements at this time. However, the City should plan and ensure that land use zoning around the WWTP is managed and consistent with the expectations of what should be constructed near a WWTP. When it looks like odors may become an issue that City needs to address, it is recommended that an odor control master plan be prepared which should include the detailed analysis of potential odor generation at the WWTP, potential for nuisance odors to travel offsite and the capital cost to mitigate nuisance odors.

Section 8

Section 8

Project Implementation

This section presents the City of Pasco (City) Wastewater Treatment Plant (WWTP) alternatives selected for implementation to address capacity and condition deficiencies as well as provide reliable treatment during the planning horizon.

8.1 Alternative Selection Process

At the start of the facility planning process the City reviewed and ranked five objectives areas for consideration in evaluating alternatives. The development of these criteria is documented in Appendix 8-1. Table 8-1 listed the criteria and their relative rank/weight per City staff input.

Table 8-1
Alternative Evaluation Criteria

Goal	Rank	Weighting
Future Uncertainty/Flexibility	1	42%
Functional/Operational	2	29%
Economic	3	21%
Societal	4	4%
Environmental	5	4%

The selection of the alternatives to address the WWTP deficiencies identified in the planning horizon was completed by the City based on discussions and materials presented during the two alternatives workshops (Appendix 6-3). A summary of the final ranking and selection of alternatives is included in Appendix 8-2.

8.2 Future Staffing and Building Needs

Current staffing at the WWTP facility consists of one Chief Plant Operator, six Plant Operators, two Utility Maintenance Workers, and one Lab Technician for a total of 10 WWTP staff. The staff are assigned to operate and maintain the treatment plant. The WWTP staff are responsible for the operation and maintenance of the City's WWTP. The WWTP operators' work hours are Monday through Friday, 7:00 am to 3:30 pm. One WWTP operator is on call outside the normal work hours. The on-call operators are responsible to handle calls, alarms, and take the required action as necessary.

As stipulated in the City's National Pollutant Discharge Elimination System (NPDES) Permit, the City must have an operator in charge responsible for the day-to-day operation of the WWTP certified by the State of Washington for at least a Class III plant. An operator certified for at least a Class II plant must be in charge during all regularly scheduled shifts. The WWTP has seven certified operators. Operator certification is shown in **Table 8-2**.

Table 8-2
Operator Certification

Operations Certification	Staff
Operator in Training	0
I	0
II	4
III	3
IV	0
Not Certified	2
Laboratory	1

As flows and loads increase at the facility, and as improvements are undertaken, staffing levels are expected to increase. **Table 8-3** identifies potential staffing needs at existing and future planning horizon based on EPA's "Estimating Staffing for Municipal Wastewater Treatment Facilities" (1973). Additionally, future staffing needs were projected using the Water Environment Foundation Manual of Practice No. 8 and The Northeast Guide for Estimating Staffing at Publicly and Privately-Owned Wastewater Treatment Plants. These estimates include supervisory, administrative, clerical, laboratory, yard work, site maintenance, and unit process operations and maintenance. All methods assume 1,500 working hours per employee after holidays, time off, training, etc. These estimates are intended to be guidelines only; specific staffing levels must be determined by the City and reviewed regularly to adequately operate and maintain the facility. While each alternative considered in Sections 6 and 7 may require slightly differing amounts of staffing and staff skill specialization, the selected alternative is not meaningfully different from the existing system and by itself will not require an immediate change in existing staffing types or level needs. If the City had selected a different or more complex set of alternatives, additional staff than what is shown in Table 8-3 would be required. A comparison of the City's staffing levels against comparable utilities in the Pacific Northwest as well as a more detailed evaluation of overall wastewater utility staffing needs can be found in the City's approved Comprehensive Sewer Plan (Section 5).

To accommodate both the projected increases in staff levels and the age/condition of existing administration, control, and lab building; two building expansion allowances (PCB-1 & LAB-1) were added to the overall selected alternatives list.

Table 8-3
Wastewater System Staffing Comparison and Projection

Condition	Flow (MGD)	"EPA Method"	"MOP 8 Method"	"Northeast Guide Method"
Staff at Existing (2017) *(additional staff needed)*	6.4	21.1 *(11.1)*	14.5 *(4.5)*	12.9 *(2.9)*
Staff at 2040 *(additional staff needed)*	10.8	27.6 *(17.6)*	24.5 *(14.5)*	20.5 *(10.5)*

General Note:

1. MGD = Million Gallons per Day

8.3 Alternative Selection Summary

To meet capacity and effluent quality requirements, the recommended plan includes several improvements to the liquid treatment and solids handling processes at the WWTP. The deficiencies noted in **Table 5-6** and potential upgrades and alternatives were reviewed with City staff and in workshops to determine which were desired, to determine project timing and the corresponding scope of such work considering treatment capacity, reliable operation, and satisfying known permit conditions. **Section 6** and **Section 7** document that alternatives review process for the WWTP. The selected alternatives are summarized in **Table 8-4**.

Table 8-4
List of Recommended Improvement Projects

Unit Process	Name	Alternative Number	Total Project Cost
Preliminary Treatment	Headworks Expansion	PRE-3	$3,270,000
Secondary Treatment	Activated Sludge - Plug Flow	SEC-2	$33,720,000
Disinfection	UV Disinfection	DIS-2	$2,815,000
Outfall	Gravity Outfall	OUT-2	$6,464,000
WAS Thickening	Mechanical Thickening	WAS-2	$4,350,000
Solids Stabilization	Anaerobic Digestion	STA-2	$8,140,000
Solids Finishing	Mechanical Dewatering	FIN-2	$8,650,000
Administration/Process Control Building	Administration/Process Control Building Expansion	PCB-1	$5,075,000
Laboratory	Laboratory Expansion	LAB-1	$1,538,000
WWTP Facility Plan	WWTP Facility Plan	FP-1	$400,000

8.4 Recommended Capital Improvement Plan

The WWTP Capital Improvement Plan (CIP) defined herein was reviewed with City staff to inventory and prioritize improvements based on system needs, anticipated system growth and available funding. The CIP workshop presentation is included in **Appendix 8-3**. Many of the capital projects are triggered by anticipated future flow conditions, therefore the timing and prioritization of these improvements are based on the year in which flows are projected. As flow increases at the WWTP, the CIP timing should be reviewed to adjust project timing to flow triggers. **Appendix 8-4** summarizes the design details for the selected alternatives.

Table 8-5 and **Figure 8-1** summarizes the projected WWTP CIP cash flow through the planning period. To help account for City growth at a rate different than anticipated, the calendar year with the anticipated maximum month WWTP flow is shown in **Figure 8-1**. Projects 1 and most of 2 (2A is an exception) in the CIP, however, should be implemented independent of near-term growth to address current WWTP capacity, age/condition, and operational needs.

Figures 8-2, 8-3 and **8-4** depict the planning period CIP's process schematic, general site plan and hydraulic profile, respectively. During the preliminary design process for each project, the scope of each project will need to be reviewed to determine actual project/facility sizing, process placement, schedule and budget. A summary of each major project is discussed below. Detailed cost opinions are included in **Appendix 6-5** and **Appendix 7-1**.

Table 8-5
Capital Improvement Program of Recommended Improvements (Presented in 1,000's of dollars)

Project Number	Unit Process	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1	Project 1	**$3,173**	**$6,581**	**$7,898**	**$6,421**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1A	*Outfall Study*	*$175*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1B	*Secondary Treatment Project 1*	*$1,248*	*$2,672*	*$2,672*	*$2,672*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1C	*Outfall Project 1*	-	*$160*	*$1,477*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1D	*Mechanical Dewatering*	*$1,165*	*$2,496*	*$2,496*	*$2,496*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1E	*Mechanical Thickening*	*$585*	*$1,253*	*$1,253*	*$1,253*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Project 2	-	-	-	-	**$2,196**	**$5,156**	**$5,156**	**$5,156**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2A	*Secondary Treatment Project 2*	-	-	-	-	*$1,340*	*$2,870*	*$2,870*	*$2,870*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2B	*Outfall Project 2*	-	-	-	-	*$476*	*$1,474*	*$1,474*	*$1,474*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2C	*UV Expansion Project*	-	-	-	-	*$380*	*$812*	*$812*	*$812*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	WWTP Facility Plan	-	-	-	-	-	-	-	-	$400	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Secondary Treatment Project 3	-	-	-	-	-	-	-	-	$695	$2,235	$2,232	-	-	-	-	-	-	-	-	-	-	-
5	Secondary Treatment Project 4	-	-	-	-	-	-	-	-	-	-	$909	$6,406	$3,638	-	-	-	-	-	-	-	-	-
6	Anaerobic Digestion Expansion	-	-	-	-	-	-	-	-	-	-	-	-	$1,096	$7,042	-	-	-	-	-	-	-	-
7	Administration Building	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$684	$4,392	-	-	-	-	-
8	Laboratory Building	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$208	$1,331	-	-	-	-
9	Headworks Expansion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$440	$2,829	-	-
	TOTAL	**$3,173**	**$6,581**	**$7,898**	**$6,421**	**$2,196**	**$5,156**	**$5,156**	**$5,156**	**$1,095**	**$2,235**	**$3,141**	**$6,406**	**$4,734**	**$7,042**	**-**	**$684**	**$4,600**	**$1,331**	**$440**	**$2,829**	**-**	**-**

Figure 8-1
Capital Improvement Program of Recommended Improvements

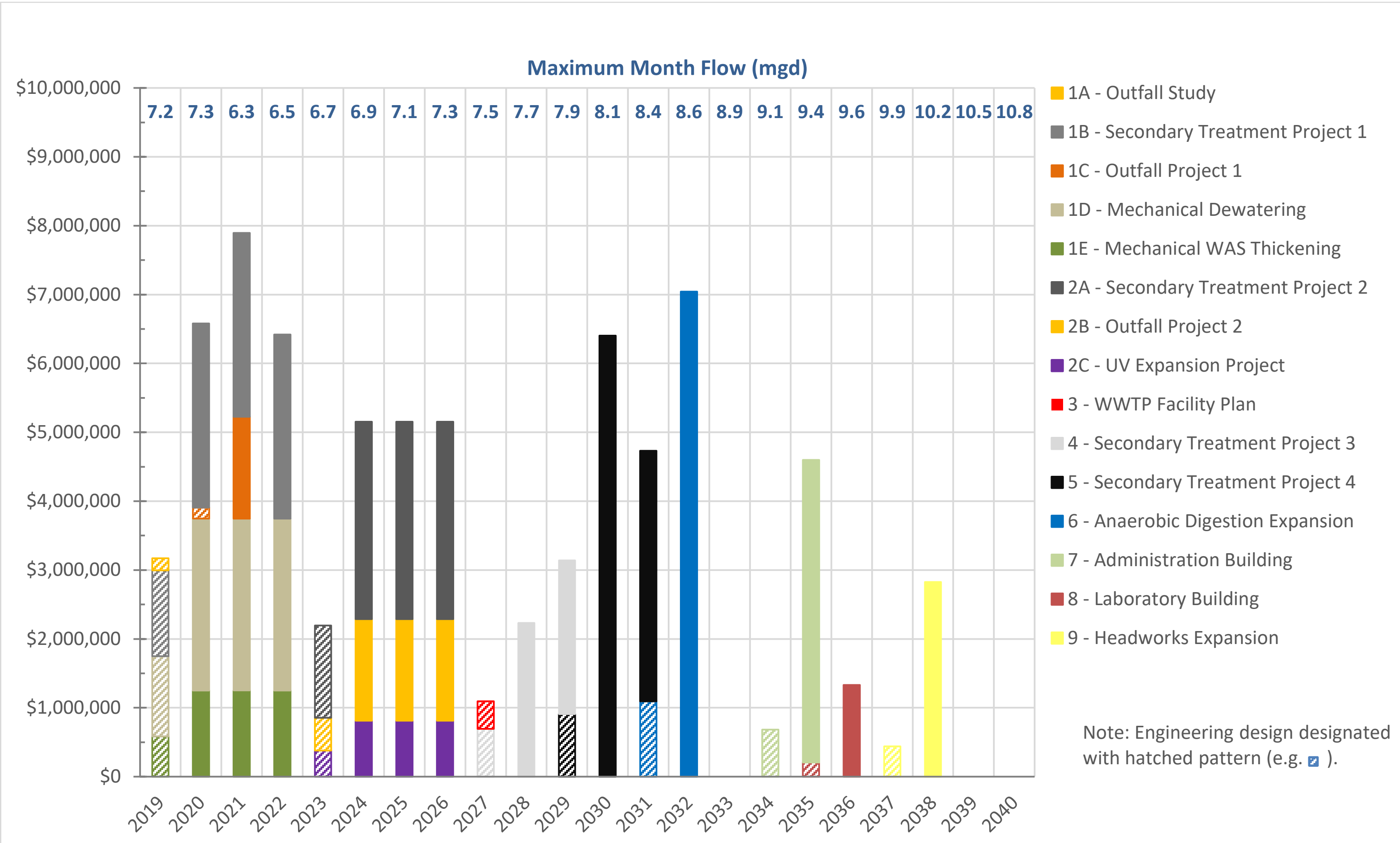


Figure 8-2
Process Schematic with Recommended Improvements

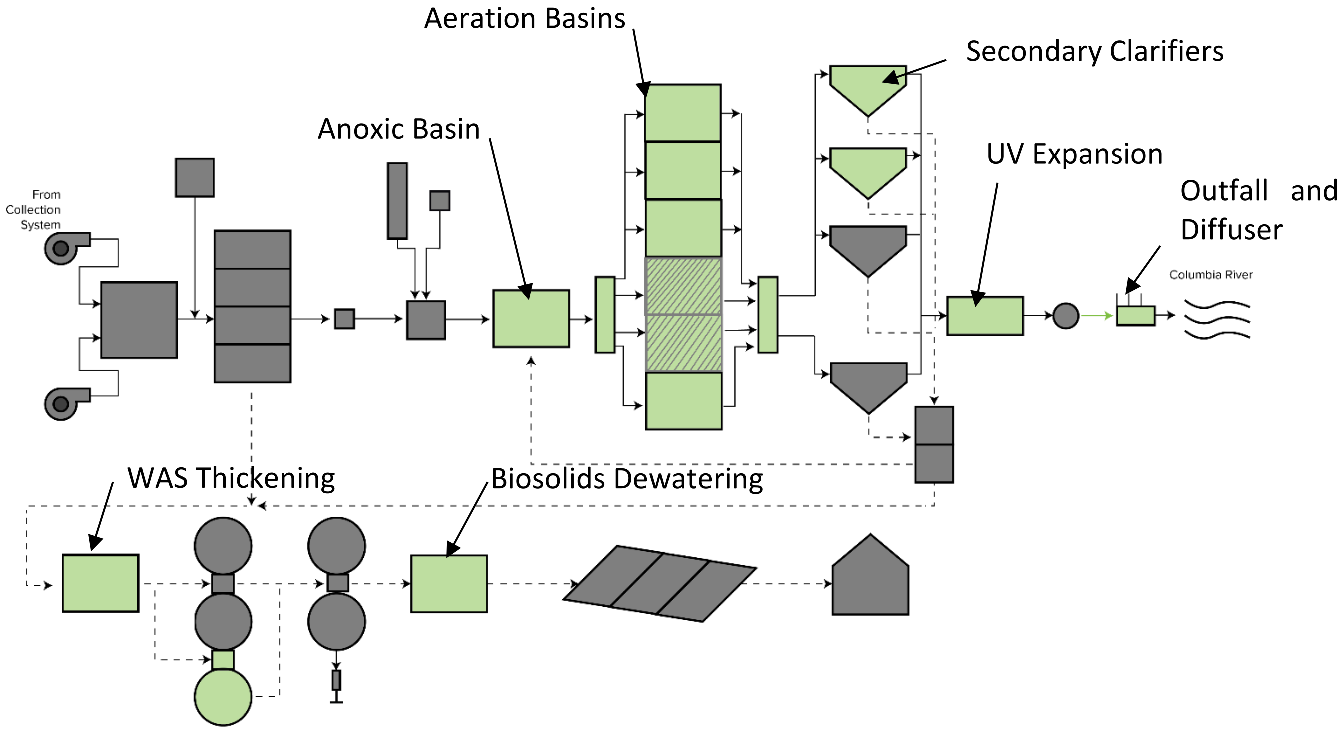
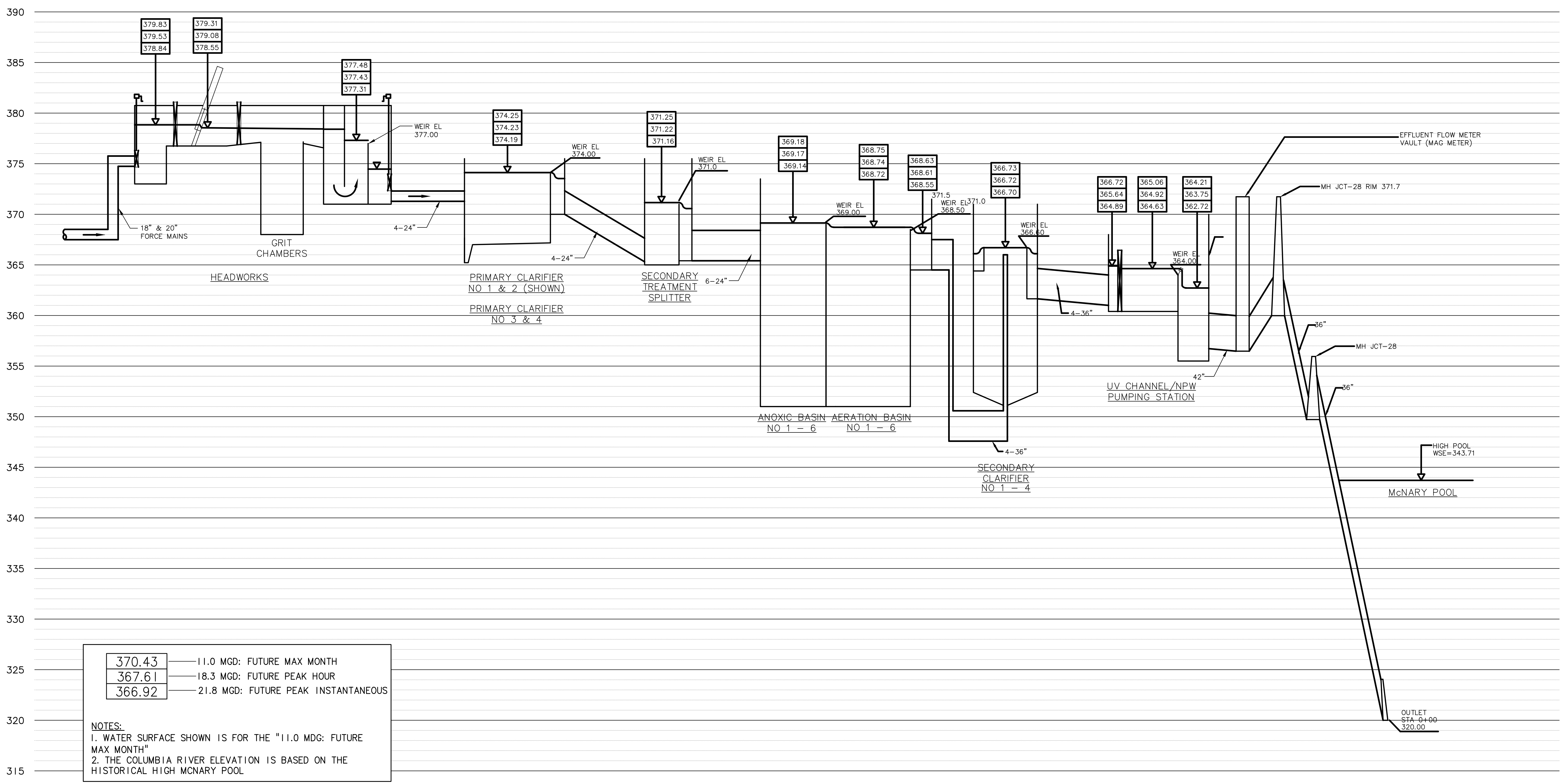


Figure 8-3
Site Plan with Recommended Improvements



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City of Pasco Washington

Wastewater Treatment Plant Facility Plan

Figure 8-4
Hydraulic Profile

March 2019 16-1916

I:\BOI_Projects\16\1916 - Pasco Immediate Needs\0 FACILTY PLAN\Alternatives\Hydraulic Profile\Fig8-4_PascoHydProfile.dwg Layout1 4/8/2019 5:12 PM MAC 22.0s (LMS Tech)

8.5 Effect of Capital Improvement Plan Implementation

By implementing the recommended WWTP improvements in a timely manner, and as included in this Facility Plan, the City can ensure:

- The ability to handle wastewater generated within the collection system service area
- Compliance with discharge permit requirements for multiple constituents
- Protection of water quality in the Columbia River
- The ability to handle the projected biosolids generated at the WWTP

Ultimately, by following the recommendations in this Plan, the City will serve its sewer customers, the general public and the environment for years to come while avoiding regulatory enforcement actions and fines.

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2019 Wastewater Treatment Plant Facility Plan

City of Pasco Washington

Appendices Volume 1 of 2

JULY 2019

Table of Contents

3. Existing Conditions – Treatment Facilities

4. Existing Capacity Analysis

5. Future Conditions

6. Liquid Stream Alternatives

7. Biosolids Handling Alternatives

8. Project Implementation

Figures

Tables

Appendices

Appendix 7-1 Solids Handling Alternatives Capital Cost Opinions

Appendix 8-1 WWTP Goals, Objectives and Evaluation Criteria

Appendix 8-2 Ranking Summary of Alternatives

Appendix 8-3 Workshop 4: Capital Improvement Plan Development

Appendix 8-4 Design Summary of Selected Alternatives

References

AACE International Recommended Practice No. 56R-08 Cost Estimate Classification System - As Applied for the Building and General Construction Industries - TCM Framework: 7.3 - Cost Estimating and Budgeting Rev. December 31, 2011

City of Pasco, City of Pasco Comprehensive Sewer Plan, May 2014

Daigger, G.T. Development of Refined Clarifier Operating Diagrams Using an Updated Settling Characteristics Database; 1995

Daigger G.T., Roper R.E.; The Relationship Between SVI and Activated Sludge Settling Characteristics, 1985

HDR, Primary Clarifier Performance Testing, February 2018

Metcalf & Eddy, *Wastewater Engineering: Treatment and Resource Recovery*. McGraw-Hill, 2017

NPDES Waste discharge permit No. WA-004496

State of Washington Department of Ecology; Criteria for Sewage Works Design (Orange Book); August 2008

State of Washington Department of Ecology; Water Quality Permitting and Reporting Information System (Paris); Pasco WWTP Facility Summary: https://apps.ecology.wa.gov/paris/FacilitySummary.aspx?FacilityId=23413, August 2018

Water Environment Federation, Design of Water Resource Recovery Facilities, WEF Manual of Practice No. 8, 5th Ed., 2010

APPENDIX 1-1

Appendix 1-1

Facility Plan Requirements

This document was prepared in accordance with Washington Department of Ecology and Washington Administrative Code (WAC) 173-240-060 requirements. The following tables include a summary of required facility plan contents from Orange Book **Table G1-1** and **Table G1-2** (WAC 173-240-060) as modified by Washington Department of Ecology staff communication. The location of the required information is listed in these tables as an aid to the reader.

Table 1-1.1
Orange Book Table G1-1 Requirements for Engineering Report and Facility Plan

Element	Requirements		Comments and Location in Facility Plan
	Engineering Report	Facility Plan	
Site Description, Problem Identification, and Map	Well documented.	Same as engineering report.	See **Section 1, part 1.1** for project background and general problem identification. **Sections 2 and 3** provide descriptions and maps for the general study area and the wastewater treatment plant, respectively.
Description of Discharge Standards	Well documented.	Same as engineering report.	Discharge standards for the WWTP are summarized in **Section 3, part 3.6**.
Background Information	Existing Environment • Water, air, sensitive areas: • Flood plains • Shorelands • Wetlands • Endangered species/habitats • Public health Demographics and Land Use • Current population • Present wastewater treatment • AWT need evaluated • I/I studies • CSOs • Sanitary surveys for unsewered areas	Existing Environment Same as engineering report, plus identification of: • Prime or unique farmland • Archaeological and historical sites • Any federally recognized "wild and scenic rivers" • Threatened species Demographics and Land Use Same as engineering report, plus specific determinations that I/I is not excessive (that is, not less expensive to remove it than treat it at plant).	Existing Environment: See **Section 2** and supporting information in the Section **2 Appendices**. Demographics and Land Use and non-excessive I/I documentation: Included in the **City of Pasco Comprehensive Sewer Plan (2014)**, bound separately. **Section 5** of the Facility Plan includes updated current population.
Future Conditions	Demographics and Land Use • Projected population levels • Appropriateness of population date source, zoning changes • Future domestic and industrial flows, and flow reduction options • Future flows and coding • Reserved capacity • Future environment without project	Same as engineering report, plus discussion of whether recreation and open space alternatives could be incorporated.	**Section 5** presents expected population growth, changes in domestic and industrial flows, and projected flows and loads **Section 6** and **Section 7** present No Action (i.e. "Do Nothing") alternatives to show conditions without a project.
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	Same as engineering report, plus description of innovative and alternative technologies [that is, those saving energy and nonconventional treatment (land application, etc.)].	See the **City of Pasco Comprehensive Sewer Plan (2014)** for collection system related topics. **Section 6** presents the liquid stream alternatives, analysis and evaluation. **Section 7** presents biosolids management alternatives, analysis and evaluation. **Section 8** summarizes the selection of a preferred alternatives (liquid and biosolids).

Element	Requirements		Comments and Location in Facility Plan
	Engineering Report	Facility Plan	
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	Same as engineering report.	Details related to the selected alternatives are included in **Section 6**, **Section 7** and **Section 8**. **Section 8** includes a site layout, flow diagram and staffing collectively for the liquid and biosolids alternatives selected.
Financial Analysis	• Costs • User charges • Financial capability • Capital financing plan • Implementation plan	Same as engineering report.	Financial considerations for the selected WWTP alternatives are presented in the **City of Pasco Comprehensive Sewer Plan (2014)**. Project costs for the selected alternatives are presented in **Section 8**.
Other	• Water quality management plan conformance • SEPA approval • List required permits	Same as engineering report, ~~plus state- approved SERP compliance, including:~~ ~~• Environmental issues analysis~~ ~~• Documentation that the project is identified in a sewer general plan~~ ~~• Capital improvement plan~~ ~~• Documentation of adequate public involvement process~~	**Section 2** summarizes the environmental analysis performed with detailed supporting information in the **Section 2 Appendices**. A Non-Project SEPA checklist was prepared and submitted to the City as lead agency. A Determination of Non-Signification (DNS) was issued on March 29, 2019. A copy of the SEPA checklist and DNS are included in the **Section 2 Appendices**. Additional water quality and environmental element analysis (including a Tier II Anti-degradation analysis) are presented in **Section 5** and the **Section 5 Appendices** **Section 8** presents the City approved Capital Improvement Plan (CIP). *Ecology indicated during the March 7, 2019 project workshop and subsequent correspondence that a SEPA checklist with DNS would be sufficient to meet the requirements of WAC 173-240-060(r) and that completion of the SERP process is not needed at this time. The SERP process would come later as the specific projects are designed. A Federal Cross-Cutter review is not required at this time or prior to application for an Ecology loan, but could be required if the City both receives a loan and is selected as an "equivalency project".*

Table 1-1.2
Orange Book Table G1-2 Explanation of Engineering Report Requirements (Rev. 11/2007)

Text from WAC 173-240-060	Explanation	Comments and Location in Facility Plan
060(1) Planning Requirements		
The engineering report for a domestic wastewater facility shall include each appropriate (as determined by Ecology) item required in WAC 173-240-050 for general sewer plans unless an up-to-date general sewer plan is on file with Ecology. Normally, an engineering report is not required for sewer line extensions or pump stations. See WAC 173-240-020(13) and 173-240-030(5). *The facility plan described in 40 CFR 35 is an "engineering report."*	The report must comply with an up-to-date general sewer plan (WAC 173- 240-050) that is on file with Ecology. The community must certify that its general sewer plan adequately addresses the current conditions and service area. If Ecology does not have an adequate, up-to-date, existing general sewer plan, it will identify those portions of Section 050 that include in the engineering report. Where no up-to-date general sewer plan exists, the entity may expand the engineering report to meet the requirements for a general sewer plan, including local approval requirements in Chapters 35.63, 36.70, 36.94, and 56.08 RCW. Ecology does not normally require an engineering report for sewer line extensions or pump stations that conform with an Ecology- approved general sewer plan, where Ecology does not provide financial assistance.	The City has an up-to-date sewer plan per WAC 173- 240-050. See **City of Pasco Comprehensive Sewer Plan (2014)**, bound separately.
060(2) Sufficiently Complete		
The engineering report shall be sufficiently complete so that plans and specifications can be developed from it without substantial changes.	"Sufficiently complete" as used in the regulations is defined to mean the report must contain sufficient design information to allow an engineer not involved in writing the report to produce construction drawings for the facility as envisioned by the report writer without any need for process change or more than minor unit-sizing modifications. "Substantial change" means a change in the selected treatment process, facility size, design criteria, performance standards, or environmental impacts, or an increase in total project cost. A substantial change requires an amendment to the approved engineering report. "Adequate detail" means that the report includes suitable attention to the individual elements and components that make up the whole proposed project.	A description of each alternative is presented in **Section 6** and **Section 7**. The City selected alternatives, design criteria and detailed opinions of probable cost are included in **Section 8**. A preliminary process schematic and site plan are provided in **Chapter 8**.
060(3) Minimum Information Required		

Text from WAC 173-240-060	Explanation	Comments and Location in Facility Plan	
The engineering report shall include the following information, together with any other relevant data as requested by Ecology:			
(a) The name, address, and telephone number of the owner of the proposed facilities, and their authorized representative.	The report must include the name, address, and telephone number of the owner and the owner's representative. The named person or position must have the authority to sign contracts relating to this project. Examples of the owner's representative include the mayor, chair of the city council sewer committee, city manager, public works director, etc. Additionally, the entity may identify a specific project contact person other than the legal representative.	The legal representative/owner of the proposed facilities is: City of Pasco Dave Zabel, City Manager City of Pasco (509) 545-3404 zabelld@pasco-wa.gov 525 Third Avenue, Pasco, WA 99301	Project specific contact: Maria Serra PE, Senior Civil Engineer (Facility Plan Project Manager) City of Pasco (509) 545-3444 seeram@pasco-wa.gov 525 Third Avenue, Pasco, WA 99301
(b) A project description including a location map and a map of the present and proposed service area.	The project description includes the where, what, and why of the report and documentation of the need for the proposed project. Include a location map of the project area, along with a map showing the current and proposed sewer service area. Scale the map(s) so that at least one map shows the complete, current, and proposed service areas along with the relationship of this service area to adjacent service areas. One map must show the existing collection system changes and the proposed locations of land applications of wastewater. Include a current zoning map for the service area to support the population and waste load projection process.	The project description is included in **Section 1.1**. The WWTP Site is shown in **Figure 2-1**. The service area for the WWTP is shown in **Figure 2-2**. Details pertinent to the collection system are included in the **City of Pasco Comprehensive Sewer Plan (2014)**, bound separately.	
(c) A statement of the present and expected future quantity and quality of wastewater, including any industrial wastes which may be present or expected in the sewer system.	This includes an analysis of the current waste load (flow, BOD, TSS, etc.) received by the treatment plant, its sources (the percentages of domestic, commercial, and industrial dischargers), the characteristics of industrial discharges/pretreatment, the current I/I flows, CSOs as defined in Chapter 173-245 WAC, diurnal flow and loading variations, and seasonal load and flow variations. Include at least one full year of CURRENT wastewater flow and loading data to justify appropriate design parameters for the new system (more than one year of data is preferable). Data must include sufficient detail to demonstrate the degree of flow and loading variability expected. Wastewater characterization must also identify any constituents that may have a detrimental impact on any proposed unit process (i.e., chemicals toxic to microbes, constituents that may interfere with disinfection, high variability in peak flows and loading). Proponents must ensure that laboratory data were obtained from an Ecology-accredited laboratory. Proponents must obtain flow data from meters that have a documented history of proper calibration. Include the location of influent and effluent sampling, the type of samples taken, and the locations of treatment process return streams. To demonstrate that the data is truly representative of current conditions, RCW 90.48.495 requires the entity consider water conservation measures in sewer plans. Include a discussion of water conservation measures considered or under way and their anticipated impact on public sewer service. Estimate the future (normally 20 years from the date of the report) waste load and sources of wastewater including the above items. Base the estimates on the present (or known future) zoning pattern, council of government's population forecasts, historical population trends, existing industrial users, and anticipated future industrial wastewater sources.	Available waste load (flow, BOD, TSS, etc.) for the previous six years is presented in **Section 3**. Projected conditions through the 20-year planning period are also included in **Section 5**.	

Text from WAC 173-240-060	Explanation	Comments and Location in Facility Plan
(d) The degree of treatment required based upon applicable permits and regulations, the receiving water, the amount and strength of wastewater to be treated, and other influencing factors.	Include a copy of the current discharge permit and any compliance orders in the engineering report. For new discharges, include a draft permit. Use the evaluation results of Sections 3(e), (h), and (l) to estimate the degree of treatment needed in lieu of the existence of a current permit or a draft permit prepared by Ecology. At a minimum, the engineering report must contain an evaluation of the WWTP discharge compliance with water quality criteria (Chapter 173-201A WAC). For municipal WWTPs, this means an analysis of ammonia and chlorine that may indicate the need for nitrification or dechlorination. If the receiving water is listed on the 303(d) list as impaired, the analysis must include the parameters identified in the impairment listing. Design values must align with waste load allocations established in a TMDL, if available. Additionally, the report must evaluate the effects of industrial discharges to the collection system on the final effluent, including the potential for toxic materials to pass through the treatment facility to the final effluent or sludge. The engineering report must determine if the discharge from a proposed system will cause a measurable change in existing water quality measured at the boundary of the chronic mixing zone if one has been authorized. A measurable change is any one of the following: 1) Temperature increase 0.3 C. or greater. 2) Dissolved oxygen decrease of 0.2 mg/L or greater. 3) Bacteria count increase of 2 cfu or greater. 4) pH change of 0.1 units or greater. 5) Turbidity increase of 0.5 NTU or greater or. 6) Any detectable increase in the concentration of a toxic pollutant or radioactive substance. The proponent must consult with regional Ecology staff to determine the level of analysis needed to comply with the Antidegradation provisions of WAC 173-201A-300 to 330.	The City of Pasco is authorized to discharge to the Columbia River through a Washington Department of Ecology NPDES permit as documented in **Section 2**. The **Section 2 Appendices** include the current NPDES permit and accompanying Fact Sheet. Existing and future water quality requirements of the receiving water are summarized in **Sections 3 and 5**, respectively, and the associated appendices. The facility's ability to satisfying the current and known future discharge requirements can be found in **Sections 4 and 5**. Alternatives in **Chapters 6** and **Section 7** are developed to address known water quality requirements during the planning period.
(e) A description of the receiving water, applicable water quality standards, and how water quality standards will be met at the boundary of any applicable dilution zone. (173-201A-10Q WAC)	Give the name, location (river mile, latitude/longitude, waterway segment number, township/range, etc.), and water quality classification of the proposed receiving water. Summarize any existing receiving water data (monitoring stations reporting to STORET, CRMS, USGS reports, NOAA reports, FERC license reports, data collected for this report, etc.). Include data collected for this report in an appendix to the report. For fresh water streams and rivers, determine and provide the 7Q10 (seven- day, ten-year recurrence low flow) flow in the report. This is the flow used for calculating mixing zone sizing in streams and rivers. For salt water and estuaries, determine and provide current velocity, appropriate salinity, density, and temperature profile conditions in the report. This information is then used to design and evaluate the size and shape of allowable mixing zones. Evaluate toxic chemicals in the effluent (toxic pollutant scan may be required). This includes an evaluation of the effects of toxic chemicals on migratory fish (i.e., barrier to fish migration). Evaluate the applicable numerical Water Quality Criteria (EPA) and determine which criteria are limiting for this discharge (see Ecology's "Permit Writer's Manual"). The NPDES permit may contain requirements for whole effluent toxicity testing and limits (WET rule, Chapter 173-205 WAC). Identification of the various chemicals that may be present in the discharge and the species present in the receiving water may affect the need or frequency of biomonitoring WET testing. In salt water, evaluate not only the effects of chemical discharges, but also the impacts of bacterial discharges on shellfish beds (certification or decertification). Refer to the criteria and information in the DOH documents "Special Sewage Works Design Consideration for Protection of Waters Used for Shellfish Harvest," "Water Supplies or Other Areas of Special Public Health Concern," and "Shellfish and Domestic Wastewater Discharge Outfall Projects," Oct. 1995 (interagency permit streamline). For groundwater discharges, address the minimum requirements of the hydrogeologic study. These requirements are listed in E3-4 and are fully described in the "Implementation Guidance for Ground Water Quality Standards" (Ecology, 1996; Revised October 2005).	The City of Pasco currently has authorization to discharge to the Columbia River through a Washington Department of Ecology NPDES permit – reference **Chapter 2** and **Section 2 Appendices**.

Text from WAC 173-240-060	Explanation	Comments and Location in Facility Plan
(f) The type of treatment process proposed, based upon the character of the wastewater to be handled, the method of disposal, the degree of treatment required, and a discussion of the alternatives evaluated and the reasons they are unacceptable.	Consider at least one of each of the following wastewater treatment categories and options: fixed growth processes, suspended growth processes, land treatment processes, lagoons, innovative treatment processes, nonstructural alternatives (operational changes), and no action. The report must include the no action alternative. Rank the alternatives considered (with their reasons) according to their ability to meet the receiving water quality standards, costs, and other objectives of the engineering report. From this group of ranked alternatives, select for further development and evaluation a top group of three to five distinct, final alternatives that meet the report's objectives. Further evaluation includes environmental impact, applicability to available site(s), cost effectiveness (capital cost and present worth cost), ease of operation, and other criteria deemed important by the community. Base costs on EPA cost curves, CAPDET analysis, or any other cost estimating method acceptable to Ecology. A final alternate recommended for implementation should rank first in this further evaluation. The selection of the recommended alternate includes a discussion of why the other alternates were not selected. If the selected alternative is not the lowest cost effective alternative, provide discussion to support the decision to not choose the cost effective alternative. If the proponent will seek Ecology funding from the Centennial Clean Water Fund and/or the Sate Revolving Fund, project eligibility may be limited if the least cost alternative is not selected. Consult with regional Ecology staff in advance to identify how alternative selection may impact project eligibility.	Evaluation of No Action for the liquid stream components is included in **Section 6**. Alternatives to satisfy water quality objectives and identified WWTP deficiencies are also included in **Section 6**. The alternatives were limited to no action, fixed growth processes, suspended growth processes, and innovative/alternative suspended growth processes. Discussion of alternatives is presented in **Chapter 6**. Evaluation of No Action for the solids stream components is included in **Section 7**. Alternative for biosolids treatment and disposal are also included in **Section 7**. Discussion of biosolids alternatives is presented in **Section 7**. **Section 8** and **Appendix 8-2** provides a summary of the alternative selection.
(g) The basic design data and sizing calculations of each unit of the treatment works. Expected efficiencies of each unit, the entire plant, and character of effluent anticipated.	Provide basic design data and sizing calculations for all of the final alternates as part of the ranking process. Use the data to estimate construction and operation and maintenance costs for cost comparisons as required in 3(p) below. The detailed sizing calculations and design criteria used for sizing the selected alternative treatment systems must agree with the appropriate chapters of this manual or other authoritative reference. Thoroughly justify any deviation from the design criteria in this manual. Section 3(c) above provides the basic hydraulic and pollutant loading data to be used for sizing the treatment systems. Describe the age, capacities, and adequacy of all existing treatment units used in the upgraded facilities.	Pertinent design criteria for alternatives are presented in **Section 6** (liquid stream), **Section 7** (solids stream), **Section 8** (Capital Improvement Plan) and **Appendix 8-4** (Design Summary of Selected Alternatives).
(h) Discussion of the various sites available and the advantages and disadvantages of the site(s) recommended. The proximity of residences or developed areas to any treatment works. The relationship of a 25-year and 100-year flood to the treatment plant site and the various plant units.	This is part of the alternative evaluation process (c) through (f). When evaluating multiple potential treatment plant sites, assess their topography, flood potential, impacts to existing wetlands, soils suitability for construction, zoning, and proximity to residential areas. Do not limit flood analysis to determining whether or not a site is included within a flood plain mapped on a FEMA Flood Insurance Rate Map (FIRM). Evaluate the flooding potential of any drainage way passing through or near the site for site flooding potential. Show the existence of wetlands on a proposed site on the site map. Mapping the extent of wetlands may require the use of a wetlands specialist. Compare wall and floor elevations to potential 100-yr flood elevations to ensure that basins are not over-topped or buildings flooded if major flooding occurs. Consider using a continuous hydrologic and hydraulic model with long term (20+ years) precipitation record to model the development and its contributing drainage area to evaluate the hydraulic capacity of the conveyance system and flooding potential. During the planning stage, conduct adequate soils analyses at the final alternate sites to understand the ability of the soils to structurally support the proposed structures or provide the wastewater treatment required. That is, perform enough soils analyses to ensure that during design or construction a “changed site condition” clause does not need to be invoked because the soils are unable to perform as required).	The existing treatment plant site will be utilized for any expansion or changes to the process.
(i) A flow diagram showing general layout of the various units, the location of the effluent discharge, and a hydraulic profile of the system that is the subject of the engineering report and any hydraulically related portions.	Proponent must present flow diagrams for each of the final alternates considered. Reports must include a schematic flow diagram showing all wastewater liquid and solids flow paths. Include proposed sampling locations as well as a scaled site layout (with the site topography) that shows how proposed treatment units fit on the land available. Develop hydraulic profile(s) in detail for the selected alternate. Include the hydraulic profile for at least the high plant flow and high receiving water flow/elevation and low plant flow conditions. Include hydraulic profiles for other critical flow conditions if necessary to justify unique design elements or operating conditions.	**Section 8** includes the process schematic, preliminary site map and hydraulic profile for the selected WWTP alternatives. The selected alternative must be incorporated into the facility’s existing hydraulic profile and site; therefore, these are considered applicable at this stage. It is anticipated that project specific hydraulic profiles and site plans will be further developed during preliminary design.

Text from WAC 173-240-060	Explanation	Comments and Location in Facility Plan
(j) A discussion of infiltration and inflow problems, overflows and bypasses, and proposed corrections and controls.	Evaluate the existing treatment plant flows showing the degree of I/I in the collection system. The analysis must include a review of the age and characteristics of the existing sewerage system, flow monitoring in the system and location of sewer lines with high I/I. A complete evaluation of I/I in a system requires at least one year of testing to establish the baseline flows and conditions for further evaluations. Refer to section C1-7 for further guidance on conducting I/I investigations. Identify discharge locations for sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs) on a map and discuss their current frequency and impacts on receiving water. Include any recommendations of how to eliminate SSOs and minimize CSOs and their effect on the receiving water. Ecology will not approve plans that will result in an increase of the frequency or impact of SSO and/or CSO discharges. Chapter 173-245 WAC requires municipalities to submit a CSO reduction plan if their sewer system contains any CSOs. The final project recommendation must include plans for I/I reduction, SSO elimination, and incorporate recommendations presented in a CSO control plan that conform to Chapter 173-245 WAC.	An I/I evaluation of the collection system is included in the **City of Pasco Comprehensive Sewer Plan (2014)**, bound separately.
(k) A discussion of any special provisions for treating industrial wastes, including any pretreatment requirements for significant industrial sources.	Identify any industrial wastes that require special handling by the treatment plant and discuss proposed methods for handling those wastes. Reference appropriate treatability studies for existing industrial wastewaters to identify the potential to interfere with proposed treatment plant unit processes. Identify the extent of industrial pretreatment needed to ensure stable plant operation and water quality protection.	See the **City of Pasco Comprehensive Sewer Plan (2014)**, bound separately, and **Section 5** of this Facility Plan. The City of Pasco does have one industrial users which discharges to the WWTP. The single discharger is anticipated to cease discharging to the municipal WWTP and is not expected to affect plant performance into the future.
(l) Detailed outfall analysis or other disposal method selected.	See 3(e) above. The outfall location and diffuser design, whether existing or proposed, must ensure effluent discharge will meet applicable water quality standards presented in Chapter 173-201A WAC. The report must include a detailed outfall analysis to justify that water quality standards will be met at the point of discharge or at the boundaries of acute and chronic mixing zones as defined by 173-201A-400 WAC. The analysis must be consistent with Ecology's "Guidance for Conducting Mixing Zone Analyses" (Publication 97- e12) and EPA's "Technical Support Document for Water Quality-based Toxics Control". Ecology encourages the use of computer dilution models, such as PLUMES or CORMIX, that are calibrated to actual conditions in the field to develop the outfall analysis. The analysis must include all critical flow and loading situations expected for the facility. For river discharges the low flow must represent the 7Q10 flow or other regulated low flow. Marine discharges must use mean lower low water elevation and seasonal conditions that result in the greatest stratification in the water column. Ecology considers the outfall and diffuser a basic unit of the treatment system and proponents must include them in the data for 3(g) above. For land application of wastewater, see (4) below.	The facility's existing outfall, as well as design drawings, reports and evaluations, are summarized in **Section 5** and **Section 5 Appendices**. Recommended projects for the Outfall and Diffuser are included in **Section 6** and **Section 8**.
(m) A discussion of the method of final sludge disposal and any alternatives considered.	Include a residual solids management plan that evaluates the expected solids quantities and quality, and the potential disposal or beneficial use options (including regional biosolids disposal and utilization options). The management plan includes evaluating sludge treatment options at the plant and relating these treatment options to the sludge disposal or biosolids utilization options considered. The proponent must ensure compliance with applicable laws and regulations (40 CFR 503 and 258), Ecology's Minimal Functional Standards and local permits. Guidance on the content of a residual solids management plan is available in Chapter S of this manual and from Ecology's Regional Biosolids Coordinator. Determine solids mass balance for the treatment plant as an important part of the process of developing and comparing both the sludge treatment and wastewater treatment alternatives. Present a ranking of the various residual solids handling alternatives considered and identify the preferred alternative and actions necessary for implementation. Also present the reasons for not selecting the other alternatives. Part of the alternatives analysis referred to in 3(f) and (g) above includes the selection of a residual solids treatment and disposal process.	Design Criteria (including expected future liquid and solid quantities) are provided in **Section 6, part 6.2**. Evaluation of a No Action alternative for the solids stream components is included in **Chapter 7**. Alternative for biosolids treatment and disposal are included in subsequent sections of **Chapter 7**.
(n) Provision for future needs.	The proponent must discuss the future wastewater needs of the community with an emphasis on identifying potential alternatives to accommodate for future growth. The discussion should include the potential to expand an existing treatment plant on a given site, construction a new plant on an alternate site (including locations to construct a new facility), and the ability to extend the sewerage system. Identify the population, industrial, and commercial growth expectations of the service area. Growth expectations should consider high, medium, and low growth profiles. The time frame for this evaluation may range from five years for a phased project to 20 years for complete build out of the service area. Ecology recommends that proponents include 20 years of treatment capacity in each project.	The facility plan was completed with a 20-year study period. Expansion needs for the facility are estimated and presented in **Sections 5, 6, 7 and 8**.

Text from WAC 173-240-060	Explanation	Comments and Location in Facility Plan
(o) Staffing and testing requirements for the facilities.	The comparison of alternatives must discuss the potential staffing needs of each final treatment alternative, including staffing levels and specialization needs of each. EPA's document "Estimating Staffing for Municipal Wastewater Facilities" provides an acceptable estimating tool for this purpose. Evaluate the facility during the design phase facility classification under Chapter 173-230 WAC. The staffing plan must include at least one operator matching the facility classification as the operator in responsible charge. Describe the selected alternative in adequate detail to evaluate the facility classification.	Existing staffing levels are compared to estimated staffing needs for the selected alternative in **Section 8.**
(p) An estimate of the costs and expenses of the proposed facilities and the method of assessing costs and expenses. The total amount shall include both capital costs and also operation and maintenance costs for the life of the project, and shall be presented in terms of total annual cost and present worth.	The cost estimate must be the engineer's best opinion of probable final costs based on an intermixed estimate of quantities and costs. Proponents interested in obtaining construction financial assistance from Ecology must provide a project financing (user charge) evaluation. The financing evaluation must include the potential Ecology grant or loan funding in addition to an analysis that does not include any Ecology grant or loan funding. Also include a present worth analysis of O&M costs for each of the final alternates as part of the ranking process.	Cost opinions are presented in **Section 6**, **Section 7** and **Section 8.** The basis for these costs are provided in the **Section 6 and 7 appendices**. Project financing considerations are presented in the **City of Pasco Comprehensive Sewer Plan (2014)**, bound separately.
(q) A statement regarding compliance with any applicable state or local water quality management plan or any such plan adopted pursuant to the federal Water Pollution Control Act as amended.	Identify any applicable water quality management plan connected to the proposed project and discuss how the project is connected to that plan.	See **Section 5** for a discussion on applicable water quality plans.
(r) A statement regarding compliance with SEPA and NEPA, if applicable.	Prepare an environmental report that identifies the potential environmental impacts of the project. Include a copy of the completed SEPA checklist along with the appropriate adopted SEPA determination (Determination of Non- significance, mitigation plan, Environmental Impact Statement, etc.) in the engineering report. The action taken that requires SEPA is the adoption of the engineering report and its recommended project. For federally funded projects, excluding SRF Loans, append a NEPA environmental assessment or reference to an applicable FEIS and final NEPA action in the engineering report. The local government must make final SEPA declaration prior to approval of the engineering report. ~~If the project anticipates Ecology SRF or Centennial Grant funding, the proponent must also complete the SERP process. This process is in addition to the SEPA process, but can be replaced by NEPA. See G1-2.6 for more information about SERP.~~	See **Sections 2 and 5** and their associated appendices for discussions on potential environmental impacts of the project. A Non-Project SEPA checklist was prepared and submitted to the City as lead agency. A Determination of Non-Signification (DNS) was issued on March 29, 2019. A copy of the SEPA checklist and DNS are included in the **Section 2 Appendices**. *Ecology indicated during the March 7, 2019 project workshop and subsequent correspondence that a SEPA checklist with DNS would be sufficient to meet the requirements of WAC 173-240-060(r) and that completion of the SERP process is not needed at this time. The SERP process would come later as the specific projects are designed. A Federal Cross-Cutter review is not required at this time or prior to application for an Ecology loan, but could be required if the City both receives a loan* and *is selected as an "equivalency project".*
060(4) Land Application Discharges		**Not applicable.**

APPENDIX 2-1

Issuance Date: June 29, 2010
Effective Date: July 1, 2010
Expiration Date: June 30, 2015

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT No. WA-004496-2

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7600

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 1342 et seq.

City of Pasco
P.O. Box 293
1015 S. Grey Street
Pasco, WA 99301

is authorized to discharge in accordance with the Special and General Conditions that follow.

Plant Location: 1015 South Grey Street	Receiving Water: Columbia River, at RM 327.6 of the McNary Pool reach of the river. Aka Lake Wallula
Waterbody I.D. No.: - 1189897461506	Discharge Location: Latitude: 46° 12' 58" N Longitude: 119° 05' 12" W
Plant Type: Advanced Secondary treatment with activated sludge and ultraviolet light disinfection	

James M. Bellatty
Water Quality Section Manager
Eastern Regional Office
Washington State Department of Ecology

TABLE OF CONTENTS

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
S3	Discharge Monitoring Report	Monthly	August 15, 2010
S3.E	Reporting Permit Violations	As necessary	
S3.F	Other Reporting	As necessary	
S4.B	Plans for Maintaining Adequate Capacity	As necessary	
S4.D	Notification of New or Altered Sources	As necessary	
S5.G.	Operations and Maintenance Manual Update or Review Confirmation Letter	Annually	
S6.E	Local Limits Development	1/permit cycle	April 15, 2011
S8.	Engineering Report	1/permit cycle	January 15, 2011
S9.	Permit Application	1/permit cycle	December 31, 2014
G1.C	Notice of Change in Authorization	As necessary	
G4	Reporting Planned Changes	As necessary	
G5	Engineering Report for Construction or Modification Activities	As necessary	
G7	Notice of Permit Transfer	As necessary	
G10	Duty to Provide Information	As necessary	
G23	Contract Submittal	As necessary	

SPECIAL CONDITIONS

In this permit, the word "must" denotes an action that is mandatory and is equivalent to the word "shall" used in previous permits.

S1. DISCHARGE LIMITS

A. Effluent Limits

All discharges and activities authorized by this permit must comply 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 violates the terms and conditions of this permit.

Beginning on the effective date of this permit and lasting through the expiration date, the Permittee may discharge municipal wastewater at the permitted location subject to compliance with the following limits:

EFFLUENT LIMITS: OUTFALL # 1		
Parameter	**Average Monthly** [a]	**Average Weekly** [b]
Biochemical Oxygen Demand (5-day)	30 mg/L, 1131 lbs/day 85% removal of influent BOD	45 mg/L, 1696 lbs/day
Total Suspended Solids	30 mg/L, 1131 lbs/day 85% removal of influent TSS	45 mg/L, 1696 lbs/day
Fecal Coliform Bacteria [c]	200/100 mL	400/100 mL
pH [d]	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0.	
a	Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. See footnote c for fecal coliform calculations.	
b	Average weekly discharge limitation means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharge" measured during a calendar week divided by the number of "daily discharges" measured during that week. See footnote [c] for fecal coliform calculations.	
c	To calculate the average monthly and average weekly values for fecal coliforms you must use the geometric mean. Ecology gives directions to calculate this value in publication No. 04-10-020, *Information Manual for Treatment Plant Operators* available at: http://www.ecy.wa.gov/pubs/0410020.pdf	
d	Indicates the range of permitted values. The Permittee must report the instantaneous maximum and minimum pH monthly. Do not average pH values.	

B. Mixing Zone Authorization

The following paragraphs define the maximum boundaries or flow-volume restriction of the mixing zones:

The chronic mixing zone shall extend no more than 330 feet downstream from the point of discharge.

The acute mixing zone shall extend no more than 33 feet downstream of the point of discharge.

Available Dilution (dilution factor)	
Acute Aquatic Life Criteria	1:181
Chronic Aquatic Life Criteria	1:2198
Human Health Criteria - Carcinogen	1:8477
Human Health Criteria - Non-carcinogen	1:3077

S2. MONITORING REQUIREMENTS

A. Monitoring Schedule

The Permittee must monitor in accordance with the following schedule and must use the laboratory methods, and meet the detection levels (DL), and quantitation levels (QL) specified in Appendix A. The Permittee may use alternative methods included in 40 CFR Part 136 if the DL and QL are equivalent to those specified in Appendix A or if the alternative method's DL and QL are low enough to detect the parameter:

Parameter	Units	Minimum Sampling Frequency	Sample Type
(1) Wastewater Influent			
Wastewater Influent means the raw sewage flow. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.			
Flow	MGD	Daily	Continuous measurement [b]
BOD_5	mg/L	2/week	24 hour composite [c]
BOD_5	lbs/day	2/week	24 hour composite [c]
TSS	mg/L	2/week	24 hour composite [c]
TSS	lbs/day	2/week	24 hour composite [c]
Ammonia Nitrogen (NH_3-N)	mg/L	2/week	24 hour composite [c]
Total Phosphorus	mg/L	2/month on alternate weeks	24 hour composite [c]

Parameter	Units	Minimum Sampling Frequency	Sample Type
Temperature	°C	Daily	Continuous with thermistor or equal See. S.2.C.3
Dissolved Oxygen	mg/L	Daily	Grab [e]
pH	std units	Daily	Grab [e]
Cyanide	mg/L	Quarterly [a]	Grab [e]
Phenols	mg/L	Quarterly [a]	Grab [e]
volatile organic compounds	mg/L	Twice a year – February and August	24 hour composite [c]
base-neutral compounds	mg/L	Twice a year – February and August	24 hour composite [c]
acid-extractable compounds	mg/L	Twice a year – February and August	24 hour composite [c]
Copper	ug/L	Quarterly [a]	24 hour composite [c]
Lead	ug/L	Yearly in first quarter [a]	24 hour composite [c]
Cadmium	ug/L	Yearly in first quarter [a]	24 hour composite [c]
Mercury	ug/L	Yearly in first quarter [a]	24 hour composite [c]
(2) Final Wastewater Effluent			
Final Wastewater Effluent means wastewater which is exiting, or has exited, the last treatment process or operation. Typically, this is after or at the exit from the disinfection process. The Permittee may take effluent samples for the BOD5 analysis before or after the disinfection process. If taken after, dechlorinate if appropriate and reseed the sample.			
Flow	MGD	Daily	Continuous measurement [b]
BOD_5	mg/L	2/week	24 hour composite [c]
BOD_5	lbs/day	2/week	24 hour composite [c]
BOD_5	% removal [d]	2/week	24 hour composite [c]
TSS	mg/L	2/week	24 hour composite [c]
TSS	lbs/day	2/week	24 hour composite [c]
TSS	% removal [d]	2/week	24 hour composite [c]
Ammonia Nitrogen (NH_3-N)	mg/L	2/week	24 hour composite [c]
Total Phosphorus	mg/L	2/month on alternate weeks	24 hour composite [c]
Fecal Coliform	Org./100 ml	2/week	Grab [e]
pH	Standard Units	Daily	Grab [e]
Temperature	°C	Daily	Continuous with thermistor or equal See. S.2.C.3

Parameter	Units	Minimum Sampling Frequency	Sample Type
Dissolved Oxygen	mg/L	5/week	Grab [e]
Cyanide	mg/L	Quarterly [b]	Grab [e]
Phenols	mg/L	Quarterly [b]	Grab [e]
volatile compounds [g]	mg/L	Twice a year – February and August	24 hour composite [c]
base-neutral compounds [g]	mg/L	Twice a year – February and August	24 hour composite [c]
acid compounds [g]	mg/L	Twice a year – February and August	24 hour composite [c]
Copper	ug/L	Quarterly [b]	24 hour composite [c]
Arsenic	ug/L	Yearly in first quarter [b]	24 hour composite [c]
Cadmium	ug/L	Yearly in first quarter [b]	24 hour composite [c]
Lead	ug/L	Yearly in first quarter [b]	24 hour composite [c]
Mercury	ug/L	Yearly in first quarter [b]	24 hour composite [c]
Molybdenum	ug/L	Yearly in first quarter [b]	24 hour composite [c]
Selenium	ug/L	Yearly in first quarter [b]	24 hour composite [c]
Zinc	ug/L	Yearly in first quarter [b]	24 hour composite [c]
For Temperature sampling measured continuously, the Permittee must determine and report a daily maximum from half-hour measurements in a 24-hour period. To determine the daily average, use the temperature on the half-hour from the chart for the twenty-four (24) hour period and calculate the average of the values. Continuous monitoring instruments must achieve an accuracy of 0.2 degrees C and the Permittee must verify accuracy annually. See S.2.C.3.			
The Permittee must record and report the wastewater treatment plant flow discharged on the day it collects the sample for priority pollutant testing with the discharge monitoring report.			
[a] Quarter is defined as: Jan.-March, April – June, July – Sept., October – December			
[b] Continuous means uninterrupted except for brief lengths of time for calibration, for power failure, or for unanticipated equipment repair or maintenance.			
[c] 24-hour composite means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.			
[d] Calculate the Percent (%) removal of BOD and TSS using the following algorithm (concentrations in mg/L): (Average Monthly Influent Concentration - Average Monthly Effluent Concentration)/Average Monthly Influent Concentration.			
[e] Grab means an individual sample collected over a fifteen (15) minute, or less, period.			
[f] 3/week means three (3) times during each calendar week and on a rotational basis throughout the days of the week, except weekends and holidays.			
[g] See Appendix A for the specific parameters and the required detection (DL) or quantitation (QL) levels. Report single analytical values below detection as “less than (detection level)” where (detection level) is the numeric value specified in attachment A.			

Parameter	Units	Minimum Sampling Frequency	Sample Type
Report single analytical values between the agency-required detection and quantitation levels with qualifier code of j following the value. To calculate the average value (monthly average): • Use the reported numeric value for all parameters measured between the agency-required detection value and the agency-required quantitation value. • For values reported below detection, use one-half the detection value if the lab detected the parameter in another sample for the reporting period. • For values reported below detection, use zero if the lab did not detect the parameter in another sample for the reporting period. If the Permittee is unable to obtain the required DL and QL in its effluent due to matrix effects, the Permittee must submit a matrix specific MDL and a QL to Ecology with appropriate laboratory documentation.			

B. Sampling and Analytical Procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters. The Permittee must conduct representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions that may affect effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136.

C. Flow Measurement, and Continuous Monitoring Devices

The Permittee must:

1. Select and use appropriate flow measurement and continuous monitoring devices and methods consistent with accepted scientific practices.
2. Install, calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard and the manufacturer's recommendation for that type of device.
3. If the Permittee uses micro-recording temperature devices known as thermistors it must calibrate the devices using protocols from Ecology's Quality Assurance Project Plan Development Tool (*Continuous Temperature Sampling Protocols for the Environmental Monitoring and Trends*). This document is available online at http://www.ecy.wa.gov/programs/eap/qa/docs/QAPPtool/Mod6%20Ecology%20SOPs/Protocols/ContinuousTemperatureSampling.pdf. Calibration as specified in this document is not required if the Permittee uses recording devices which are certified by the manufacturer.
4. Calibrate flow monitoring devices at a minimum frequency of at least one calibration per year.
5. Maintain calibration records for at least three years.

D. Laboratory Accreditation

The Permittee must ensure that all monitoring data required by Ecology is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories.* Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement.

S3. REPORTING AND RECORDING 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. Submit priority pollutant analysis data no later than forty-five (45) days following the monitoring.
6. Send report(s) to Ecology at:

Water Quality Permit Coordinator
Department of Ecology
Eastern Regional Office
4601 North Monroe Street
Spokane, WA 99205-1295

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 (3) 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:

a. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the noncompliance and correct the problem.

b. If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (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-hr. number listed below:

Eastern Regional Office	509-329-3400

   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:

Eastern Regional Office	509-329-3400
Department of Health,	360-521-0323 (business hours)
Drinking Water Program	360-481-4901 (after business hours)

2. Twenty-four-hour Reporting

   The Permittee must report the following occurrences of noncompliance by telephone, to Ecology at (509)329-3400, 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. 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

The flows or waste loads for the permitted facility must not exceed the following design criteria:

Influent Loadings in the Design Criteria	Year 2030
Flow	
Average Annual (MGD)	TBD
Maximum Month (MGD)	TBD
Maximum Day (MGD)	TBD
Maximum Hour (MGD)	TBD
Wastewater Loadings	
BOD_5 – Average Annual (1,000 lbs/day)	TBD
BOD_5 – Maximum Month (1,000 lbs/day)	TBD
TSS – Average Annual (1,000 lbs/day)	TBD
TSS – Maximum Month (1,000 lbs/day)	TBD
Ammonia – Average Annual (1,000 lbs/day)	TBD
Ammonia – Maximum Month (1,000 lbs/day)	TBD

B. Plans for Maintaining Adequate Capacity

See section S8, Compliance Schedule.

C. Duty to Mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

D. Notification of New or Altered Sources

1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the POTW is proposed which:

    a. Would interfere with the operation of, or exceed the design capacity of, any portion of the POTW;

    b. Is not part of an approved general sewer plan or approved plans and specifications; or

    c. Would be subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.

2. This notice must 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 Permittee’s effluent [40 CFR 122.42(b)].

S5. OPERATION AND MAINTENANCE

The Permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic), adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

A. Certified Operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class III plant. This operator must be in responsible charge of the day-to-day operation of the wastewater treatment plant. An operator certified for at least a Class II plant must be in charge during all regularly scheduled shifts.

B. O & M Program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.

2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.

3. Make maintenance records available for inspection at all times.

C. Short-term Reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out in a manner approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.

2. Detail 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 its obligations under this permit.

D. Electrical Power Failure

The Permittee must ensure that adequate safeguards 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. Adequate safeguards include, but are not limited to: alternate power sources, standby generator(s), or retention of inadequately treated wastes.

For Reliability Class II - The Permittee must maintain Reliability Class II (EPA 430/9-74-001) at the wastewater treatment plant, Reliability Class II requires a backup power source sufficient to operate all vital components and critical lighting and ventilation during peak wastewater flow conditions. 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 must be sufficient to maintain the biota.

E. Prevent Connection of Inflow

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

F. Bypass Procedures

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

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 limits or other conditions of this permit, or adversely impact public health as determined by Ecology prior to the bypass. The Permittee must submit prior notice, if possible, at least ten (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. No feasible alternatives to the bypass exist, such as:

      - The use of auxiliary treatment facilities.
      - Retention of untreated wastes.
      - Stopping production.
      - Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass.
      - Transport of untreated wastes to another treatment facility 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. If bypass is anticipated and has the potential to result in noncompliance of this permit.

a. The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

- A description of the bypass and its cause.
- An analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.
- A cost-effectiveness analysis of alternatives including comparative resource damage assessment.
- The minimum and maximum duration of bypass under each alternative.
- A recommendation as to the preferred alternative for conducting the bypass.
- The projected date of bypass initiation.
- A statement of compliance with SEPA.
- A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
- Details of the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during preparation of the engineering report or facilities plan and plans and specifications and must include these to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.

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

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

- If feasible alternatives to bypass exist, 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.

- If the Permittee planned and scheduled the bypass 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. Ecology will give the public an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Ecology will approve a request to bypass by issuing an administrative order under RCW 90.48.120.

G. Operations and Maintenance Manual

The Permittee must:

1. Review the O&M Manual at least annually and confirm this review by letter to Ecology.
2. Submit to Ecology for review and approval substantial changes or updates to the O&M Manual whenever it incorporates them into the manual.
3. Keep the approved O&M Manual at the permitted facility.
4. Follow the instructions and procedures of this manual.

S6. PRETREATMENT

A. General Requirements

The Permittee must work with Ecology to ensure that all commercial and industrial users of the publicly owned treatment works (POTW) comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that the Environmental Protection Agency (U.S. EPA) may promulgate under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

B. Duty to Enforce Discharge Prohibitions

1. Under 40 CFR 403.5(a), the Permittee must not authorize or knowingly allow the discharge of any pollutants into its POTW which may be reasonably expected to cause pass through or interference, or which otherwise violate general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC-173-216-060.

2. The Permittee must 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, non-biodegradable 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 40 degrees Centigrade (104 degrees Fahrenheit) 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. The Permittee must also not allow the following discharges to the POTW unless approved in writing by Ecology:

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 must notify Ecology if any industrial user violates the prohibitions listed in this section (S6.B), and initiate enforcement action to promptly curtail any such discharge.

C. Wastewater Discharge Permit Required

The Permittee must require all non-domestic discharges to apply for a permit, and may not allow any significant industrial users (SIUs) to discharge wastewater to the Permittee's sewer system until such user has received a wastewater discharge permit from Ecology in accordance with chapter 90.48 RCW and chapter 173-216 WAC.

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

1. The Permittee must 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 sewer system (see Appendix B of the 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 must notify such user by registered mail that, if classified as an SIU, they must apply to Ecology and obtain a State Waste Discharge Permit. The Permittee must send a copy of this notification letter to Ecology within this same 30-day period.
3. The Permittee must also notify all Potential SIUs (PSIUs), as they are identified, that if their classification should change to an SIU, they must apply to Ecology for a State Waste Discharge Permit within 30 days of such change.

E. Local Limit Development

By **April 15, 2011**, the Permittee shall, in consultation with the Department, reevaluate and update their local limits in order to prevent pass through or interference.

If Ecology determines that any pollutant present causes pass through or interference, or exceeds established sludge standards, the Permittee must establish new local limits or revise existing local limits as required by 40 CFR 403.5. Ecology may also require the Permittee to revise or establish local limits for any pollutant discharged from the POTW that has a reasonable potential to exceed the Water Quality Standards, or established effluent limits, or causes whole effluent toxicity. The determination by the Department shall be in the form of an Administrative Order.

S7. SOLID WASTES

A. Solid Waste Handling

The Permittee must handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

B. Leachate

The Permittee must not allow leachate from its solid waste material to enter state waters without providing all known, available and reasonable methods of treatment, nor allow such leachate to cause violations of the State Surface Water Quality Standards, Chapter 173-201A WAC, or the State Ground Water Quality Standards, Chapter 173-200 WAC. The Permittee must apply for a permit or permit modification as may be required for such discharges to state ground or surface waters.

S8. COMPLIANCE SCHEDULE

A. The Permittee must prepare and submit two copies of an approvable engineering report or facility plan in accordance with chapter 173-240 WAC to Ecology for review and approval by **January 15, 2011**.

B. The engineering report must evaluate the hydraulic and organic loading capacity of the City of Pasco's wastewater facilities as they currently exist and if necessary recommend upgrades appropriate for the wastewater facilities to provide 20 years of additional service to the community. The engineering report must include a Tier II analysis demonstrating that accommodating an additional 20 years the hydraulic and organic loading capacity will not cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

C. The report must contain any appropriate requirements as described in *Water Reclamation and Reuse Standards* (Washington State Department of Ecology and Department of Health Publication No. 97-23, 1997). As required by RCW 90.48.112, the report must address the feasibility of using reclaimed water as defined in RCW 90.46.010.

S9. APPLICATION FOR PERMIT RENEWAL

The Permittee must submit an application for renewal of this permit by December 31, 2014. The Permittee need only submit an updated EPA Form 1 unless it has made significant changes and needs to update Form 2A.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

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

1. In the case of corporations, by a responsible corporate officer.

   For the purpose of this section, a responsible corporate officer means:

   (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation, or

   (ii) The manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

2. In the case of a partnership, by a general partner.

3. In the case of sole proprietorship, by the proprietor.

4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

Applications for permits for domestic wastewater facilities that are either owned or operated by, or under contract to, a public entity shall be submitted by the public entity.

B. All reports required by this permit and other information requested by Ecology must 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 must 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 gathered and evaluated 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 must 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, 40 CFR 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.

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.

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. When 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. When 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 must, 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.

G5. PLAN REVIEW REQUIRED

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

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

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

G7. TRANSFER OF THIS PERMIT

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

A. <u>Transfers by Modification</u>

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 thirty (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.

G8. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, must 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.

G9. REMOVED SUBSTANCES

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

G10. DUTY TO PROVIDE INFORMATION

The Permittee must 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 must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. OTHER REQUIREMENTS OF 40 CFR

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

G12. ADDITIONAL MONITORING

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

G13. PAYMENT OF FEES

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

G14. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit is deemed guilty of a crime, and upon conviction thereof must be punished by a fine of up to ten thousand dollars ($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 will incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars ($10,000) for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is deemed to be a separate and distinct violation.

G15. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits 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 limits if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
1) an upset occurred and that the Permittee can identify the 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 action, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G16. PROPERTY RIGHTS

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

G17. DUTY TO COMPLY

The Permittee must 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.

G18. TOXIC POLLUTANTS

The Permittee must 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.

G19. 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 must, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two (2) 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 must be a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or by both.

G20. 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 must be submitted no later than fourteen (14) days following each schedule date.

G21. CONTRACT REVIEW

The Permittee must submit to Ecology any proposed contract for the operation of any wastewater treatment facility covered by this permit. The review is to ensure consistency with chapters 90.46 and 90.48 RCW. In the event that Ecology does not comment within a thirty (30)-day period, the Permittee may assume consistency and proceed with the contract.

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
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
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
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 (101-55-3)	625	0.2	0.4
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
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.

murraysmith

APPENDIX 2-2

FACT SHEET FOR NPDES PERMIT WA-004496-2
CITY OF PASCO WASTEWATER TREATMENT WORKS

PURPOSE of this Fact Sheet

This fact sheet explains and documents the decisions Ecology made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) Permit for the City of Pasco Treatment Works.

This fact sheet complies with Section 173-220-060 of the Washington Administrative Code (WAC), which requires Ecology to prepare a draft permit *and accompanying fact sheet* for public evaluation before issuing an NPDES permit.

Ecology makes the draft permit and fact sheet available for public review and comment at least 30 days before issuing the final permit. Copies of the fact sheet and draft permit for the City of Pasco Wastewater Treatment Works, NPDES Permit **WA-0044962,** are available for public review and comment from May 12, 2010 until June 11, 2010. For more details on preparing and filing comments about these documents, please see **Appendix A - Public Involvement**.

The City of Pasco's wastewater utility staff reviewed the draft permit and fact sheet for factual accuracy. Ecology corrected any errors or omissions regarding the facility's location, history, discharges, or receiving water.

After the public comment period closes, Ecology will summarize substantive comments and provide responses to them. Ecology will include the summary and responses to comments in this Fact Sheet as **Appendix D - Response to Comments**, and publish it when issuing the final NPDES permit. Ecology will not revise the rest of the fact sheet, but the full document will become part of the legal history contained in the facility's permit file.

SUMMARY

The City of Pasco Wastewater Treatment Works discharges to the Columbia River. The treatment facilities generally produce an excellent quality effluent. Past exceptions were usually related to illegal discharges into the sewer collection system resulting in minor inhibitory or toxic impacts on the biological community in the aeration basin. The wastewater treatment plant staff has been optimizing solids handling to better mitigate impacts from recycled solids. The facility has added a solids thickening drum and improvements to the digesters have been made. Changes in the proposed permit from the previous permit are primarily a compliance schedule requiring submission of an engineering report suitable for approval. The engineering report must evaluate the hydraulic and organic loading capacity of the City of Pasco's wastewater facilities as they currently exist and if necessary recommend upgrades appropriate for the wastewater facilities to provide twenty years of additional service to the community.

TABLE OF CONTENTS

I. INTRODUCTION

The Federal Clean Water Act (FCWA, 1972, and later amendments in 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES), administered by the federal Environmental Protection Agency (EPA). The EPA authorized the State of Washington to manage the NPDES permit program in our state. Our state legislature accepted the delegation and assigned the power and duty for conducting NPDES permitting and enforcement to Ecology. The legislature defined Ecology's authority and obligations for the wastewater discharge permit program in 90.48 RCW (Revised Code of Washington).

The following regulations apply to municipal NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC)
- Technical criteria for discharges from municipal wastewater treatment facilities (chapter 173-221 WAC)
- Water quality criteria for surface waters (chapter 173-201A WAC) and for ground waters (chapter 173-200 WAC)
- Sediment management standards (chapter 173-204 WAC)
- Submission of Plans and Reports for Construction of Wastewater Facilities (Chapter 173-240 WAC)

These rules require any treatment facility operator to obtain an NPDES permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for requirements imposed by the permit.

Under the NPDES permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make them available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of thirty days (WAC 173-220-050). (See **Appendix A - *Public Involvement*** for more detail about the public notice and comment procedures). After the public comment period ends, Ecology may make changes to the draft NPDES permit. Ecology will summarize the responses to comments and any changes to the permit in **Appendix D.**

II. BACKGROUND INFORMATION

Table 1: General Facility Information

Applicant:	City of Pasco
Facility Name and Address:	Wastewater Treatment Plant 1015 South Grey Street Pasco, WA 99301
Type of Treatment:	Advanced Secondary treatment with ultraviolet light disinfection.
Discharge Location:	Columbia River at RM 327.6 of the McNary Pool reach of the river. Lake Wallula Latitude: 46° 12' 58" N Longitude: 119° 05' 12" W.

Figure 1: Facility Location Map

A. Facility Description

The City of Pasco owns and operates an activated sludge process domestic wastewater treatment plant designed to oxidize, nitrify and disinfect wastewater with ultraviolet light radiation. Ecology provided financial assistance with the expectation that the treatment plant would remove ammonia and chlorine from the receiving environment and eliminate non-compliance issues. The facility is classified as an EPA major discharger and discharges to the Lake Wallula reach of the Columbia River.

History

Pasco originally built the wastewater treatment plant in 1954 as a primary treatment facility. In 1970, it constructed a trickling filter so that the plant could meet secondary treatment requirements. The 1970 addition of a secondary treatment process increased the plant's design population equivalent to 30,000. The most recent upgrade (1998) increased the design population equivalent to 43,500. During the last permit cycle, the City upgraded the solids handling facilities, digestion and solids thickening. These improvements likely increased the overall treatment works capacity.

Collection System Status

The City of Pasco submitted a Comprehensive Sewer Plan to Ecology in December 1992 and updated it in 1999. The City submitted a facility plan with supplements in 1993, which was approved in February 1994. The plan proposed improvements to the City's collection system, wastewater treatment facility and pumping stations. The City has replaced the pumping stations at the intersection of 9th and Washington and at the intersection of 5th and Ainsworth with a single pump station at 9th and Washington resulting in the elimination of an overflow. It also replaced the old “Navy” pump station in the industrial area east of the airport. Areas in West Pasco and East Pasco have been added to the sewerage system. The Port of Pasco abandoned the wastewater stabilization lagoons serving its facilities on Ainsworth and the City now serves the area by a trunk sewer connected to its sewerage system. The City’s collection system consists of gravity sewers from 8 inches to 36 inches in diameter, pump stations and pressure piping.

Treatment Processes

The current wastewater treatment facility includes:

- A headworks building with grit removal.
- Screening equipment and inlet piping.
- An operations building and laboratory.
- A renovated primary clarifier and trickling filter (new distributor).
- Secondary process elements designed to provide nitrification - aeration basins.
- Secondary clarifiers with lime addition for alkalinity and pH control.
- Ultraviolet disinfection.
- Anaerobic digesters.
- Renovated and expanded sludge digestion processes with the addition of a solids drum thickener and a sludge drying bed.

The City's rate of growth is reflected in the increase in flows. The wastewater treatment works design is based on the presumed need to nitrify and avoid toxic effects from ammonia in the Columbia River. At the time the City's outfall was an end of pipe in the river. While the wastewater treatment plant was built to nitrify, consideration was also given to extend the outfall further into the river and add a multi-port diffuser. The installation of the outfall negated the need to nitrify in terms of water quality based effluent limitations. In August 2005, the City commissioned an engineering evaluation of the wastewater treatment facilities capacity. Until recently, the wastewater treatment works was being operated in a nitrifying mode in order to minimize the generation of biosolids.

The treatment facilities generally produce an excellent quality effluent. Past exceptions were usually related to illegal discharges into the sewer collection system resulting in minor inhibitory or toxic impacts on the biological community in the aeration basin. Some violations were related to how recycle of solids was handled. The wastewater treatment plant staff has been optimizing solids handling to better mitigate impacts from recycled solids. The facility has added a solids thickening drum and improvements to the digesters have been made. The 2005 assessment of the wastewater treatment facilities capacity pointed that solids handling was a critical capacity limiting factor. With the new digester it is time to reassess the capacity of the facility and its ability to serve the community.

The WWTP is an activated sludge treatment plant with a flow between 1 MGD and 10 MGD. As such, it is a class III facility according to **WAC 173-230-140; *Classification of Wastewater Treatment Plants*.**

Discharge Outfall

The effluent is discharged from the facility via a 24-inch steel multiport diffuser outfall into the Columbia River. The outfall has three 8" diameter diffuser ports. At this location the river flows west to east south east. Leaving the plant site, the outfall follows a southerly line defined by Gray Street continuing approximately 900 feet offshore from the north bank and at a depth of approximately 30 feet.

Solid Wastes

The treatment facilities remove solids during the treatment of the wastewater at the headworks (grit and screenings), and at the primary and secondary clarifiers (biosolids). In addition to incidental solids (rags, scum, and other debris) removed as part of the routine maintenance of the equipment, Scum is routed to the anaerobic digester for biological oxidation.

Biosolids removed from the clarifiers are thickened (dissolved air floatation), anaerobically digested, dried in the drying beds and land applied under a permit issued by Ecology's Waste 2 Resources Program. The biosolids produced at the treatment works are of exceptional quality and beneficial use options are available. Grit, rags, and screenings are drained and disposed of as solid waste at the local landfill. The proposed permit includes a condition requiring the City to properly handle residual solids so that no leachate enters ground or surface water.

B. Permit Status

Ecology issued the previous permit for this facility on July 7, 2004. The previous permit placed effluent limitations on 5-day Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), pH, and Fecal Coliform Bacteria.

The City of Pasco submitted an application for permit renewal on January 5, 2009. Ecology accepted it as complete on January 30, 2009.

C. Summary of Compliance with Previous Permit Issued

Ecology staff last conducted a non-sampling compliance inspection on June 12, 2008. The City of Pasco WWTP has complied with the effluent limits and permit conditions throughout the duration of the permit issued on July 7, 2004**.** Ecology assessed compliance based on its review of the facility's discharge monitoring reports (DMRs) and on inspections conducted by Ecology.

D. Wastewater Characterization

The concentration of pollutants in the discharge was reported in the NPDES application and in discharge monitoring reports (DMRs). The tabulated data represents the quality of the effluent discharged from the Pasco WWTP using DMR data from January 2005 through March 2009. The effluent is characterized as follows:

Table 2: Wastewater Characterization

Parameter	Average Concentration	Maximum Concentration	Minimum Concentration
Flow, MGD	3.23	3.62	3.01
Influent BOD_5, mg/L	237.3	313	191
Influent TSS, mg/L	246	327	203
Effluent BOD_5, mg/L	12.5	57	4
Effluent TSS, mg/L	15.7	100	6
Effluent NH_3, mg/L	13.6	35.1	0.41
Effluent Temperature, January, deg F	59	60	58
Effluent Temperature, August, deg F	78	79	77

E. Description of the Receiving Water

The City of Pasco WWTP discharges to the Columbia River. Other nearby point source outfalls include the City of Kennewick WWTP and the City of Richland WWTP.

The ambient background data used for this permit includes the following from environmental Assessment Program monitoring station 36A070 on the Columbia River near Vernita:

Table 3: Ambient Background Data

Parameter	Value used
Temperature (highest annual 1-DADMax)	21 ^{o} C
Temperature (**some waterbodies have specific temperature criteria as assigned in Table 602)	See Footnote 1
pH (Maximum / Minimum)	8.45/8.03
Dissolved Oxygen (Maximum / Minimum)	14.08/9.38 mg/L
Total Ammonia-N	0.01 mg/L
Fecal Coliform (Maximum)	11/100 mL
Turbidity	1.2 NTU
Hardness	65 mg/L as CaCO3
Lead	0.1 µg/L
Copper	0.67 µg/L
Zinc	5 µg/L

Footnote:

1. From Washington-Oregon border (river mile 309.3) to Priest Rapids Dam (river mile 397.1). Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9)

F. SEPA Compliance

Regulation exempts reissuance or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions that are no less stringent than state rules and regulations. The exemption applies only to existing discharges, not to new discharges.

The City prepared SEPA and State Environmental Review Process (SERP) documents during the planning phase of the wastewater treatment works upgrade completed in July 1998. The City prepared SERP documents to comply with Washington Water Pollution Control Revolving Fund requirements.

III. PROPOSED PERMIT LIMITS

Federal and state regulations require that effluent limits in an NPDES permit must be either technology- or water quality-based.

- Technology-based limits are based upon the treatment methods available to treat specific pollutants. Technology-based limits are set by the EPA and published as a regulation, or Ecology develops the limit on a case-by-case basis (40 CFR 125.3, and chapter 173-220 WAC).
- Water quality-based limits are calculated so that the effluent will comply 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 (40 CFR 131.36).
- Ecology must apply the most stringent of these limits to each parameter of concern. These limits are described below.

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, etc.). Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the state of Washington. Ecology does not develop effluent limits for all reported pollutants**.** 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.

Nor does Ecology usually develop limits for pollutants that were not reported in the permit application but that may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. If significant changes occur in any constituent of the effluent discharge, the City of Pasco is required to notify Ecology (40 CFR 122.42(a)). The City of Pasco may be in violation of the permit until Ecology modifies the permit to reflect additional discharge of pollutants.

G. Design Criteria

In accordance with WAC 173-220-150 (1)(g), flows or waste loadings must not exceed approved design criteria. However Ecology-is requiring an update of the design criteria to reflect recent upgrades of the solids handling treatment train which limiting hydraulic capacity and organic loading capacity.

Table 4: Design Criteria for the City of Pasco WWTP

Influent Loadings in the Design Criteria	Year
Population	To be determined (TBD)
Average Annual Flow (MGD)	TBD
Maximum Month Flow (MGD)	TBD

Influent Loadings in the Design Criteria	Year
Maximum Day Flow (MGD)	TBD
Maximum Hour Flow (MGD)	TBD
BOD_5 Loading– Average Annual (lbs/day)	TBD
BOD_5 Loading – Maximum Month (lbs/day)	TBD
TSS Loading – Average Annual (lbs/day)	TBD
TSS Loading– Maximum Month (lbs/day)	TBD
Ammonia Loading – Average Annual (lbs/day)	TBD
Ammonia Loading – Maximum Month (1,000 lbs/day)	TBD

H. Technology-Based Effluent Limits

Federal and state regulations define technology-based effluent limits for municipal wastewater treatment plants. These effluent limits 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 (AKART) for municipal wastewater.

Chapter 173-221 WAC lists the following technology-based limits for pH, fecal coliform, BOD_5, and TSS:

Table 5: Technology-based Limits

Parameter	Limit
pH	The pH must measure within the range of 6.0 to 9.0 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 technology-based mass limits are based on WAC 173-220-130(3)(b) and 173-221-030(11)(b). From the previous permit the effluent mass was as follows and will be used temporarily until the required engineering report is approved.

The maximum month effluent mass (lbs/day) was calculated as the maximum monthly design flow (4.52 MGD) x Concentration limit (30 mg/L) x 8.34 (conversion factor) = mass limitation of 1131 lb./day of BOD_5 or TSS.

Monthly effluent mass loadings (lbs/day) = maximum monthly influent design loading (10,690 lbs./day) x 0.15 = 1603.5 lbs./day, BOD5 or . (8,720 lbs./day) x 0.15 = 1308 lbs./day TSS

The weekly average effluent mass loading = 1.5 x monthly loading.
1.5 x 1603.5 lbs./day =2405 lbs/day BOD5 or 1.5 x 1308 lbs/day = 1962 lbs/day TSS

The calculation of mass based on flow x concentration x conversion faction above generates the more restrictive effluent mass limit.

I. Surface Water Quality-Based Effluent Limits

The Washington State Surface Water Quality Standards (chapter 173-201A WAC) are designed to protect existing water quality and preserve the beneficial uses of Washington's surface waters. Waste discharge permits must include conditions that ensure the discharge will meet the surface water quality standards (WAC 173-201A-510). Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily load study (TMDL).

Numerical Criteria for the Protection of Aquatic Life and Recreation

Numerical water quality criteria are listed in the water quality standards for surface waters (chapter 173-201A WAC). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. Ecology uses numerical criteria 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 limits, the discharge must meet the water quality based limits.

Numerical Criteria for the Protection of Human Health

The U.S. EPA has published 91 numeric water quality criteria for the protection of human health that are applicable to dischargers in Washington State (EPA 1992). These criteria are designed to protect humans from exposure to pollutants linked to cancer and other disease, based on consuming fish and shellfish and drinking contaminated surface waters. The water quality standards also include radionuclide criteria to protect humans from the effects of radioactive substances.

Narrative Criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1); 2006) limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge to levels below those which have the potential to:

- Adversely affect designated water uses.
- Cause acute or chronic toxicity to biota.
- Impair aesthetic values.
- Adversely affect human health.

Narrative criteria protect the specific designated uses of all fresh waters (WAC 173-201A-200, 2006) and of all marine waters (WAC 173-201A-210,; 2006) in the State of Washington.

Antidegradation

The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330; 2006) is to:

- Restore and maintain the highest possible quality of the surface waters of Washington.
- Describe situations under which water quality may be lowered from its current condition.
- Apply to human activities that are likely to have an impact on the water quality of surface water.
- Ensure that all human activities likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART).
- Apply three tiers of protection (described below) for surface waters of the state.

Tier I ensures existing and designated uses are maintained and protected and applies to all waters and all sources of pollutions. Tier II ensures that waters of a higher quality than the criteria assigned are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities. Tier III prevents the degradation of waters formally listed as "outstanding resource waters," and applies to all sources of pollution.

A facility must prepare a Tier II analysis when all three of the following conditions are met:

- The facility is planning a new or expanded action.
- Ecology regulates or authorizes the action.

- The action has the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

This facility must meet Tier I requirements.

- Dischargers must maintain and protect existing and designated uses. Ecology must not allow any degradation that will interfere with, or become injurious to, existing or designated uses, except as provided for in chapter 173-201A WAC.
- The facility must include a Tier II analysis in the engineering report demonstrating that accommodating an additional 20 years of capacity will not cause measurable degradation to existing water quality at the edge of a chronic mixing zone.

Mixing Zones

A mixing zone is the defined area in the receiving water surrounding the discharge port(s), where wastewater mixes with receiving water. Within mixing zones the pollutant concentrations may exceed water quality numeric standards, so long as the discharge does not interfere with designated uses of the receiving water body (for example, recreation, water supply, and aquatic life and wildlife habitat, etc.) The pollutant concentrations outside of the mixing zones must meet water quality numeric standards.
State and federal rules allow mixing zones because the concentrations and effects of most pollutants diminish rapidly after discharge, due to dilution. Ecology defines mixing zone sizes to limit the amount of time any exposure to the end-of-pipe discharge could harm water quality, plants, or fish.

The state's water quality standards allow Ecology to authorize mixing zones for the facility's permitted wastewater discharges only if those discharges already receive all known, available, and reasonable methods of prevention, control, and treatment (AKART). Mixing zones typically require compliance with water quality criteria within a specified distance from the point of discharge and use no more than 25% of the available width of the water body for dilution. Ecology uses modeling to estimate the amount of mixing within the mixing zone. Through modeling, Ecology determines the potential for violating the water quality standards at the edge of the mixing zone and derive any necessary effluent limits. Steady state models are the most frequently used tools for conducting mixing zone analyses. Ecology chooses values for each effluent and for receiving water variables that correspond to the time period when the most critical condition is likely to occur (see Ecology's *Permit Writer's Manual*). Each critical condition parameter, by itself, has a low probability of occurrence and the resulting dilution factor is conservative. The term "reasonable worst-case" applies to these values.

The mixing zone analysis produces a numerical value called a dilution factor (DF). A dilution factor represents the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. For example, a dilution factor of 10 means the effluent is 10% and the receiving water is 90% of the total volume of water at the boundary of the mixing zone. Ecology uses dilution factors with the water quality criteria to calculate reasonable potentials and effluent limits.

Water quality standards include both aquatic life-based criteria and human health-based criteria. The former are applied at both the acute and chronic mixing zone boundaries; the latter are applied only at the chronic boundary. The concentration of pollutants at the boundaries of any of these mixing zones may not exceed the numerical criteria for that zone.

Each aquatic life **acute** criterion is based on the assumption that organisms are not exposed to that concentration for more than one hour and more often than one exposure in three years.
Each aquatic life **chronic** criterion is based on the assumption that organisms are not exposed to that concentration for more than four consecutive days and more often than once in three years.

The two types of human health-based water quality criteria distinguish between those pollutants linked to non-cancer effects (non-carcinogenic) and those linked to cancer effects (carcinogenic). The human health-based water quality criteria incorporate several exposure and risk assumptions. These assumptions include:

- A 70-year lifetime of daily exposures.
- An ingestion rate for fish or shellfish measured in kg/day.
- An ingestion rate of two liters/day for drinking water
- A one-in-one-million cancer risk for carcinogenic chemicals.

This permit authorizes a small acute mixing zone, surrounded by a chronic mixing zone around the point of discharge (WAC 173-201A-400). The water quality standards impose certain conditions before allowing the discharger a mixing zone:

1. Ecology must specify both the allowed size and location in a permit.

The mixing zones will accommodate the geometric configuration and flow restriction for mixing zones in Chapter 173-201A WAC and are defined as follows:

The chronic mixing zone shall extend no more than 330 feet downstream from the point of discharge and the acute mixing zone shall extend no more than 33 feet downstream.

Ecology used the mixing zone dilution using as-built record drawing information for the new outfall, the defined mixing zone geometry and the CORMIX model to verify that the outfall provides adequate dilution to ensure that the discharge meets water quality standards. Ecology determined the following dilution factors using CORMIX in preparation for issuing the 1999 NPDES permit.

Temperature scenario	Acute mixing zone dilution	Chronic mixing zone dilution
Summer	1:150	1:182 effluent:river
Winter	1:139	1:173 effluent:river

Ecology used the following critical conditions to model the discharge:

- The seven-day-average low river flow with a recurrence interval of ten years (7Q10); was 38,000 cfs when the outfall was designed and modeled.

Parameter	Value	Value
Velocity	0.17 m/s	0.17 m/s
Depth	9.1 m	9.1 m
Width	915 m	915 m
Roughness (Manning)	0.025	0.025
Temperature	4 C	21 C
Copper (August 2002 result)	35 ug/L in effluent	35 ug/L in effluent

Before reissuing the NPDES permit in 2004 Ecology rechecked dilution using Visual Plumes and modeled the discharge from each diffuser ports separately. The plumes are separate and distinct within the allowed mixing zone, particularly in winter. In summer, when the effluent is slightly more buoyant than the receiving water, the plumes begin to merge at the edge of the chronic mixing zone. However, the dilution at the edge of the chronic mixing zone as calculated by Visual Plumes is 649.8. Using Visual Plumes the dilution at the edge of the acute mixing zone is 27.9.

No changes have occurred generating new input parameters. Therefore, Ecology has used the mixing analysis completed for the 2004 permit for this proposed permit.

2. The facility must fully apply "all known, available, and reasonable methods of prevention, control and treatment" (AKART) to its discharge.

Ecology has determined that the treatment provided at the Pasco WWTP meets the requirements of AKART (see "Technology based Limits").

3. Ecology must consider critical discharge conditions.

Surface water quality-based limits are derived for the waterbody's critical condition (the receiving water and waste discharge condition with the highest potential for adverse impact on the aquatic biota, human health, and existing or designated waterbody uses). The critical discharge condition is often pollutant-specific or waterbody-specific.

Critical discharge conditions are those conditions that result in reduced dilution or increased effect of the pollutant. Factors affecting dilution include the depth of water, the density stratification in the water column, the currents, and the rate of discharge. Density stratification is determined by the salinity and temperature of the receiving water. Temperatures are warmer in the surface waters in summer. Therefore, density stratification is generally greatest during the summer months. Density stratification affects how far up in the water column a freshwater plume may rise.

The rate of mixing is greatest when an effluent is rising. The effluent stops rising when the mixed effluent is the same density as the surrounding water. After the effluent stops rising, the rate of mixing is much more gradual. Water depth can affect dilution when a plume might rise to the surface when there is little or no stratification. Ecology's *Permit Writer's Manual* describes additional guidance on criteria/design conditions for determining dilution factors. The manual can be obtained from Ecology's website at http://www.ecy.wa.gov/biblio/92109.html.

4. **Supporting information must clearly indicate the mixing zone would not:**
   - **Have a reasonable potential to cause the loss of sensitive or important habitat.**
   - **Substantially interfere with the existing or characteristic uses.**
   - **Result in damage to the ecosystem.**
   - **Adversely affect public health.**

Ecology established Washington State water quality criteria for toxic chemicals using EPA criteria. EPA developed the criteria using toxicity tests with numerous organisms and set the criteria to generally protect the species tested and to fully protect all commercially and recreationally important species.

EPA sets acute criteria for toxic chemicals assuming organisms are exposed to the pollutant at the criteria concentration for one hour. They set chronic standards assuming organisms are exposed to the pollutant at the criteria concentration for four days. Dilution modeling under critical conditions generally shows that both acute and chronic criteria concentrations are reached within minutes of being discharged.

The discharge plume does not impact drifting and non-strong swimming organisms because they cannot stay in the plume close to the outfall long enough to be affected. Strong swimming fish could maintain a position within the plume, but they can also avoid the discharge by swimming away. Mixing zones generally do not affect benthic organisms (bottom dwellers) because the buoyant plume rises in the water column. Ecology has additionally determined that the effluent will not exceed 33 degrees C for more than two seconds after discharge; and that the temperature of the water will not create lethal conditions or blockages to fish migration.

Ecology evaluates the cumulative toxicity of an effluent by testing the discharge with whole effluent toxicity (WET) testing.

Ecology reviewed the above information, the specific information on the characteristics of the discharge, the receiving water characteristics and the discharge location. Based on this review, Ecology concluded that the discharge does not have a reasonable potential to cause the loss of sensitive or important habitat, substantially interfere with existing or characteristics uses, result in damage to the ecosystem, or adversely affect public health if the permit limits are met.

5. The discharge/receiving water mixture must not exceed water quality criteria outside the boundary of a mixing zone.

Ecology conducted a reasonable potential analysis using procedures established by the EPA and by Ecology for each pollutant and concluded that the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

6. The size of the mixing zone and the concentrations of the pollutants must be minimized.

At any given time, the effluent plume uses only a portion of the acute and chronic mixing zone, which minimizes the volume of water involved in mixing. The plume may rise through the water column as it mixes depending on the temperature, therefore much of the receiving water volume at lower depths in the mixing zone may not be mixed with discharge. Similarly, because the discharge may stop rising at some depth due to density stratification, waters above that depth will not mix with the discharge. Ecology determined it is impractical to specify in the permit the actual, much more limited volume in which the dilution occurs as the plume rises and moves with the current.

Ecology minimizes the size of mixing zones by requiring dischargers to install diffusers when they are appropriate to the discharge and the specific receiving waterbody. Pasco has a multi-port diffuser, 3 ports. When a diffuser is installed, the discharge is more completely mixed with the receiving water in a shorter time.
Ecology also minimizes the size of the mixing zone (in the form of the dilution factor) using design criteria with a low probability of occurrence. For example, Ecology uses the expected 95^{th} percentile pollutant concentration, the 90^{th} percentile background concentration, the centerline dilution factor, and the lowest flow occurring once in every ten years to perform the reasonable potential analysis.

Because of the above reasons, Ecology has effectively minimized the size of the mixing zone authorized in the proposed permit.

7. Maximum size of mixing zone.

The authorized mixing zone does not exceed the maximum size restriction.

8. Acute mixing zone.

- **The discharge/receiving water mixture must comply with acute criteria as near to the point of discharge as practicably attainable.**

  Ecology determined that the acute criteria will be met at 10% of the distance or of the chronic mixing zone at the ten year low flow.

- **The pollutant concentration, duration, and frequency of exposure to the discharge will not create a barrier to migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.**

  As described above, the toxicity of any pollutant depends upon the exposure, the pollutant concentration, and the time the organism is exposed to that concentration. Authorizing a limited acute mixing zone for this discharge assures that it will not create a barrier to migration. The effluent from this discharge will rise as it enters the receiving water, assuring that the rising effluent will not cause translocation of indigenous organisms near the point of discharge (below the rising effluent).

- **Comply with size restrictions.**

  The mixing zone authorized for this discharge complies with the size restrictions published in chapter 173-201A WAC.

9. Overlap of Mixing Zones.

This mixing zone does not overlap another mixing zone.

J. Designated Uses and Surface Water Quality Criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. In addition, the U.S. EPA set human health criteria for toxic pollutants (EPA 1992). Criteria applicable to this facility's discharge are summarized below in Table 6.

- Aquatic Life Uses are designated based on the presence of, or the intent to provide protection for, the key uses. All indigenous fish and non-fish aquatic species must be protected in waters of the state in addition to the key species. The Aquatic Life Uses for this receiving water are identified below.

Table 6: Aquatic Life Uses & Associated Criteria

Salmonid Rearing and Migration Only	
Temperature Criteria – Highest 7DAD MAX	From the Washington-Oregon border (river mile 309.3) to Priest Rapids Dam (river mile 397.1) temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9).
Dissolved Oxygen Criteria – Lowest 1-Day Minimum	6.5 mg/L
Turbidity Criteria	• 10 NTU over background when the background is 50 NTU or less; or • A 20 percent increase in turbidity when the

	background turbidity is more than 50 NTU
Total Dissolved Gas Criteria	Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection
pH Criteria	pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units

- The recreational uses are extraordinary primary contact recreation, primary contact recreation, and secondary contact recreation. The recreational uses for this receiving water are identified below.

Table 7: Recreational Uses and Associated Criteria

Recreational Use	Criteria
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies/100 mL

- The **water supply uses** are domestic, agricultural, industrial, and stock watering.
- The **miscellaneous freshwater use**s are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

K. Evaluation of Surface Water Quality-Based Effluent Limits for Numeric Criteria

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 biological oxygen demand (BOD) is a far-field pollutant whose adverse effect occurs away from the discharge even after dilution has occurred. Thus, the method of calculating surface water quality-based effluent limits varies with the point at which the pollutant has its maximum effect.

With technology-based controls (AKART), predicted pollutant concentrations in the discharge exceed water quality criteria. Ecology therefore authorizes a mixing zone in accordance with the geometric configuration, flow restriction, and other restrictions imposed on mixing zones by chapter 173-201A WAC.

Chronic Mixing Zone

WAC 173-201A-400(7)(a) specifies that mixing zones must not extend in a downstream direction from the discharge ports for a distance greater than 300 feet plus the depth of water over the discharge ports or extend upstream for a distance of over 100 feet, not utilize greater than **25%** of the flow, and not occupy greater than **25%** of the width of the water body.

The maximum boundaries of the mixing zones are defined as follows: The chronic mixing zone shall extend no more than 330 feet downstream from the point of discharge. The acute mixing zone shall extend no more than 33 feet downstream of the point of discharge.

Acute Mixing Zone

WAC 173-201A-400(8)(a) specifies that in rivers and streams a zone where acute toxics criteria may be exceeded must not extend beyond 10% of the distance towards the upstream and downstream boundaries of the chronic zone, not use greater than **2.5%** of the flow and not occupy greater than **25%** of the width of the water body.

Ecology determined the dilution factors that occur within these zones at the critical condition using the reasonable potential spreadsheet. The dilution factors are listed in Table 7. The dilution factors below use a 7Q10 from the most recent recorded data from USGS; the current 7Q10 flow is 61,200 cfs.

Table 8: Dilution Factors (DF)

Criteria	Acute	Chronic
Aquatic Life	1:181	1:2198
Human Health, Carcinogen		1:8477
Human Health, Non-carcinogen		1:3077

Ecology determined the impacts of temperature, pH, ammonia, and copper as described below, using the dilution factors in the above table. The derivation of surface water quality-based limits also takes into account the variability of pollutant concentrations in both the effluent and the receiving water.

BOD_5--With technology-based limits, this discharge results in a small amount of BOD loading relative to the large amount of dilution in the receiving water at critical conditions. Technology-based limits will ensure that dissolved oxygen criteria are met in the receiving water.

Temperature--The state temperature standards (WAC 173-201A-200-210 and 600-612) include multiple elements:

- Annual summer maximum threshold criteria (June 15 to September 15)
- Supplemental spawning and rearing season criteria (September 15 to June 15)
- Incremental warming restrictions
- Protections against acute effects

Ecology evaluates each criterion independently to determine reasonable potential and derive permit limits.

- Annual summer maximum and supplementary spawning/rearing criteria

Each water body has an annual maximum temperature criterion [WAC 173-201A-200(1)(c), 210(1)(c), and Table 602]. These threshold criteria (e.g., 12, 16, 17.5, 20°C) protect specific categories of aquatic life by controlling the effect of human actions on summer temperatures.

Some waters have an additional threshold criterion to protect the spawning and incubation of salmonids (9°C for char and 13°C for salmon and trout) [WAC 173-201A-602, Table 602]. These criteria apply during specific date-windows.

The threshold criteria apply at the edge of the chronic mixing zone. Criteria for most fresh waters are expressed as the highest 7-Day average of daily maximum temperature (7-DADMax).

The 7-DADMax temperature is the arithmetic average of seven consecutive measures of daily maximum temperatures. Criteria for marine waters and some fresh waters are expressed as the highest 1-Day annual maximum temperature (1-DMax).

- Incremental warming criteria

The water quality standards limit the amount of warming human sources can cause under specific situations [WAC 173-201A-200(1)(c)(i)-(ii), 210(1)(c)(i)-(ii)]. The incremental warming criteria apply at the edge of the chronic mixing zone.

At locations and times when background temperatures are cooler than the assigned threshold criterion, point sources are permitted to warm the water by only a defined increment.

These increments are permitted only to the extent doing so does not cause temperatures to exceed either the annual maximum or supplemental spawning criteria.

At locations and times when a threshold criterion is being exceeded due to <u>natural conditions</u>, all human sources, considered cumulatively, must not warm the water more than 0.3°C above the naturally warm condition.

When Ecology has not yet completed a TMDL, our policy allows each point source to warm water at the edge of the chronic mixing zone by 0.3°C. This is true regardless of the background temperature and even if doing so would cause the temperature at the edge of a standard mixing zone to exceed the numeric threshold criteria. Allowing a 0.3°C warming for each point source is reasonable and protective where the dilution factor is based on 25% or less of the critical flow. This is because the fully mixed effect on temperature will only be a fraction of the 0.3°C cumulative allowance (0.075°C or less) for all human sources combined.

- Temperature Acute Effects

  Instantaneous lethality to passing fish: The upper 99th percentile daily maximum effluent temperature must not exceed 33°C; unless a dilution analysis indicates ambient temperatures will not exceed 33°C 2-seconds after discharge.

  General lethality and migration blockage: Measurable (0.3°C) increases in temperature at the edge of a chronic mixing zone are not allowed when the receiving water temperature exceeds either a 1DMax of 23°C or a 7DADMax of 22°C.

  Lethality to incubating fish: Human actions must not cause a measurable (0.3°C) warming above 17.5°C at locations where eggs are incubating.

Annual summer maximum, supplementary spawning criterion, and incremental warming criteria: Ecology calculated the reasonable potential for the discharge to exceed the annual summer maximum, the supplementary spawning criterion, and the incremental warming criteria at the edge of the chronic mixing zone during critical condition(s). Reasonable potential for temperature was checked for early summer when a higher difference between effluent temperature and river temperature was noted. The incremental increase was marginally greater in June and both June and August (critical condition) had incremental increase much less than the criteria. The incremental increase (0.04 C) for this discharge is within the allowable amount. Therefore, the proposed permit does not include a temperature limit.

The proposed permit will require monitoring of effluent and influent temperatures. USGS data supplies the ambient temperature.

pH--Ecology predicts no violation of the pH criteria under critical conditions. Therefore, the proposed permit includes technology-based effluent limits for pH.

Fecal Coliform--Under critical conditions, modeling predicts no violation of the water quality criterion for fecal coliform. Therefore, the proposed permit includes the technology-based effluent limit for fecal coliform bacteria.

Toxic Pollutants--Federal regulations (40 CFR 122.44) require Ecology to place limits in NPDES permits on toxic chemicals in an effluent whenever there is a reasonable potential for those chemicals to exceed the surface water quality criteria. Ecology does not exempt facilities with technology-based effluent limits from meeting the surface water quality standards.

The following toxic pollutants are present in the discharge: ammonia, and heavy metals.

Valid ambient background data was available for ammonia and copper. Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards.

Ecology determined that ammonia and copper pose no reasonable potential to exceed the water quality criteria at the critical condition using procedures given in EPA, 1991 and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit.

L. Whole Effluent Toxicity

The water quality standards for surface waters forbid discharge of effluent that causes toxic effects in the receiving waters. Many toxic pollutants cannot be measured by commonly available detection methods. However, laboratory tests can measure toxicity directly by exposing living organisms to the wastewater and measuring their responses. These tests measure the aggregate toxicity of the whole effluent, so this approach is called whole effluent toxicity (WET) testing. Some WET tests measure acute toxicity and other WET tests measure chronic toxicity.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water **acute** toxicity. The proposed permit will not impose an acute WET limit.

If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization.

WET testing conducted during effluent characterization showed no reasonable potential for the effluent to cause receiving water **chronic** toxicity. The proposed permit will not impose a chronic WET limit.

- If this facility makes process or material changes which, in Ecology's opinion, increase the potential for effluent toxicity, then Ecology may (in a regulatory order, by permit modification, or in the permit renewal) require the facility to conduct additional effluent characterization.

M. Human Health

Washington's water quality standards include 91 numeric human health-based criteria that Ecology must consider when writing NPDES permits. These criteria were established in 1992 by the U.S. EPA in its National Toxics Rule (40 CFR 131.36). The National Toxics Rule allows states to use mixing zones to evaluate whether discharges comply with human health criteria.

Ecology determined the applicant's discharge does not contain chemicals of concern based on existing effluent data or knowledge of discharges to their system. Ecology will reevaluate this discharge for impacts to human health at the next permit reissuance.

N. Sediment Quality

The aquatic sediment standards (chapter 173-204 WAC) protect aquatic biota and human health. Under these standards Ecology may require a facility to evaluate the potential for its discharge to cause a violation of sediment standards (WAC 173-204-400). You can obtain additional information about sediments at the Aquatic Lands Cleanup Unit website at http://www.ecy.wa.gov/programs/tcp/smu/sediment.html .

Through a review of the discharger characteristics and of the effluent characteristics, Ecology determined that this discharge has no reasonable potential to violate the sediment management standards.

O. Ground Water Quality Limits

The ground water quality standards (chapter 173-200 WAC) protect beneficial uses of ground water. Permits issued by Ecology must not allow violations of those standards (WAC 173-200-100).

The City of Pasco Wastewater Treatment Plant does not discharge wastewater to the ground. No permit limits are required to protect ground water.

P. Comparison of Effluent Limits with the Previous Permit Issued on July 7, 2004

Table 9: Comparison of Effluent Limits

	Basis of Limit	Previous Effluent Limits: Outfall # 001		Proposed Effluent Limits: Outfall # 001	
		Average Monthly	**Average Weekly**	**Average Monthly**	**Average Weekly**
Biochemical Oxygen Demand (5-day)	Technology	30 mg/L	45 mg/L	30 mg/L	45 mg/L
Total Suspended Solids	Technology	30 mg/L	45 mg/L	30 mg/L	45 mg/L
Fecal Coliform Bacteria	Technology	200/100 mL	400/100 mL	200/100 mL	400/100 mL
pH	Technology	6.0 to 9.0		6.0 to 9.0	
Parameter		**Average Monthly**	**Maximum Daily**	**Average Monthly**	**Maximum Daily**
pH	Technology		9.0		9.0

IV. MONITORING REQUIREMENTS

Ecology requires monitoring, recording, and reporting (WAC 173-220-210 and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's effluent limits.

The monitoring schedule is detailed in the proposed permit under Condition S.2. Specified monitoring frequencies take into account the quantity and variability of the 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 Ecology's *Permit Writer's Manual* (Publication Number 92-09) for a municipal wastewater treatment plant using the activated sludge process and having an annual average flow of between 2 and 5 MGD. Ecology's *Permit Writer's Manual* also recommends that WWTP with flow over 1.0 MGD or having a pretreatment program monitor for phenols, cyanide, volatile organic compounds, base-neutral compounds and acid-extractable compounds.

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

As a pretreatment publicly owned treatment works (POTW), the City of Pasco is required to sample influent, primary clarifier effluent, final effluent, and sludge for toxic pollutants in order to characterize the industrial input. Sampling is also done to determine if pollutants interfere with the treatment process or pass-through the plant to the sludge or the receiving water. The City of Pasco will use the monitoring data to develop local limits which commercial and industrial users must meet.

Q. Lab Accreditation

Ecology requires that facilities must use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories* to prepare all monitoring data (with the exception of certain parameters). Ecology accredited the laboratory at this facility for the following parameters:

General Chemistry			
parameter name	**method**	**reference**	**matrix** *
Alkalinity, Total	2320 B	SM	N
Ammonia	4500-NH3 D	SM 19/20	N
Biochemical Oxygen Demand, BOD/CBOD	5210 B	SM	N
Chlorine Residual, Total	4500-Cl G	SM	N
Dissolved Oxygen	4500-O G	SM	N
Nitrate	10020	Hach	N
pH	4500-H	SM	N
Solids, Total Suspended	2540 D	SM	N
Specific Conductance	2510 B	SM	N
Microbiology			

parameter name	method	reference	matrix *
Fecal Coliform - count	9222 D	SM	N
* Matrix key: D = drinking water; N = non-potable water; S = solids/chem materials; A = air			

V. OTHER PERMIT CONDITIONS

R. Reporting and Record Keeping

Ecology based permit condition S3 on our authority to specify any appropriate reporting and record keeping requirements to prevent and control waste discharges (WAC 173-220-210).

S. 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 City of Pasco 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.

The City of Pasco did exceed 85% of the design maximum month in October, November and December 2008. This likely is due to infiltration. Historically the highest flows of the year are in the fall of the year. In August 2005, the City requested a capacity analysis of the various components. The trickling filter is the limiting unit process. However, the trickling filter is used as a roughing filter and is not a limiting critical unit. The next limiting process unit at the time of the report was the anaerobic digester. The solids portion of the plant was upgraded last year and the solids portion of the plant is now unlikely to be the limiting factor. It is not clear what the current capacity and design criteria is.

The proposed permit will require an evaluation of the hydraulic and organic loading capacity of the City of Pasco’s wastewater facilities as they currently exist and if necessary make recommendations appropriate for the City’s wastewater facilities to provide twenty years of additional service to the community.

T. 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. Ecology included it to ensure proper operation and regular maintenance of equipment, and to ensure that the City of Pasco Wastewater Treatment Plant takes adequate safeguards so that it uses the constructed facilities to their optimum potential in terms of pollutant capture and treatment.

U. Pretreatment

Duty to Enforce Discharge Prohibitions

This provision prohibits the publicly owned treatment works (POTW) from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer.

- The first section of the pretreatment requirements prohibits the POTW from accepting pollutants which causes "Pass-through" or "Interference". This general prohibition is from 40 CFR §403.5(a). Appendix B of this fact sheet defines these terms.

- The second section reinforces a number of specific State and Federal pretreatment prohibitions found in WAC 173-216-060 and 40 CFR §403.5(b). These reinforce that the POTW may not accept certain wastes, which:
  - Are prohibited due to dangerous waste rules.
  - Are explosive or flammable.
  - Have too high or low of a pH (too corrosive, acidic or basic).
  - May cause a blockage such as grease, sand, rocks, or viscous materials.
  - Are hot enough to cause a problem.
  - Are of sufficient strength or volume to interfere with treatment.
  - Contain too much petroleum-based oils, mineral oil, or cutting fluid.
  - Create noxious or toxic gases at any point.

  40 CFR Part 403 contains the regulatory basis for these prohibitions, with the exception of the pH provisions which are based on WAC 173-216-060.

- The third section of pretreatment conditions reflects state prohibitions on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology. These discharges include:
  - Cooling water in significant volumes.
  - Stormwater and other direct inflow sources.
  - Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Federal and State Pretreatment Program Requirements

Ecology administers the Pretreatment Program 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) and 40 CFR, part 403. Under this delegation of authority, Ecology issues wastewater discharge permits for significant industrial users (SIUs) discharging to POTWs which have not been delegated authority to issue wastewater discharge permits. Ecology must 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) and(iii)).

Industrial dischargers must obtain a permit from Ecology before discharging waste to the City of Pasco Wastewater Treatment Plant (WAC 173-216-110(5)). Industries discharging wastewater that is similar in character to domestic wastewater do not require a permit.

Routine Identification and Reporting of Industrial Users

The permit requires non-delegated POTWs to take "continuous, routine measures to identify all existing, new, and proposed significant industrial users (SIUs) and potential significant industrial users (PSIUs)" discharging to their sewer system. Examples of such routine measures include regular review of water and sewer billing records, business license and building permit applications, advertisements, and personal reconnaissance. System maintenance personnel should be trained on what to look for so they can identify and report new industrial dischargers in the course of performing their jobs. The POTW may not allow SIUs to discharge prior to receiving a permit, and must notify all industrial dischargers (significant or not) in writing of their responsibility to apply for a State Waste Discharge Permit. The POTW must send a copy of this notification to Ecology.

Requirements for Performing an Industrial User Survey

The proposed permit is to be issued for 1 year. The requirement for an Industrial User Survey has been deleted from the proposed permit. It will be in the following permit.

V. Solid Waste Control

To prevent water quality problems the facility 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 from this facility is regulated by U.S. EPA under 40 CFR 503, and by Ecology under chapter 70.95J RCW, chapter 173-308 WAC "Biosolids Management," and chapter 173-350 WAC "Solid Waste Handling Standards." The disposal of other solid waste is under the jurisdiction of the Benton Franklin County Health District.

Requirements for monitoring sewage sludge and record keeping are included in this permit. This information will be used by Ecology to develop or update local limits and is also required under 40 CFR 503.

W. General Conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all individual municipal NPDES permits issued by Ecology.

VI. PERMIT ISSUANCE PROCEDURES

X. Permit Modifications

Ecology may modify this permit to impose numerical limits, if necessary to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for ground waters, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may also modify this permit to comply with new or amended state or federal regulations.

Y. Proposed Permit Issuance

This proposed permit meets all statutory requirements for Ecology to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the state of Washington. Ecology proposes to issue this permit for a term of 1 year with a compliance schedule requiring submission of an engineering report suitable for approval. The engineering report must evaluate the hydraulic and organic loading capacity of the City of Pasco's wastewater facilities as they currently exist and if necessary recommend appropriate upgrade to the wastewater facilities enabling it to provide twenty years of additional service to the community. The report must also include a Tier II antidegradation analysis as described earlier in the fact sheet.

VII.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.

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

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

Washington State Department of Ecology.

2006. *Permit Writer's Manual.* Publication Number 92-109 (http://www.ecy.wa.gov/biblio/92109.html)

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)

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

Ecology proposes to reissue a permit to the City of Pasco Wastewater Treatment Plant. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology will place a Public Notice of Draft on May 12, 2010 in the Tri-City Herald to inform the public and to invite comment on the proposed draft National Pollutant Discharge Elimination System permit and fact sheet.

The notice –

- Tells where copies of the draft permit and fact sheet are available for public evaluation.
- Offers to provide the documents in an alternate format to accommodate special needs.
- Asks people to tell us how well the proposed permit would protect the receiving water.
- Invites people to suggest fairer conditions, limits, and requirements for the permit.
- Invites comments on Ecology's determination of compliance with antidegradation rules.
- Urges people to submit their comments, in writing, before the end of the comment period.
- Tells how to request a public hearing about the proposed NPDES permit.
- Explains the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting* which is available on our website at http://www.ecy.wa.gov/biblio/0307023.html.

You may obtain further information from Ecology by telephone at (509) 329-3455 or by writing to the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Eastern Regional Office
4601 North Monroe Street
Spokane, WA 99205-1295

The primary author of this permit and fact sheet is Richard A. Koch, P.E.

APPENDIX B—GLOSSARY

1-DMax or **1-day maximum temperature -** The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or **7-day average of the daily maximum temperatures -** The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

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

AKART - The acronym for "all known, available, and reasonable methods of prevention, control and treatment." AKART is a technology-based approach to limiting pollutants from wastewater discharges which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

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.

Annual Average Design Flow (AADF) - The average of the daily flow volumes anticipated to occur over a calendar year.

Average Monthly Discharge Limit - The average of the measured values obtained over a calendar month's time.

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 receiving waters 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.

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 compound 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.

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 for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition it includes 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 85 percent removal requirement. Ecology may conduct additional sampling.

Composite Sample - A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing 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 (DF) - 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 percent effluent fraction, for example, 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 must 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 a period of time as is feasible.

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.

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 Limit - 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.

Maximum Day Design Flow (MDDF) - The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum Month Design Flow (MMDF) - The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum Week Design Flow (MWDF) - The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

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

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 - An area 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.

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

Peak Hour Design Flow (PHDF) - The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Peak Instantaneous Design Flow (PIDF) - The maximum anticipated instantaneous flow.

Quantitation Level (QL) - The smallest detectable concentration of analyte greater than the Method Detection Limit (MDL) where the accuracy (precision &bias) achieves the objectives of the intended purpose.

Reasonable Potential - A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

Responsible Corporate Officer - A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

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 is the particulate material in an effluent. Large quantities of TSS discharged to receiving waters 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.

Solid waste - All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

State Waters - Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, 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.

Upset - An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits 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 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 receiving waters.

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 Ecology's homepage at http://www.ecy.wa.gov/programs/eap/pwspread/pwspread.html.

APPENDIX D—RESPONSE TO COMMENTS

The public notice that informed the public that a draft permit was available for review was published in the Tri-City Herald on May 12, 2010. Ecology did not receive any comments on the draft permit following the 30-day public comment period.

APPENDIX 2-3

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Franklin County, Washington

February 22, 2018

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:6,120 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 250, 500, 1000, 1500

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Franklin County, Washington
Survey Area Data: Version 15, Sep 5, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 28, 2014—Sep 11, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
186	Urban land-Torripsamments complex, gently rolling	31.6	96.4%
220	Water	1.2	3.6%
Totals for Area of Interest		**32.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Franklin County, Washington

186—Urban land-Torripsamments complex, gently rolling

Map Unit Setting

National map unit symbol: 2djv
Elevation: 300 to 500 feet
Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 180 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 65 percent
Torripsamments and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Terraces

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Torripsamments

Setting

Landform: Terraces
Parent material: Mixed eolian sands

Typical profile

H1 - 0 to 8 inches: loamy fine sand
H2 - 8 to 31 inches: loamy fine sand
H3 - 31 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: SANDY 6-10 PZ (R007XY501WA)

Hydric soil rating: No

Minor Components

Royal

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: No

Sagehill

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: No

220—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Setting

Landform: Alluvial cones

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the following National Soil Survey Handbook link: “National Soil Survey Handbook.”

ABC soil

A soil having an A, a B, and a C horizon.

Ablation till

Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

AC soil

A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil

The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil

Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone

A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan

A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium

Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl

A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM)

The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions

Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon

A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo

The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect

The direction toward which a slope faces. Also called slope aspect.

Association, soil

A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity)

The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low: 0 to 3
Low: 3 to 6
Moderate: 6 to 9
High: 9 to 12
Very high: More than 12

Backslope

The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp

A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland

A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada

A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area

The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology)

A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane

A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system

A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock

The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography

A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace

A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum

Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout (map symbol)

A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed. The adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Borrow pit (map symbol)

An open excavation from which soil and underlying material have been removed, usually for construction purposes.

Bottom land

An informal term loosely applied to various portions of a flood plain.

Boulders

Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks

A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height

An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management

Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte

An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding

A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil

A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche

A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR)

The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy

The leafy crown of trees or shrubs. (See Crown.)

Canyon

A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena

A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation

An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps

See Terracettes.

Cement rock

Shaly limestone used in the manufacture of cement.

Channery soil material

Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment

Control of unwanted vegetation through the use of chemicals.

Chiseling

Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque

A steep-walled, semicircular or crescent-shaped, half-bowl-like recess or hollow, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain. It was produced by the erosive activity of a mountain glacier. It commonly contains a small round lake (tarn).

Clay

As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions

See Redoximorphic features.

Clay film

A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (map symbol)

A spot where the surface texture is silty clay or clay in areas where the surface layer of the soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.

Claypan

A dense, compact subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. The layer restricts the downward movement of water through the soil. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community

The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil

Sand or loamy sand.

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material

Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility)

See Linear extensibility.

Colluvium

Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope

Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil

A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions

See Redoximorphic features.

Conglomerate

A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system

Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage

A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section

The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat)

A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology)

A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations)

Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop

A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management

Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system

Growing crops according to a planned system of rotation and management practices.

Cross-slope farming

Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown

The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbate

A mass of soil or other unconsolidated earthy material moved or disturbed by frost action. It is typically coarser than the underlying material.

Cuesta

An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI)

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave

The walls of excavations tend to cave in or slough.

Decreasers

The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing

Postponing grazing or resting grazing land for a prescribed period.

Delta

A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer

A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression, closed (map symbol)

A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and that does not have a natural outlet for surface drainage.

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement

A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth

A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope

A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace)

A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming

A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface

Runoff, or surface flow of water, from an area.

Drainageway

A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw

A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Drift

A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin

A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

Duff

A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill

See Mine spoil.

Ecological site

An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation

A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit

Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream

A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation

A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion

The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic)

Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion pavement

A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface

A land surface shaped by the action of erosion, especially by running water.

Escarpment

A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Escarpment, bedrock (map symbol)

A relatively continuous and steep slope or cliff, produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.

Escarpment, nonbedrock (map symbol)

A relatively continuous and steep slope or cliff, generally produced by erosion but in some places produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.

Esker

A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Extrusive rock

Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth's surface.

Fallow

Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant

A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fertility, soil

The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat)

The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope

A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil

Sandy clay, silty clay, or clay.

Firebreak

An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom

An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material

Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone

A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain

The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms

A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay

A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step

An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial

Of or pertaining to rivers or streams; produced by stream or river action.

Foothills

A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope

The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb

Any herbaceous plant not a grass or a sedge.

Forest cover

All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type

A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan

A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai

Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glaciofluvial deposits

Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits

Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

Gleyed soil

Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping

Growing crops in strips that grade toward a protected waterway.

Grassed waterway

A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (map symbol)

An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel.

Gravelly soil material

Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (map symbol)

A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area that has less than 15 percent rock fragments.

Green manure crop (agronomy)

A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water

Water filling all the unblocked pores of the material below the water table.

Gully (map symbol)

A small, steep-sided channel caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage whereas a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock

Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim

Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology)

A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat)

Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops

Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill

A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope

A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon: An organic layer of fresh and decaying plant residue.

L horizon: A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

A horizon: The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon: The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon: Soft, consolidated bedrock beneath the soil.

R layer: Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

M layer: A root-limiting subsoil layer consisting of nearly continuous, horizontally oriented, human-manufactured materials.

W layer: A layer of water within or beneath the soil.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups

Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock

Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation

The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers

Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate

The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Very low: Less than 0.2
Low: 0.2 to 0.4
Moderately low: 0.4 to 0.75
Moderate: 0.75 to 1.25
Moderately high: 1.25 to 1.75
High: 1.75 to 2.5
Very high: More than 2.5

Interfluve

A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology)

A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream

A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders

On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions

See Redoximorphic features.

Irrigation

Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin: Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border: Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding: Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation: Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle): Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow: Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler: Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation: Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding: Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame

A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst (topography)

A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll

A small, low, rounded hill rising above adjacent landforms.

Ksat

See Saturated hydraulic conductivity.

Lacustrine deposit

Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain

A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace

A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landfill (map symbol)

An area of accumulated waste products of human habitation, either above or below natural ground level.

Landslide

A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones

Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lava flow (map symbol)

A solidified, commonly lobate body of rock formed through lateral, surface outpouring of molten lava from a vent or fissure.

Leaching

The removal of soluble material from soil or other material by percolating water.

Levee (map symbol)

An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow onto lowlands.

Linear extensibility

Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit

The moisture content at which the soil passes from a plastic to a liquid state.

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess

Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength

The soil is not strong enough to support loads.

Low-residue crops

Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl

An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Marsh or swamp (map symbol)

A water-saturated, very poorly drained area that is intermittently or permanently covered by water. Sedges, cattails, and rushes are the dominant vegetation in marshes, and trees or shrubs are the dominant vegetation in swamps. Not used in map units where the named soils are poorly drained or very poorly drained.

Mass movement

A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses

See Redoximorphic features.

Meander belt

The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar

A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll

One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment

Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt.

Mesa

A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock

Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth’s crust. Nearly all such rocks are crystalline.

Mine or quarry (map symbol)

An open excavation from which soil and underlying material have been removed and in which bedrock is exposed. Also denotes surface openings to underground mines.

Mine spoil

An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage

Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area

A kind of map unit that has little or no natural soil and supports little or no vegetation.

Miscellaneous water (map symbol)

Small, constructed bodies of water that are used for industrial, sanitary, or mining applications and that contain water most of the year.

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon

A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine

In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil

Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain

A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck

Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat

See Hemic soil material.

Mudstone

A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation

A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon

A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil

A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules

See Redoximorphic features.

Nose slope (geomorphology)

A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant

Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter

Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low: Less than 0.5 percent
Low: 0.5 to 1.0 percent
Moderately low: 1.0 to 2.0 percent
Moderate: 2.0 to 4.0 percent
High: 4.0 to 8.0 percent
Very high: More than 8.0 percent

Outwash

Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain

An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace

An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material

The unconsolidated organic and mineral material in which soil forms.

Peat

Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment

A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon

The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation

The movement of water through the soil.

Perennial water (map symbol)

Small, natural or constructed lakes, ponds, or pits that contain water most of the year.

Permafrost

Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

pH value

A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil

A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping

Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting

Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit

The moisture content at which a soil changes from semisolid to plastic.

Plasticity index

The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology)

A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa

The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite

The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan

A compacted layer formed in the soil directly below the plowed layer.

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded

Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings

See Redoximorphic features.

Potential native plant community

See Climax plant community.

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning

Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil

The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use

Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland

Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil

A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid: Less than 3.5

Extremely acid: 3.5 to 4.4

Very strongly acid: 4.5 to 5.0

Strongly acid: 5.1 to 5.5

Moderately acid: 5.6 to 6.0

Slightly acid: 6.1 to 6.5

Neutral: 6.6 to 7.3

Slightly alkaline: 7.4 to 7.8

Moderately alkaline: 7.9 to 8.4

Strongly alkaline: 8.5 to 9.0

Very strongly alkaline: 9.1 and higher

Red beds

Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations

See Redoximorphic features.

Redoximorphic depletions

See Redoximorphic features.

Redoximorphic features

Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix

See Redoximorphic features.

Regolith

All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material)

Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill

A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser

The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut

A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop (map symbol)

An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit.

Root zone

The part of the soil that can be penetrated by plant roots.

Runoff

The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil

A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline spot (map symbol)

An area where the surface layer has an electrical conductivity of 8 mmhos/cm more than the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has an electrical conductivity of 2 mmhos/cm or less.

Sand

As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone

Sedimentary rock containing dominantly sand-sized particles.

Sandy spot (map symbol)

A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils in the surrounding map unit is very fine sandy loam or finer.

Sapric soil material (muck)

The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat)

The ease with which pores of a saturated soil transmit water. Formally, the proportionality coefficient that expresses the relationship of the rate of water movement to hydraulic gradient in Darcy's Law, a law that describes the rate of water movement through porous media. Commonly abbreviated as "Ksat." Terms describing saturated hydraulic conductivity are:

Very high: 100 or more micrometers per second (14.17 or more inches per hour)

High: 10 to 100 micrometers per second (1.417 to 14.17 inches per hour)

Moderately high: 1 to 10 micrometers per second (0.1417 inch to 1.417 inches per hour)

Moderately low: 0.1 to 1 micrometer per second (0.01417 to 0.1417 inch per hour)

Low: 0.01 to 0.1 micrometer per second (0.001417 to 0.01417 inch per hour)

Very low: Less than 0.01 micrometer per second (less than 0.001417 inch per hour).

To convert inches per hour to micrometers per second, multiply inches per hour by 7.0572. To convert micrometers per second to inches per hour, multiply micrometers per second by 0.1417.

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification

The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock

A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum

A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (map symbol)

An area where, on the average, 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units in which “severely eroded,” “very severely eroded,” or “gullied” is part of the map unit name.

Shale

Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion

The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short, steep slope (map symbol)

A narrow area of soil having slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

Shoulder

The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell

The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Shrub-coppice dune

A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology)

A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica

A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio

The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt

As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone

An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils

Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole (map symbol)

A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index

A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides (pedogenic)

Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slide or slip (map symbol)

A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces.

Slope

The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope alluvium

Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill

The slow filling of ponds, resulting from restricted water transmission in the soil.

Slow water movement

Restricted downward movement of water through the soil. See Saturated hydraulic conductivity.

Sodic (alkali) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodic spot (map symbol)

An area where the surface layer has a sodium adsorption ratio that is at least 10 more than that of the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has a sodium adsorption ratio of 5 or less.

Sodicity

The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight: Less than 13:1

Moderate: 13-30:1

Strong: More than 30:1

Sodium adsorption ratio (SAR)

A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock

Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil

A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

Soil separates

Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand: 2.0 to 1.0

Coarse sand: 1.0 to 0.5

Medium sand: 0.5 to 0.25

Fine sand: 0.25 to 0.10

Very fine sand: 0.10 to 0.05

Silt: 0.05 to 0.002

Clay: Less than 0.002

Solum

The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spoil area (map symbol)

A pile of earthy materials, either smoothed or uneven, resulting from human activity.

Stone line

In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (map symbol)

A spot where 0.01 to 0.1 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surrounding soil has no surface stones.

Strath terrace

A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace

One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping

Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are:

Platy: Flat and laminated
Prismatic: Vertically elongated and having flat tops
Columnar: Vertically elongated and having rounded tops
Angular blocky: Having faces that intersect at sharp angles (planes)
Subangular blocky: Having subrounded and planar faces (no sharp angles)
Granular: Small structural units with curved or very irregular faces

Structureless soil horizons are defined as follows:

Single grained: Entirely noncoherent (each grain by itself), as in loose sand
Massive: Occurring as a coherent mass

Stubble mulch

Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil

Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling

Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum

The part of the soil below the solum.

Subsurface layer

Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow

The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit

The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer

The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus

Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts

Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine

An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation)

An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology)

A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes

Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

Texture, soil

The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer

Otherwise suitable soil material that is too thin for the specified use.

Till

Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain

An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope

The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements

Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread

The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff

A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland

An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill

The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation

Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve

A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (map symbol)

A spot where 0.1 to 3.0 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surface of the surrounding soil is covered by less than 0.01 percent stones.

Water bars

Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering

All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth’s surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded

Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (map symbol)

A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point)

The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow

The uprooting and tipping over of trees by the wind.

murraysmith

APPENDIX 2-4

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

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.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background [HELP]

1. Name of proposed project, if applicable:
   Wastewater Treatment Plant Facility Plan - City of Pasco, WA

2. Name of applicant:
   City of Pasco, WA

3. Address and phone number of applicant and contact person:

Maria Serra

Pasco City Hall

525 N. 3rd Avenue

Pasco, WA 99301

4. Date checklist prepared:

3/11/2019

5. Agency requesting checklist:

State of Washington Department of Ecology

6. Proposed timing or schedule (including phasing, if applicable):

This WWTP facility Plan will be completed in 2019. Recommended projects are included in the plan for the future and are outlined in the capital improvement program and consist of projects that will occur over the next twenty years. In general terms the proposed projects include: secondary treatment improvements, upgrades to the solids handling equipment, expansion of disinfection capabilities, expansion of administration and laboratory buildings, and expanded influent screening capabilities.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.

Recommended projects are included in the plan for the future and are outlined in the capital improvement program.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.

The proposed WWTP Facility Plan will include additional environmental information in Section 2. To date, no sensitive environmental areas have been discovered in the WWTP site area including flood plains, shoreline, wetlands, prime or unique farmlands, archeological and historical sites, or wild and scenic rivers. Additionally, the physical characteristics (soils, geology, or topography) of the WWTP site do not include any unique or sensitive features and these will be summarized in Section 2 of the WWTP Facility Plan.

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.

None known.

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.)

This SEPA pertains to a facility plan to upgrade and expand the City of Pasco's Wastewater Treatment Plant (WWTP). The plan provides evaluates the demands in the 20-year planning horizon and identifies improvements needed to maintain, upgrade and expand the current facility. Recommended projects are included in the plan for the future and are outlined in the capital improvement program. In general, the proposed projects include: secondary treatment improvements, upgrades to the solids handling equipment, expansion of disinfection capabilities, expansion of administration and laboratory buildings, and expanded influent screening capabilities.

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 WWTP is located in Pasco Washington on South Gray Avenue. Additional site information will be given in Section 2 of the Facility Plan.

B. Environmental Elements [HELP]

1. *Earth* [help]

a. General description of the site:

(underline one): Flat, rolling, hilly, steep slopes, mountainous, other _____________

b. What is the steepest slope on the site (approximate percent slope)?

1%

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.

Loamy Sand - Urban land - Torripsamments complex

Site is not used for agriculture. Site has been a wastewater treatment plant since the 1950's.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

There are no indication or history of unstable soils in the vicinity of the project.

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.

The site is approximately 27.5 acres and future projects will impact remain on site. No filling, excavation or grading are directly planned at this time.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.
Future projects will include erosion and sediment control plans and Storm water Pollution Prevention Plans as appropriate. Future projects will stabilize soils as necessary for final surface application.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?
The site was already modified from its natural state and much of it is covered with impervious surfaces. Detailed designs are not included in this current project.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:
Future projects will be designed per requirements for stormwater and erosion for construction activities and permanent surface restoration.

2. Air [help]

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.
No emissions to air will occur due to this current project.
Emissions to the air during construction of future projects could include dust. Appropriate measures to control emissions to the air will be completed by contractor of any future projects.
Operation and maintenance of wastewater treatments plans can create odors but typically are not strong away from the direct vicinity of the plants.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
No off-site sources of emissions or odor will affect project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:
None.

3. Water [help]

a. Surface Water: [help]

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.
There are no surface water bodies in the WWTP site proper. The WWTP outfall and diffuser are in the Columbia River.

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.

The recommended future projects at the WWTP site proper are not within 200 feet of any surface water. The recommended future outfall and diffuser project are within 200 feet and within the Columbia River.

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.

No fill or dredge material will be placed or removed by any recommended future projects that are known at this time.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

None are known at this time.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

The recommended future projects at the WWTP site proper are not within a 100-year floodplain. The recommended future outfall and diffuser project are within the 100-year floodplain and the Columbia River.

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 WWTP discharges recovered water to the Columbia River. No waste materials are discharged or will be from the WWTP future project.

b. Ground Water: [help]

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.

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.

None.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) 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.

The WWTP handles all runoff onsite. No specific projects are included to improve the stormwater system.

2) Could waste materials enter ground or surface waters? If so, generally describe.
No.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site?If so, describe.
No.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

None.

4. Plants [help]

a. Check the types of vegetation found on the site:

_X__deciduous tree: alder, maple, aspen, other
____evergreen tree: fir, cedar, pine, other
____shrubs
__X_grass
____pasture
____crop or grain
____ Orchards, vineyards or other permanent crops.
____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
____water plants: water lily, eelgrass, milfoil, other
____other types of vegetation

b. What kind and amount of vegetation will be removed or altered?
The WWTP has landscaping of turf grass and deciduous trees.

b. List threatened and endangered species known to be on or near the site.
The following are known to be within Franklin County but not likely to be at the WWTP Site: White Bluffs bladderpod (Physario douglasii ssp. tuplashensis)

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:
No landscaping is included in the WWTP Facility Plan Project. Future recommended project could include small amounts of landscaping and future landscaping is expected to be minimal. Its design will be identified with preservation and enhancement of vegetation in mind.

e. List all noxious weeds and invasive species known to be on or near the site.
None known.

5. Animals [help]

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.

Examples include:

birds: hawk, heron, eagle, duck, seagulls, songbirds, other small birds.
mammals: small rodents.
fish: None on the WWTP site.

b. List any threatened and endangered species known to be on or near the site.

The following are known to be within Franklin County but not likely to be at the WWTP Site:

Yellow-billed Cuckoo (Coccyzus americanus)

Bull Trout (Salvelines confluentus)

Gray wolf (Canis lupis)

Columbia Basin Pigmy Rabbits (Brachylagus idahoensis)

c. Is the site part of a migration route? If so, explain.

Yes, the Columbia Basin is part of the the Pacific Flyway.

d. Proposed measures to preserve or enhance wildlife, if any:

Improvements to WWTP will enhance general environment with enhanced treatment.

e. List any invasive animal species known to be on or near the site.

None known.

6. Energy and Natural Resources [help]

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.

No actual construction will occur for this WWTP Facility Plan. Future projects at the WWTP will use electric power to run equipment.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

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:

No actual construction will occur for this WWTP Facility Plan. For future projects, high efficiency motors could be used, and buildings could be designed to high efficiency standards.

7. Environmental Health [help]

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.

No environmental health hazards exist as part of this WWTP Facility Plan. Future projects will be designed to code for exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste.

1) Describe any known or possible contamination at the site from present or past uses.

None are known.

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.

None are known.

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.

The WWTP does not utilize any chemicals. Future projects could utilize chemicals but are not known in detail at this time.

4) Describe special emergency services that might be required.

None are known at this time. The WWTP is an existing facility and will continue to operate and utilize best management practices and standard operating procedures that are existing to manage the plant.

5) Proposed measures to reduce or control environmental health hazards, if any:

No environmental health hazards exist as part of this WWTP Facility Plan. Future projects will be designed which will reduce or control environmental health hazards as they occur or are known.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

No noise hazards exist as part of this WWTP Facility Plan. Areas of noise occur at the WWTP and personal protective gear are recommended to reduce exposure to noise. The existing WWTP is now known to produce noises that are heard offsite.

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.

No noise hazards exist as part of this WWTP Facility Plan. Future projects and their construction could include elements that create noise. Overall, noise will not typically travel offsite.

3) Proposed measures to reduce or control noise impacts, if any:

None.

8. Land and Shoreline Use [help]

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 site is currently the City of Pasco's Wastewater Treatment Plant and will continue to be the City's Wastewater Treatment Plant.

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?
None.

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:
The proposal will not effect or be affected by working farm or forest land.

c. Describe any structures on the site.
The site is the City of Pasco's existing WWTP and has buildings, basins, and clarifiers on the site.

d. Will any structures be demolished? If so, what?
No structures are planned to be demolished at this point.

e. What is the current zoning classification of the site?
The site is currently zoned Light Industrial.

f. What is the current comprehensive plan designation of the site?
The site is within the urban growth boundary and land use is Industrial.

g. If applicable, what is the current shoreline master program designation of the site?
The current Shoreline Master Program (2014) includes the WWTP outfall and diffuser in Subreach 6c.

"Level of Existing Function: Partially Functioning Stressors:
Upland development: Vegetated riparian area with areas of mowed turf adjacent to Osprey Point, with undeveloped, non-native vegetated upland in this same vicinity. Southern portion of subreach includes industrial port development hard banks in moorage areas and elsewhere intact riparian buffers.
Recreational use: Paved trail/maintenance road at top of levee, unpaved roads waterward of E. Commerce Street at south end of subreach.
Potential Restoration Opportunities: Consider more riparian buffer areas within industrial complex.

Potential Protection Opportunities: Preserve existing riparian vegetation and if possible do not mow these woody species. Provide stormwater controls consistent with Eastern Washington Stormwater Manual."

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

No.

i. Approximately how many people would reside or work in the completed project?

There are no residents at the WWTP Site. There are approximately 10 individuals who work at the WWTP.

j. Approximately how many people would the completed project displace?

None.

k. Proposed measures to avoid or reduce displacement impacts, if any:

None.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The future work at the WWTP is compatible with existing and projected land uses. The site has been a WWTP since the 1950's and will continue to be a WWTP.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

None.

9. Housing [help]

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

No housing units will be provided at the WWTP. No housing is planned for the WWTP.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

No housing units will be eliminated.

c. Proposed measures to reduce or control housing impacts, if any:

None.

10. Aesthetics [help]

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The site is an existing WWTP and any buildings will likely be similar heights to existing building.

b. What views in the immediate vicinity would be altered or obstructed?

None. The site is an existing WWTP.

c. Proposed measures to reduce or control aesthetic impacts, if any:
The site is an existing WWTP and will continue to be built similarly architecturally and aesthetically.

11. Light and Glare [help]

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?
No additional light or glare will be caused by this WWTP Facility plan or its recommended projects.

b. Could light or glare from the finished project be a safety hazard or interfere with views?
No.

c. What existing off-site sources of light or glare may affect your proposal?
None.

d. Proposed measures to reduce or control light and glare impacts, if any:
Not necessary.

12. Recreation [help]

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.
None.

d. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:
N/A

13. Historic and cultural preservation [help]

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.
The WWTP is a treatment facility and does not have any buildings, structure or sites located on the site that are of historical significance.

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 landmarks, features or evidence of Indian or historical use or occupation at the WWTP site.

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.

Consultation with Department of Archaeology and Historic Preservation and National Register of Historic Places online mapping databases.

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.

Not necessary.

14. Transportation [help]

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 WWTP is accessed from South Gray Avenue. The public streets will not be affected by this WWTP Facility Project or other project to expand the WWTP beyond construction related traffic.

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?

No.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

None.

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).

This WWTP Facility Plan or recommended projects do not require any improvements or new roadways, streets, or transportation facilities.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

This WWTP Facility Plan or recommended projects will not utilize any water, rail or air transportation.

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 nonpassenger vehicles). What data or transportation models were used to make these estimates?

This WWTP Facility Plan or recommended projects will no increase the number of vehicular trips to the WWTP. The number of current vehicular trips is not known.

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.

This WWTP Facility Plan or recommended projects will not interfere with, affect or be affected by the movement of agricultural and forest products.

h. Proposed measures to reduce or control transportation impacts, if any:

Not necessary.

15. Public Services [help]

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.

The WWTP provides a public service and improving the WWTP will result in better services through increased reliability, redundancy and treatment of wastewater. No additional public services will be required for the facility and its improvement.

b. Proposed measures to reduce or control direct impacts on public services, if any.

The WWTP provides a public service and is necessary. Other public services will not be directly impacted by future work at the WWTP.

16. Utilities [help]

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other ___________

e. 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.

N/A.

C. Signature [HELP]

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: ____

Name of signee ____

Position and Agency/Organization ______________________________

Date Submitted: _____________

D. Supplemental sheet for nonproject actions [HELP]

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   The WWTP Facility Plan and recommended projects will further protect water, air, and land through improved treatment of sanitary sewer effluents for the City of Pasco.

   Proposed measures to avoid or reduce such increases are:

   N/A

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   The WWTP Facility Plan and recommended projects will further protect plants, animals, fish and marine life through improved treatment of treatment plant effluents.

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

   N/A

3. How would the proposal be likely to deplete energy or natural resources?

   The WWTP Facility Plan and recommended projects are not likely to deplete energy or natural resources, The WWTP will continue to treat wastewater thereby protecting the river, groundwater and soils,

   Proposed measures to protect or conserve energy and natural resources are:

   The WWTP will continue to treat wastewater and gain efficiencies where available through operational improvements (optimized operations) and efficiency improvements (e.g. high efficiency motors).

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   The WWTP Facility Plan and recommended projects will continue to use the Columbia River for the outfall and diffuser.

   Proposed measures to protect such resources or to avoid or reduce impacts are:

   Mixing zone studies and antidegradation studies will be completed to protect the Columbia River.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

The WWTP Facility Plan and recommended projects are not likely to affect land and shoreline use.

Proposed measures to avoid or reduce shoreline and land use impacts are:

N/A

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

The WWTP Facility Plan and recommended projects are not likely to increase demands on transportation or public services and utilities.

Proposed measures to reduce or respond to such demand(s) are:

N/A

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

The WWTP Facility Plan and its recommended projects will not conflict with local, state or federal laws or requirements for the protection of the environment.

APPENDIX 2-5

AGENDA
PASCO CITY COUNCIL

Workshop Meeting **7:00 p.m.** **June 10, 2019**

Page			
	1.	**CALL TO ORDER:**	
	2.	**ROLL CALL:**	
		(a)	**Pledge of Allegiance**
	3.	**VERBAL REPORTS FROM COUNCILMEMBERS:**	
	4.	**ITEMS FOR DISCUSSION:**	
3 - 7		**(a)**	**Downtown Pasco Development Authority Funding Agreement**
8 - 37		**(b)**	**PSD 2018 Capital Facility Plan Update and Impact Fee Report**
38 - 69		**(c)**	**Presentation - WWTP Facility Plan Update**
70 - 109		**(d)**	**2020-2025 Six Year Transportation Improvement Plan**
110 - 124		**(e)**	**Foster Wells Force Main Update & Agreement**
125 - 138		**(f)**	**Code Amendment: Shared Street Frontages (MF# CA2018-008)**
139 - 151		**(g)**	**Code Amendment: Special Permits (MF# CA2019-008)**
152 - 161		**(h)**	**Washington Cities Insurance Authority (WCIA) Risk Pool Update** Presentation to Council by Justin Tucker Safety/Training Specialist
	5.	**MISCELLANEOUS COUNCIL DISCUSSION:**	
	6.	**EXECUTIVE SESSION:**	
	7.	**ADJOURNMENT.**	

REMINDERS:

1. Tuesday, June 11, 3:00-4:30 p.m. - PPFD Special Meeting - Conference Room 1

(Councilmember Maloney, Rep.; Mayor Watkins, Alt.)
2. Thursday, June 13, 7:00-8:00 a.m. - BFCG Tri-Mats Policy Advisory Committee - Cousin's Restaurant (Councilmember Alvarado, Rep.; Councilmember Serrano, Alt)
3. Thursday, June 13 7:00-8:00 p.m. - Ben-Franklin Transit Board - Transit Facility (Mayor Watkins, Rep.; Councilmember Alvarado, Alt.)

This meeting is broadcast live on PSC-TV Channel 191 on Charter Cable and streamed at www.pasco-wa.gov/psctvlive.

Audio equipment available for the hearing impaired; contact the Clerk for assistance.

Spanish language interpreter service may be provided upon request. Please provide two business day's notice to the City Clerk to ensure availability. (Servicio de intérprete puede estar disponible con aviso. Por favor avisa la Secretaria Municipal dos días antes para garantizar la disponibilidad.)

AGENDA REPORT

FOR:	City Council	June 3, 2019
TO:	Dave Zabell, City Manager	Workshop Meeting: 6/10/19
FROM:	Steve Worley, Director Public Works	
SUBJECT:	Presentation - WWTP Facility Plan Update	

I. REFERENCE(S):

Draft Executive Summary of WWTP Facility Plan
Presentation

II. ACTION REQUESTED OF COUNCIL / STAFF RECOMMENDATIONS:

Discussion

III. FISCAL IMPACT:

None

IV. HISTORY AND FACTS BRIEF:

The City Wastewater Treatment Plant (WWTP) provides physical and biological treatment of the collected incoming wastewater prior to discharge of disinfected water to the Columbia River. The facility operates under NPDES Permit WA-004496-2, which regulates discharge to Columbia River and is administered by the Washington State Department of Ecology (Ecology).

The WWTP is located in the southeast region of the City. The facility was originally constructed in 1954 and has undergone a series of major and minor upgrades in the 1970s, 1990s, 2000s and 2010s to provide for additional capacity, application of new technology and replacement of some components having reached the end of useful life.

The City's current population is approximately 75,000 resulting in approximately 5.4 million gallons of wastewater per day being treated at the WWTP.

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V. DISCUSSION:

As an Ecology-permitted facility approaches capacity (85%), a Facility Plan is required to determine future expansion needs. Further, approval by Ecology of a Facility Plan is a prerequisite to any improvement that would increase capacity or alter treatment processes at the facility.

MurraySmith, an engineering consulting firm, has assisted staff in preparing the draft WWTP Facility Plan. The Plan was submitted to Ecology for their review in April 2019. The City has already received comments back from Ecology on the plan which are being addressed. Approval of the plan is anticipated in the very near future.

The WWTP Facility Plan was developed in conformance with Chapter 173-240 Washington Administrative Code (WAC). The Plan assesses the current capacity and condition of the facility. In addition, projected flows and loadings were developed for the twenty horizon based on population, industrial, and commercial growth as projected by the City's Comprehensive Land Use planning efforts. Based on the aforementioned projections, loading to the WWTP is expected to approximately double by the 2040 planning horizon.

The plan confirms that most of the major infrastructure components at the WWTP are at or approaching the end of useful life. Further, that several of those components are at or approaching maximum capacity along with other system deficiencies, such as the need for redundant systems which were not a requirement at the time the plant was constructed or during subsequent major upgrades. Accordingly, the plan recommends a series of projects to maintain reliable treatment entailing the replacement of numerous major components that have reached end of life, and to enhance their replacement to provide for increased capacity and treatment capabilities to adequately treat the 2040 projected flow and loading. The proposed improvements to the WWTP are based on a detailed evaluation of feasible alternatives, with recommendations for improvements that are cost-effective solutions for both near and long-term needs.

The cost of these improvements is on the order of $70 million over the 20 year horizon much of which will be funded through a series of revenue bonds over the next two decades supported by rates. The majority of these costs would be required with or without increases in future loading to the WWTP as current and past users have appropriately worn out the WWTP over the years. However, to maintain equity, it will be imperative that new connections continue to pay their proportional share of the cost to buy into the system and make room (capacity) for their impact.

A draft executive summary of the plan is included in this packet. The Executive Summary provides more detailed information on the findings, analysis and proposed 20-year improvement plan.

Craig Anderson, PE Principal Engineer with MurraySmith will present the update on the WWTP Facility plan supplemented by staff. Aside from the Facility Plan, MurraySmith is also assisting in the preparation of the Comprehensive Plan update so there is excellent linkage between the two efforts.

Executive Summary

Purpose

This Wastewater Treatment Plant (WWTP) Facility Plan has been developed to be in conformance with Chapter 173-240 Washington Administrative Code (WAC) involving the Submission of Plans and Reports for Construction of Wastewater Facilities and Table G1-1 of the Washington Department of Ecology (Ecology) "Criteria for Sewage Works Design." This Plan will enable the City of Pasco (City) to improve WWTP unit processes and operations, and continue to meet effluent quality requirements. This Plan includes the recommended modifications to the City's WWTP for the next 20 years that are based on a detailed evaluation of feasible alternatives, with recommendations for improvements that are found to be cost-effective solutions to both the City's near and long-term needs.

Discharge Permit

The Federal Clean Water Act requires municipal facilities that discharge treated wastewater into waters of the United States to obtain a National Pollution Discharge Elimination System (NPDES) permit. The permit establishes maximum pollutant concentrations and loads allowed in the effluent discharge stream. The Pasco WWTP operates under NPDES Permit WA-004496-2, which allows discharge of treated wastewater to the Columbia River. This permit was issued June 29, 2010 and was scheduled to end on June 30, 2015 but has been administratively extended while the Department of Ecology works on drafting the next permit. The projected wastewater flow growth in Pasco requires compliance with antidegradation standards. Based upon the results of a Tier II Antidegradation analysis and discussions with Washington Department of Ecology (Ecology) Staff, the new discharge permit is expected to be issued in 2019/20 and remain largely unchanged. Therefore, all analysis in this document is based upon the 2010 permit requirements.

It should be noted that statewide trending for discharge permits includes various levels of water quality and source control testing beyond what existing permit holders have experienced in the past. The City should review its pretreatment program and source control programs with an eye towards reducing the compliance effort to meet future discharge limits for toxics. While the permit conditions that will result from current rulemaking efforts are far from clear, the evidence points toward more stringent standards. Involvement with the rulemaking process will help the City achieve compliance flexibility and reasonable compliance schedules for any required pretreatment program, source control program, or WWTP facility changes that may become necessary in the future.

WWTP Evaluation

The City WWTP provides physical and biological treatment of the collected incoming wastewater prior to discharge of disinfected water to the Columbia River. The WWTP is located in the southeast region of the City. The facility was originally constructed in 1954 and was subsequently upgraded in the 1970s, 1990s, 2000s and 2010s. This 27.5 acre facility is the City's municipal WWTP. An industrial wastewater treatment plant treats industrial wastewater in the north part of the City. An aerial image of the WWTP facility, with major unit processes, is shown in **Figure ES-1**.

The City's current population is 71,934 (2016) and results in approximately 5.4 million gallons of wastewater per day being treated at the WWTP. Population, flow and load projections were also developed for this Plan and are expected to approximately double by the 2040 planning horizon. The City has been one of the fastest growing cities in the State of Washington and nation over the last several years.

The City has an excellent track record of meeting WWTP permit requirements. However, the capacity analysis of the WWTP identified portions of the WWTP that are currently at, or nearly at, capacity. With the additional flow projected to come to the WWTP, the majority of the WWTP will reach capacity limits during the planning horizon. These include aeration basins, the aeration system, secondary clarifiers, river outfall, dissolved air floatation thickening, anaerobic digestion, rotary drum thickener, drying beds and influent screens.

Alternatives Evaluation and Selected Improvements

Multiple alternatives to address the noted deficiencies were developed during workshops and site visits with City Staff.

Alternatives considered for the liquid and biosolids streams at the WWTP are presented in **Tables ES-1** and **ES-2, respectively**.

Figure ES-1
WWTP Site

Item	Description
1	Headworks
2	Screen
3	Grit Removal
4	Primary Clarifier
5	PC Effluent Box
6	Trickling Filter Recirculation Pump Station
7	Trickling Filter
8	Intermediate Clarifier
9	ICE Box

Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River (not pictured)
17	Columbia River Diffuser (not pictured)
18	Primary Sludge Pump Station

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
23	Sludge Storage
24	Gas Storage
25	Flare
26	Solids Thickening
27	Drying Bed

Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building
33	Laboratory
34	Blower Building
35	Machine Shop (not pictured)
36	Equipent Building

Table ES-1
Liquid Treatment Alternatives

Alternative Number	Alternative Name	Alternative Description	Deficiency Addressed
PRE-1	Screening No Action	Continued use of existing screens	None
PRE-2	Expand Screening	Expand headworks and with fourth perforated plate screen	Screen
SEC-1	Secondary Treatment No Action	Continued use of existing aeration basins	None
SEC-2	Activated Sludge - Plug Flow	Activated sludge with aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages	Secondary Treatment - Aeration Basin, Aeration System
SEC-3	Membrane Bioreactor (MBR)	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent	Aeration Basin Secondary Clarifier
SEC-4	Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth	Conventional activated sludge type basin with addition of suspended plastic media with biological growth to generate a higher total microbiological mass.	Secondary Treatment - Aeration Basin, Aeration System
SEC-5	Zee lung membrane aeration bioreactor – Fixed Growth	Conventional activated sludge type basin with submerged gas permeable membranes that support fixed film growth	Secondary Treatment - Aeration Basin, Aeration System
SEC-6	Trickling Filter/Activated Sludge	Plant flow treated over fixed film based trickling filter followed by conventional activated sludge	Secondary Treatment - Aeration Basin, Aeration System
SEC-7	BioMag Activated Sludge	Ballasted activated sludge	Secondary Treatment - Aeration Basin, Aeration System
SC-1	Secondary Clarifier No Action	Continued use of existing secondary clarifiers	None
SC-2	Secondary Clarifier 3 and 4	Expand secondary sedimentation with Secondary Clarifier 3 and 4-Gravity separation in quiescent tank	Secondary Clarifier
DIS-1	UV Disinfection No Action	Continued use of existing UV system	None
DIS-2	UV Disinfection Expansion	Expand UV system	Disinfection
OUT-1	Outfall No Action	Continued use of existing gravity outfall	None
OUT-2	Gravity Outfall	Effluent discharge through gravity pipeline and diffuser	Outfall

Table ES-2
Biosolids Handling Alternatives

Alternative Number	Alternative Name	Alternative Description	Deficiency Addressed
WAS-1	WAS Thickening No Action	Continued use of single Dissolved Air Flotation Thickener (DAFT)	None
WAS-2	Mechanical Thickening	Thickening of waste activated sludge through mechanical process prior to stabilization.	DAFT
STA-1	Anaerobic Digestion No Action	Continued use of two anaerobic digesters	None
STA-2	Anaerobic Digestion Expansion	Anaerobic digestion system to stabilize biosolids.	Anaerobic Digester
STA-3	Chemical Hydrolysis	Breakdown of sludge into smaller chemical compounds prior to stabilization process.	Anaerobic Digester
STA-4	WAS Only Thermal Drying	Drying WAS biosolids through application of heat to dry through evaporation of water. Other treatment of primary sludge biosolids will still be required.	Anaerobic Digester
FIN-1	Biosolids Finishing No Action	Continued use of single RDT and drying beds	None
FIN-2	Mechanical Dewatering	Mechanically dewater stabilized sludge to remove water and produce a "cake".	Rotary Drum Thickener Drying Beds

General Note:
1. RDT= rotary drum thickener

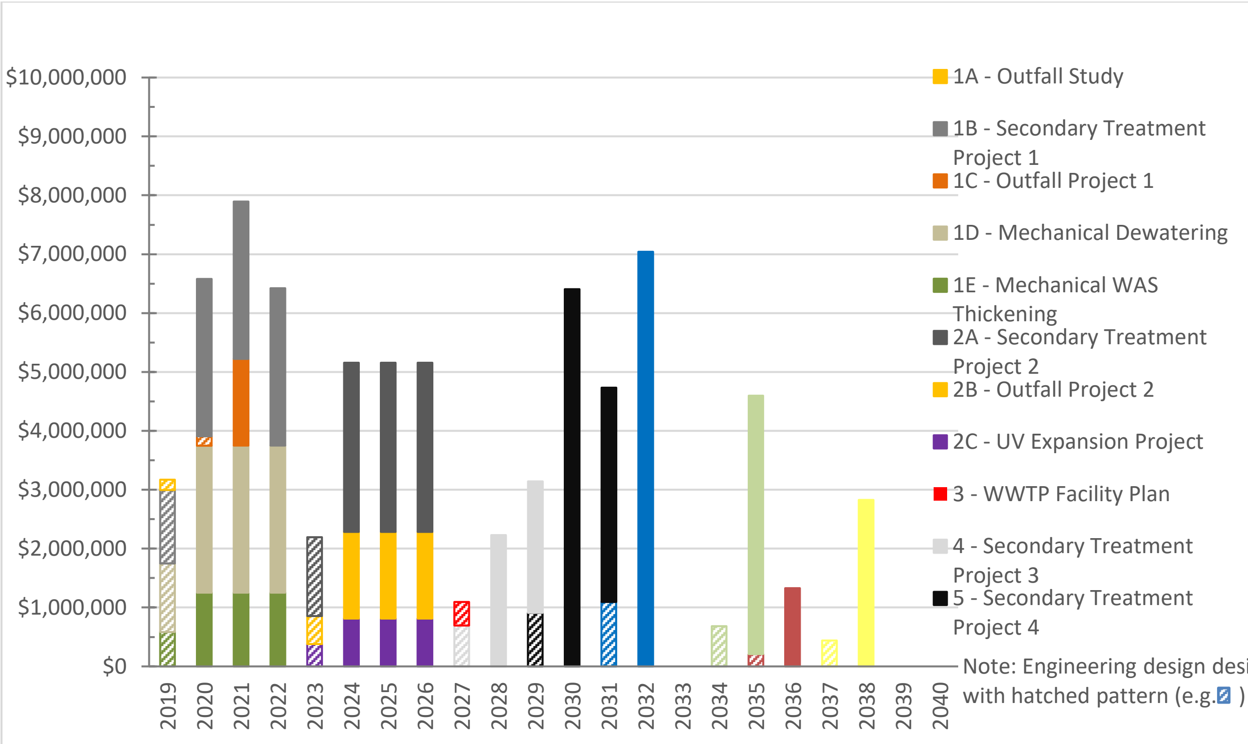
Capital Improvement Program

The alternatives presented above were reviewed by the City and project team to determine which provided the required treatment capacity, were most cost effective, maintain reliable operation, and satisfy known permit conditions. The preferred improvements were developed into the WWTP Capital Improvement Program and the projects were prioritized and spread out over the next 20 years. **Table ES-3** lists the proposed project timeframe for implementing each identified improvement, and **Figure ES-2** graphically illustrates the proposed project timeframe.

Table ES-3
List of Recommended Improvement Projects

Project Number	Project Name	2019-2022	2023-2026	2027-2033	2034-2040
1	Project 1	**$24,073,000**	-	-	-
1A	*1A Outfall Study*	*$175,000*	-	-	-
1B	*1B Secondary Treatment Project 1*	*$9,264,000*	-	-	-
1C	*1C Outfall Project 1*	*$1,637,000*	-	-	-
1D	*1D Mechanical Dewatering*	*$8,653,000*	-	-	-
1E	*1E Mechanical Thickening*	*$4,344,000*	-	-	-
2	Project 2	-	**$17,664,000**	-	-
2A	*2A Secondary Treatment Project 2*	-	*$9,950,000*	-	-
2B	*2B Outfall Project 2*	-	*$4,898,000*	-	-
2C	*2C UV Expansion Project*	-	*$2,816,000*	-	-
3	WWTP Facility Plan	-	-	$400,000	-
4	Secondary Treatment Project 3	-	-	$5,162,000	-
5	Secondary Treatment Project 4	-	-	$10,953,000	-
6	Anaerobic Digestion Expansion	-	-	$8,138,000	-
7	Administration Building	-	-	-	$5,076,000
8	Laboratory Building	-	-	-	$1,539,000
9	Headworks Expansion	-	-	-	$3,269,000
	TOTAL	**$24,073,000**	**$17,664,000**	**$24,653,000**	**$9,884,000**

Figure ES-2
Recommended Projects Phasing



Effect of Capital Improvement Plan Implementation

By implementing the recommended WWTP improvements in a timely manner, and as included in this Facility Plan, the City can ensure:

- The ability to handle wastewater generated within the collection system service area
- Compliance with discharge permit requirements for multiple constituents
- Protection of water quality in the Columbia River
- The ability to handle the projected biosolids generated at the WWTP

Ultimately, by following the recommendations in this Plan, the City will serve its sewer customers, the general public and the environment for years to come while avoiding regulatory enforcement actions and fines.

City of Pasco

Pasco City Council Meeting June 10, 2019

murraysmith

City of Pasco

2019 WWTP Facility Plan

City Council Summary

Presented by: Craig Anderson
June 10, 2019

PRESENTATION OVERVIEW

1. Existing WWTP
   - Layout
   - Function
2. Planning Period Impacts
   - Age
   - Growth/Capacity
3. Recommended Solutions
   - Selection Process
   - Final CIP

PRESENTATION OVERVIEW

1. Existing WWTP
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Pasco's WWTP

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35	Machine Shop (not pictured)
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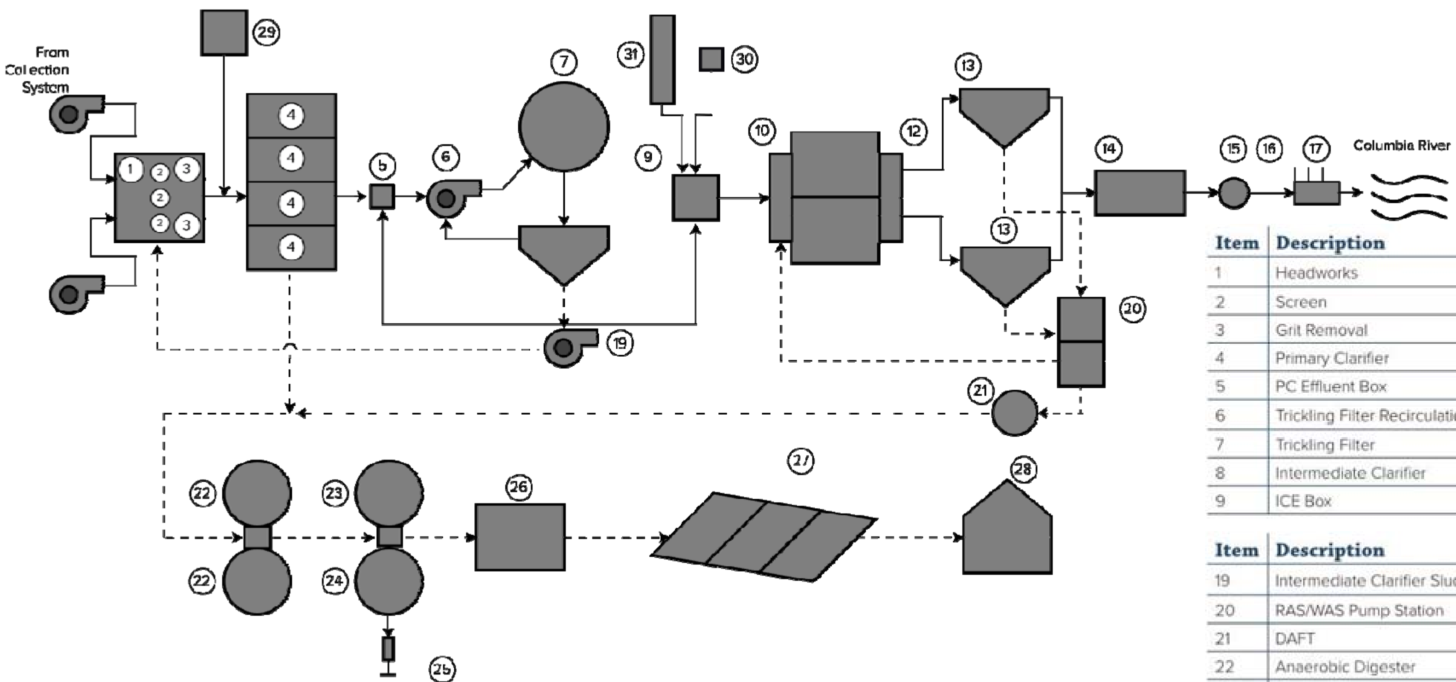
Pasco's WWTP



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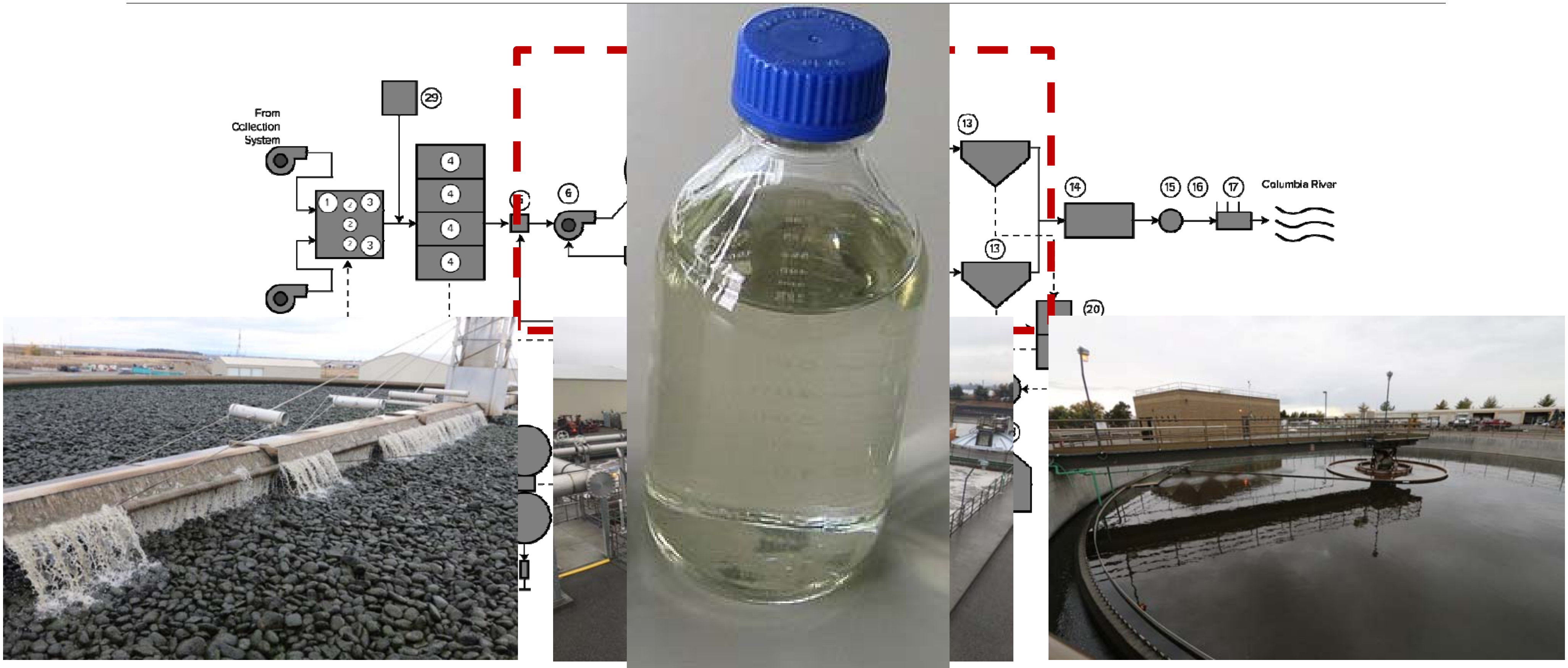
Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River
17	Columbia River Diffuser
18	Primary Sludge Pump Station (not pictured)

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
23	Sludge Storage
24	Gas Storage
25	Flare
26	Solids Thickening
27	Drying Bed

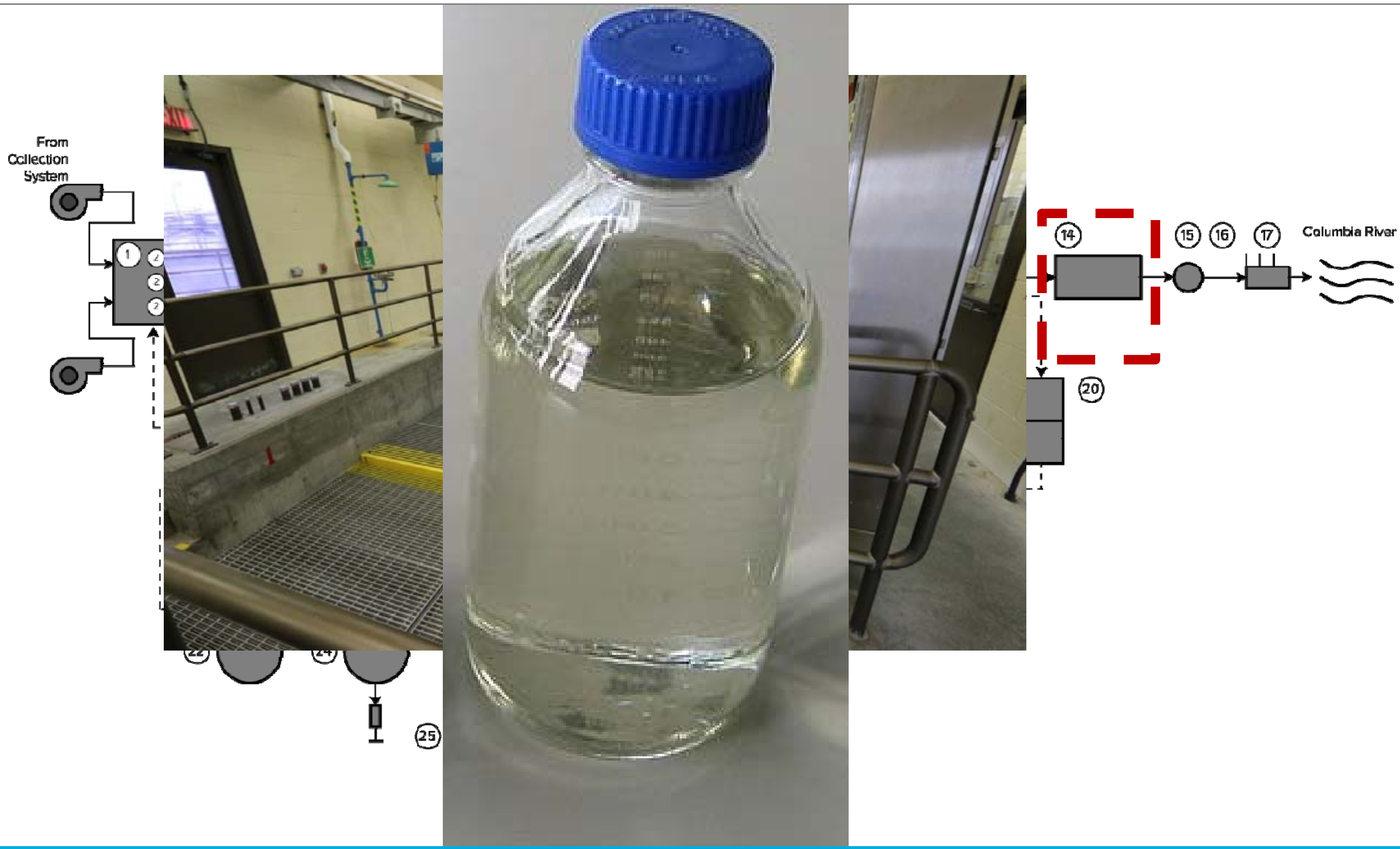
Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building (not pictured)
33	Laboratory (not pictured)
34	Blower Building (not pictured)
35	Machine Shop (not pictured)
36	Equipent Building (not pictured)

Primary Treatment

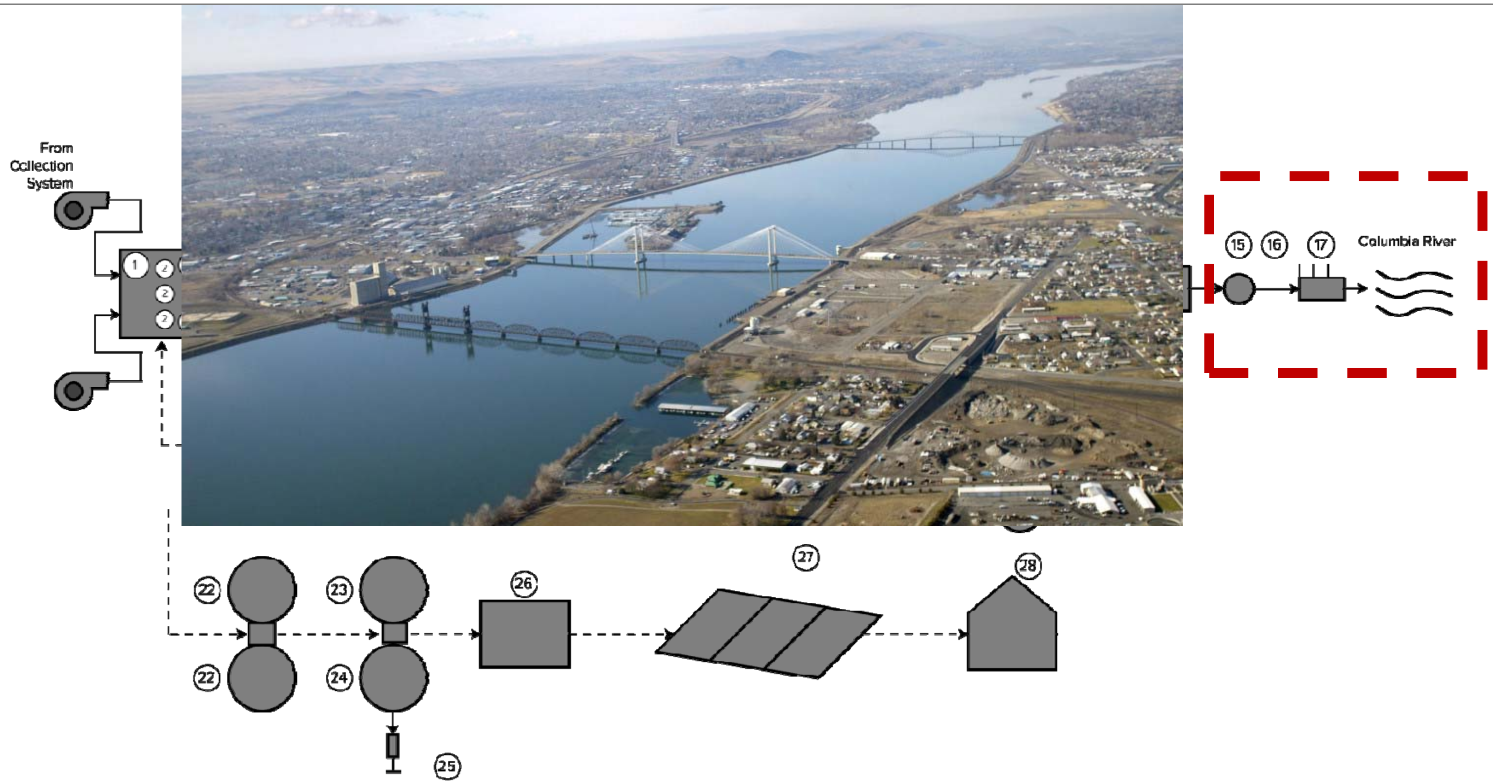
Secondary Treatment



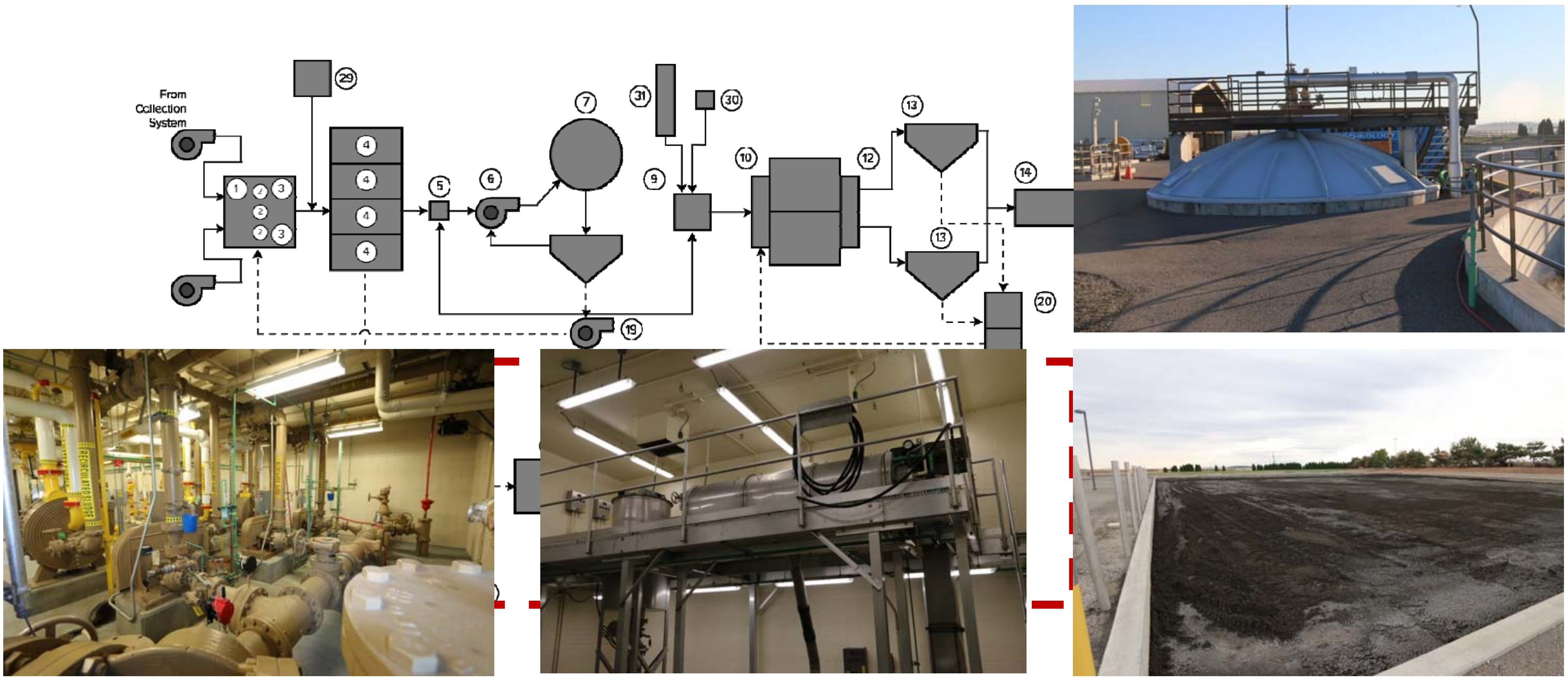
Disinfection



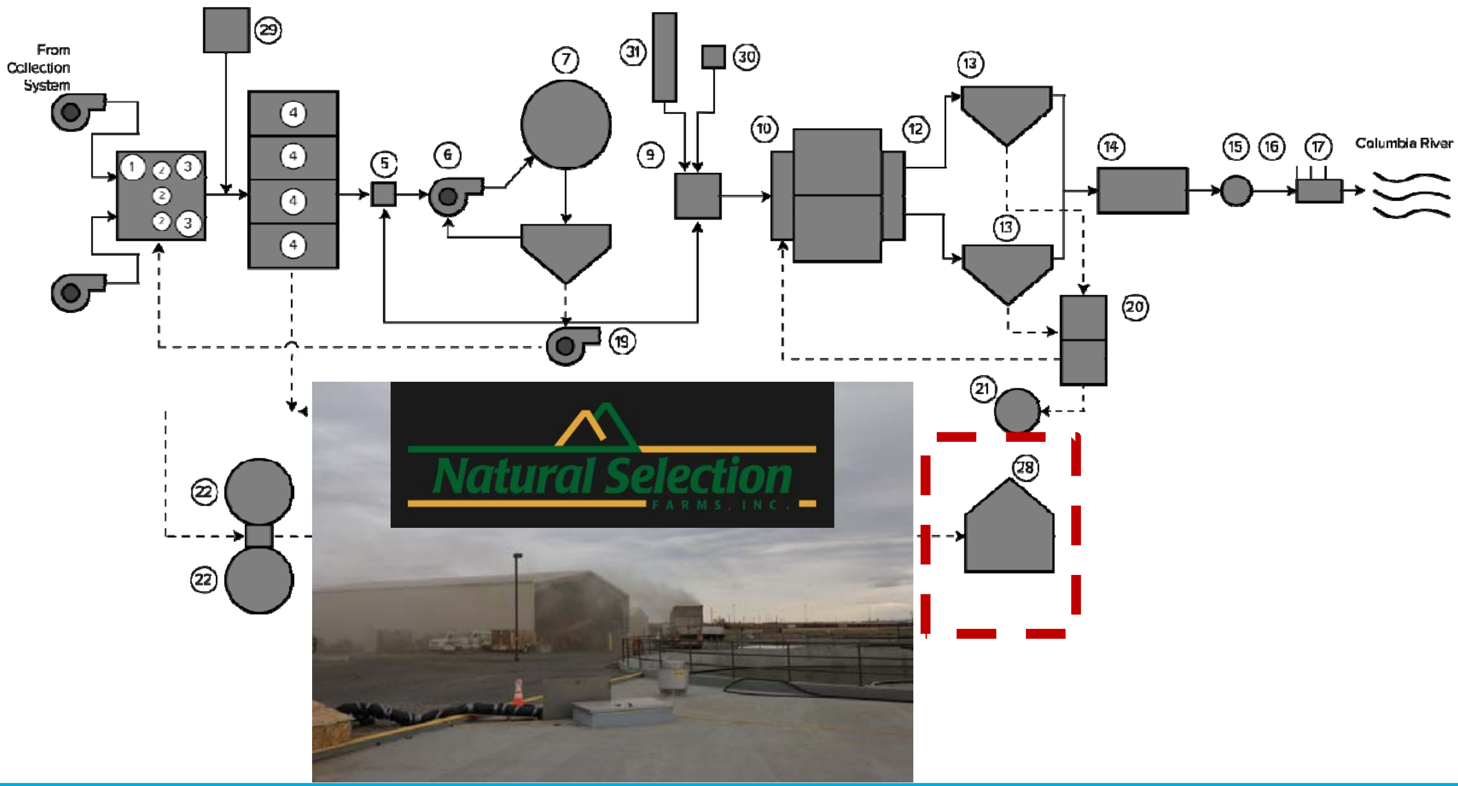
Liquid Disposal/Reuse



Solids Treatment



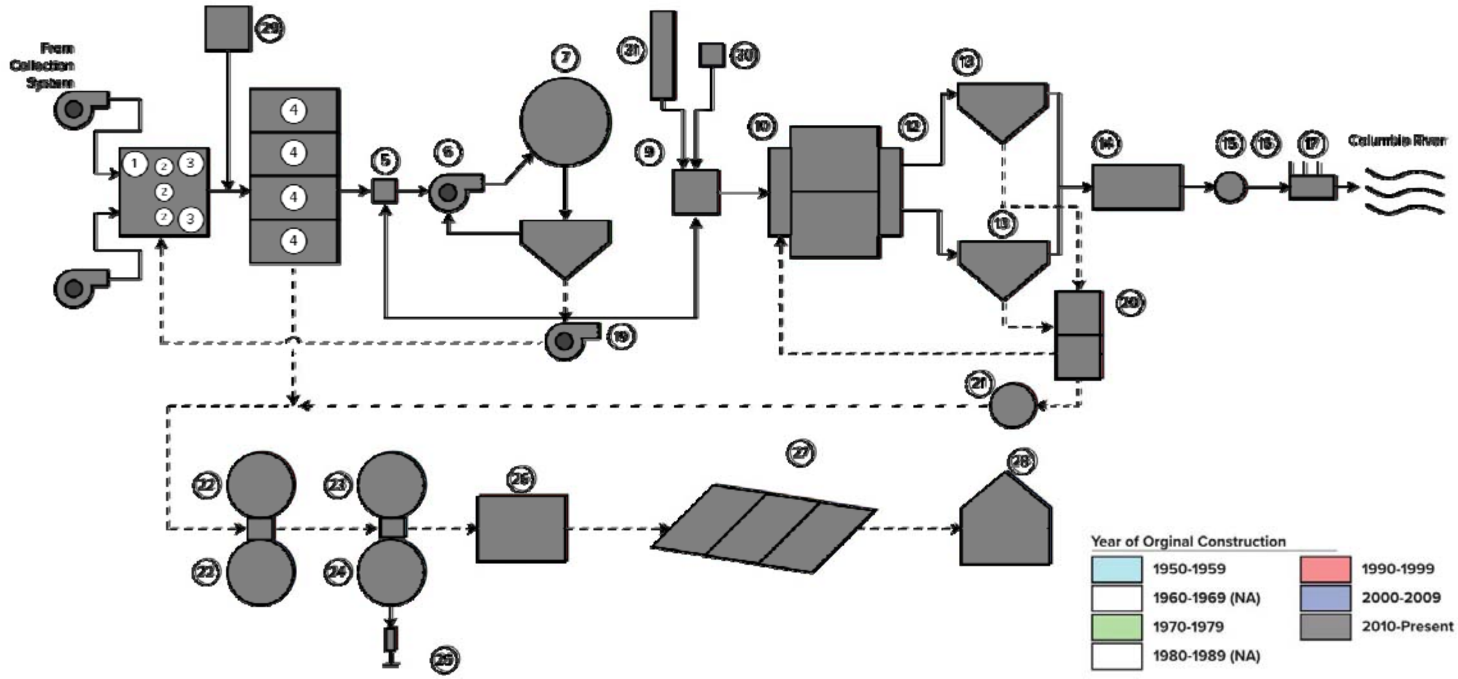
Solids Disposal/Reuse



PRESENTATION OVERVIEW

1. Existing WWTP
   - Layout
   - Function
2. Planning Period Impacts
   - Age
   - Growth/Capacity
3. Recommended Solutions
   - Selection Process
   - Final CIP

WWTP Age and History



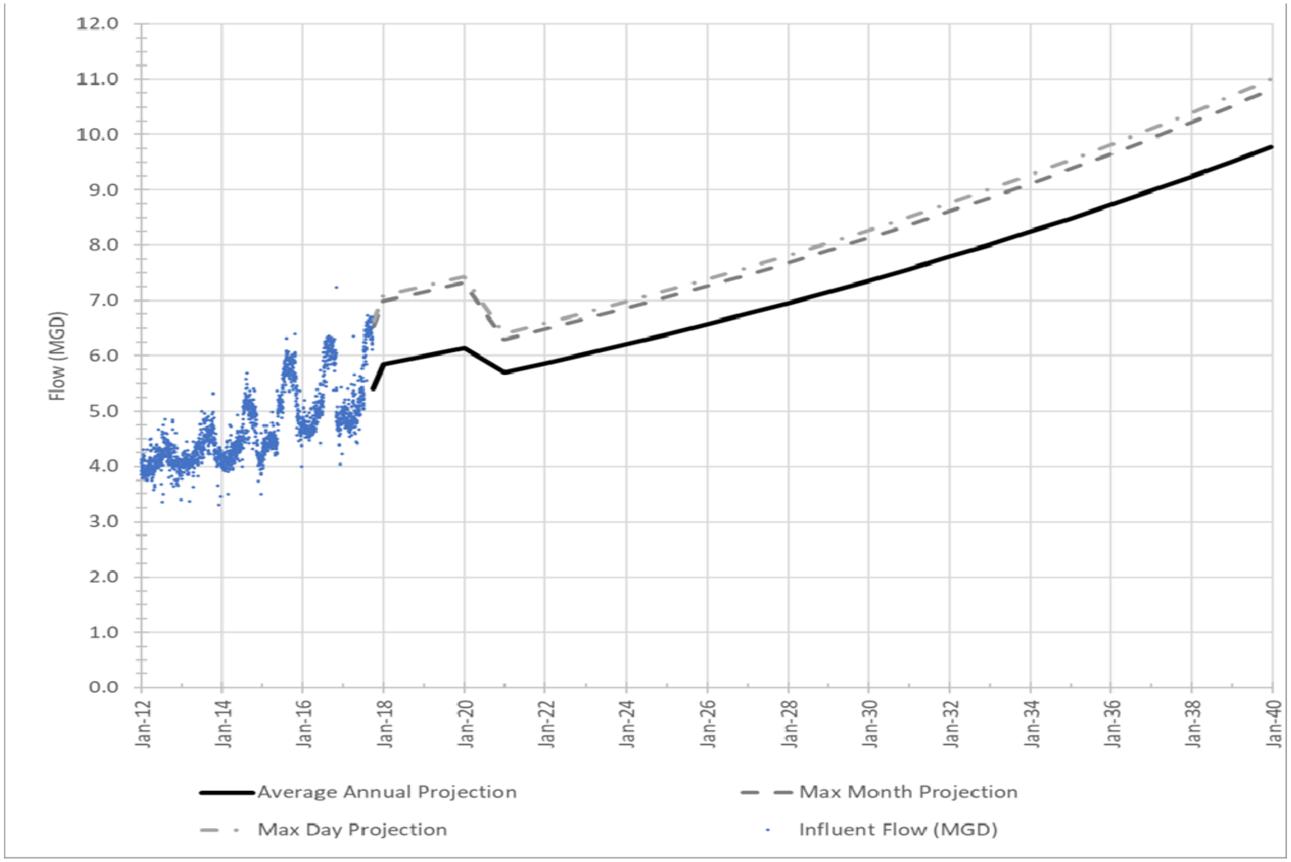
WWTP Flow Growth

Current

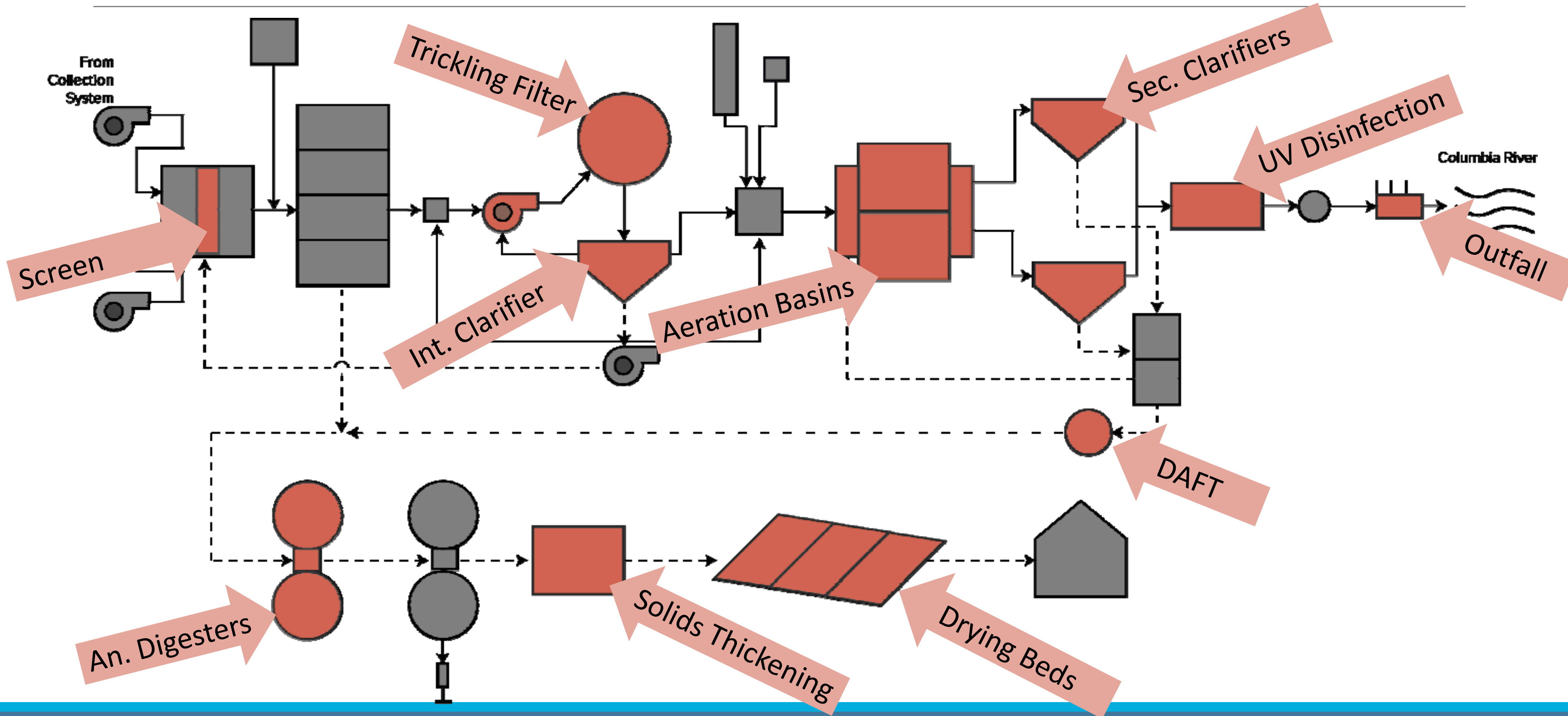
- 5.9 MGD average annual
- 6.5 MGD maximum month

Year 2040

- 9.8 MGD average annual
- 10.8 MGD maximum month



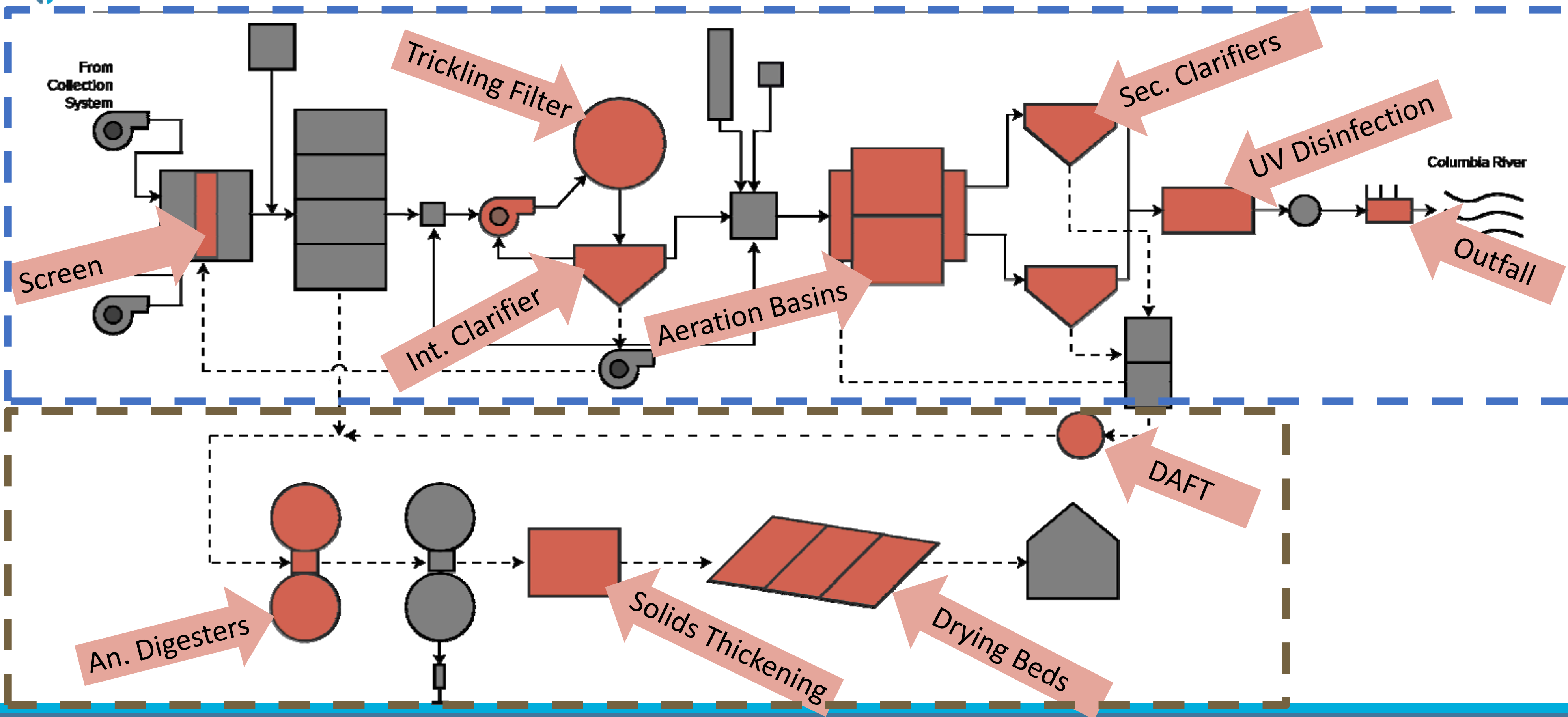
Planning Horizon Deficiencies



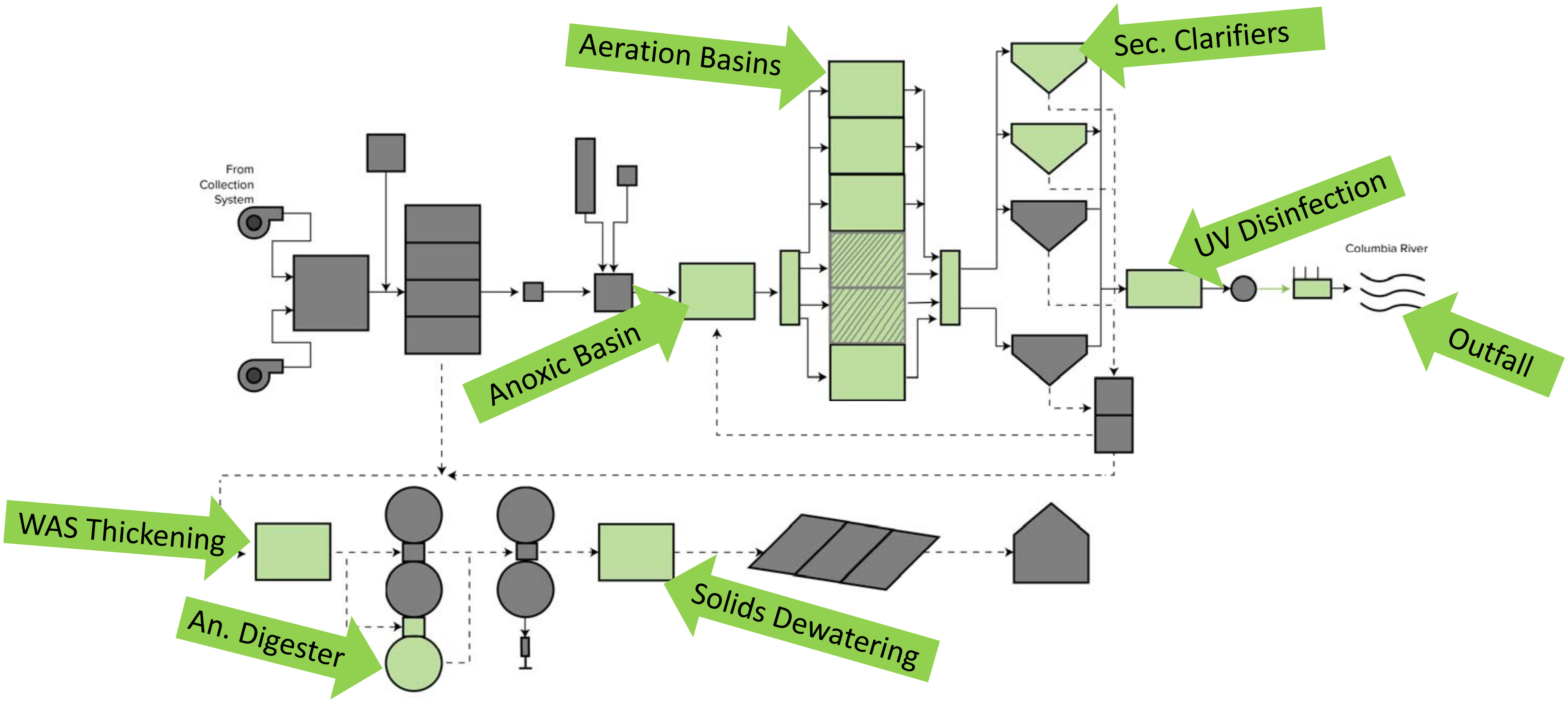
PRESENTATION OVERVIEW

1. Existing WWTP
   - Layout
   - Function
2. Planning Period Impacts
   - Age
   - Growth/Capacity
3. Recommended Solutions
   - Selection Process
   - Final CIP

Planning Horizon Deficiencies



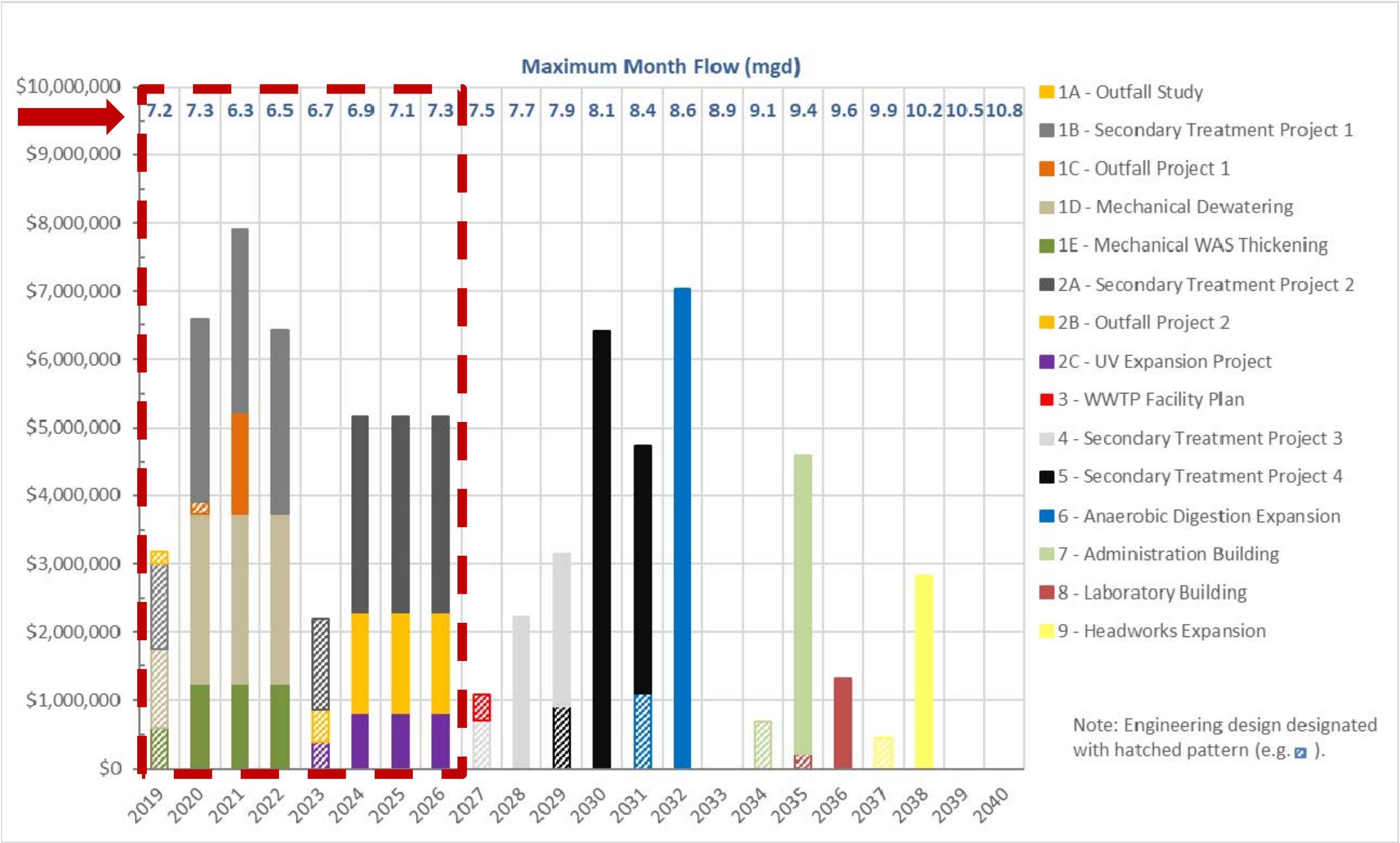
Selected WWTP Path



Overall Project Cost

Project Number	Project Name	Project Cost	
1	Project 1	$24,073,000	1A Outfall Study 1B Secondary Treatment Project 1 1C Outfall Project 1 1D Mechanical Dewatering 1E Mechanical Thickening
2	Project 2	$17,664,000	2A Secondary Treatment Project 2 2B Outfall Project 2 2C UV Expansion Project
3	WWTP Facility Plan	$400,000	
4	Secondary Treatment Project 3	$5,162,000	
5	Secondary Treatment Project 4	$10,953,000	
6	Anaerobic Digestion Expansion	$8,138,000	
7	Administration Building	$5,076,000	
8	Laboratory Building	$1,539,000	
9	Headworks Expansion	$3,269,000	
TOTAL		**$76,274,000**	

Project Cost Timeline (CIP)

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Questions

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APPENDIX 2-6

City of Pasco
Community Development Department
PO Box 293, 525 N 3rd Ave, Pasco, WA 99301
P: 509.545.3441 / F: 509.545.3499

DETERMINATION OF NON-SIGNIFICANCE

Description of Proposal: A facility plan to upgrade and expand Pasco's Wastewater Treatment Plant (WWTP). The plan evaluates the demands in the 20-year planning horizon and identifies improvements needed to maintain, upgrade, and expand the current facility.

Proponent: City of Pasco
525 N 3rd Ave
Pasco, WA 99301

Location of Proposal: 1015 S Gray Avenue in Pasco, WA

Lead Agency: City of Pasco

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An 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.

- ☐ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS. Appeals must be filed within 14 days of the issue.

Responsible Official: Rick White

Position/Title: Community & Economic Development Director

Address: PO Box 293, Pasco, WA 99301-0293

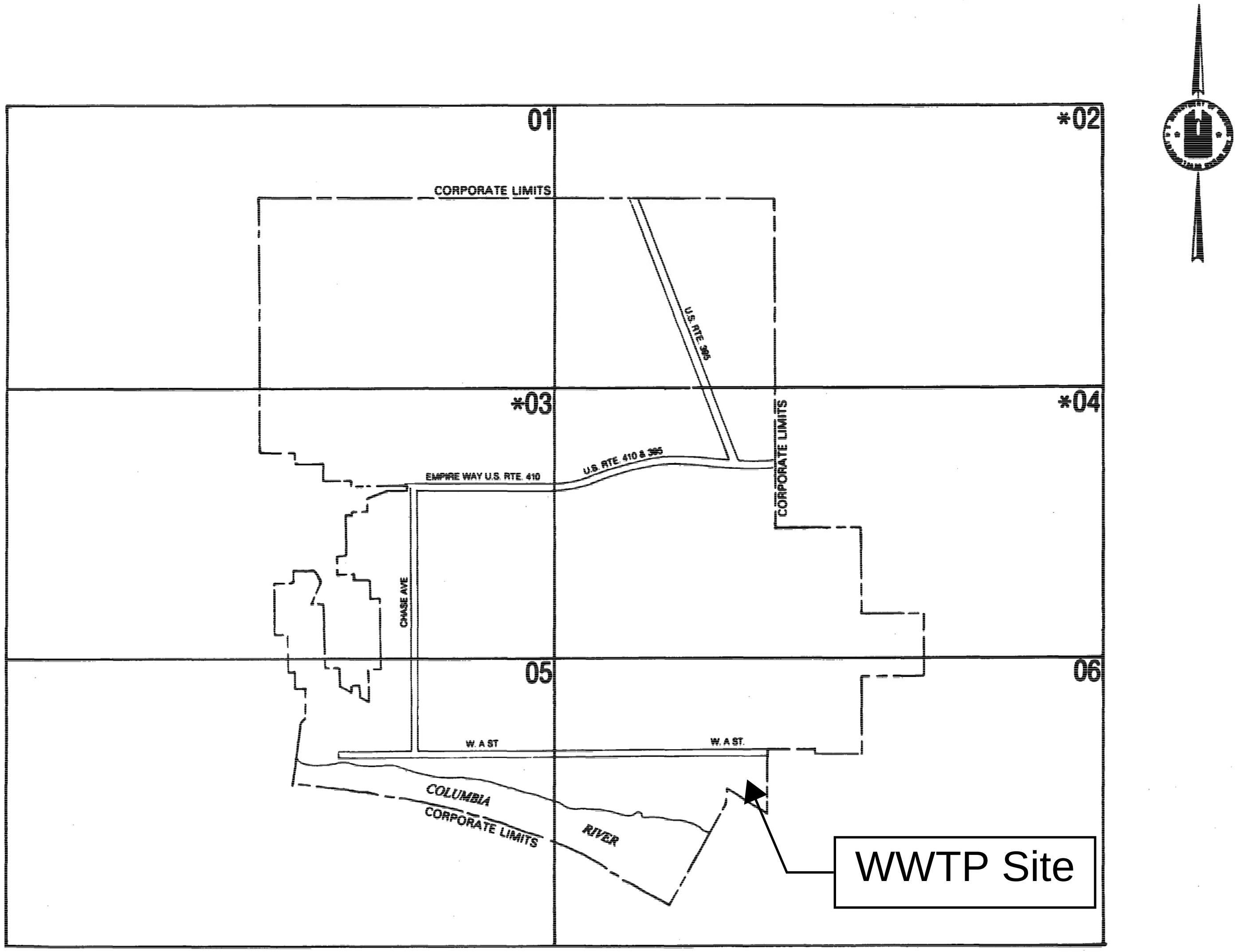
Phone: (509) 545-3441

Date: 3/29/2019

Signature: RWhite 3/29/19

ED Number: SEPA2019-013

APPENDIX 2-7



*NOT PRINTED (ALL ZONE C)

KEY TO SYMBOLS

SPECIAL FLOOD HAZARD AREA

ZONE C
ZONE A
ZONE C

Base Flood Elevation Line	513
Base Flood Elevation	(513' MSL)
Elevation Reference Mark	RM7 ×
River Mile	• M1.5

*EXPLANATION OF ZONE DESIGNATIONS

A flood insurance map displays the zone designations for a community according to areas of designated flood hazards. The zone designations used by FIA are:

Zone Symbol	Category
A	Area of special flood hazards (SFH) and without base flood elevations determined.
A1 through A30	Area of special flood hazards (SFH) with base flood elevations. Zones are assigned according to flood hazard factors, and dates of SFH identification.
AO	Area of special flood hazards that have shallow flood depths (less than two feet) and/or unpredictable flow paths. Base flood elevations are not determined.
V	Area of special flood hazards, with velocity, that are inundated by tidal floods. Zones are assigned according to flood hazard factors and dates of SFH identification.
B	Area of moderate flood hazards.
C	Area of minimal flood hazards.
D	Area of undetermined, but possible, flood hazards.

CONSULT NFIA SERVICING COMPANY OR LOCAL INSURANCE AGENT OR BROKER TO DETERMINE IF PROPERTIES IN THIS COMMUNITY ARE ELIGIBLE FOR FLOOD INSURANCE.

INITIAL IDENTIFICATION DATE:
JULY 23, 1976

MAP REVISED: MAY 10, 1977
CONVERSION FROM F.H.B.M. TO F.I.R.M.
CHANGE COMMUNITY BOUNDARY

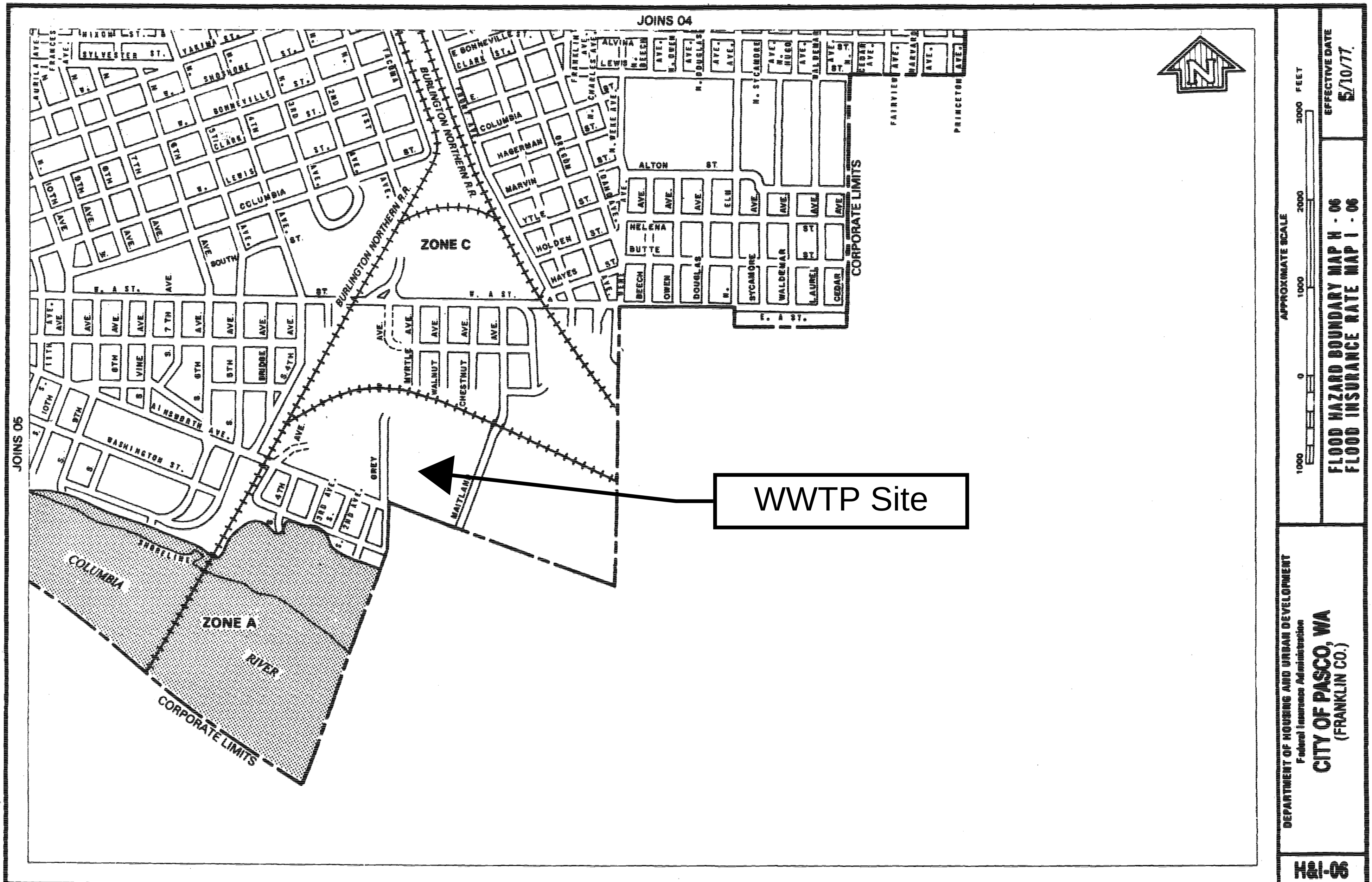
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

FLOOD HAZARD BOUNDARY MAP H - 01-06
FLOOD INSURANCE RATE MAP I - 01-06

MAP INDEX

CITY OF PASCO, WA
(FRANKLIN CO.)

COMMUNITY NO. 530046A



JOINS 04
JOINS 05
ZONE C
ZONE A
COLUMBIA
RIVER
BURLINGTON NORTHERN R.R.
CORPORATE LIMITS
WWTP Site
APPROXIMATE SCALE
1000 0 1000 2000 3000 FEET
FLOOD HAZARD BOUNDARY MAP H - 06
FLOOD INSURANCE RATE MAP I - 06
EFFECTIVE DATE
5/10/77
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration
CITY OF PASCO, WA
(FRANKLIN CO.)
H&I-06

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APPENDIX 2-8

U.S. Fish and Wildlife Service
National Wetlands Inventory

Pasco WWTP

June 26, 2017

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

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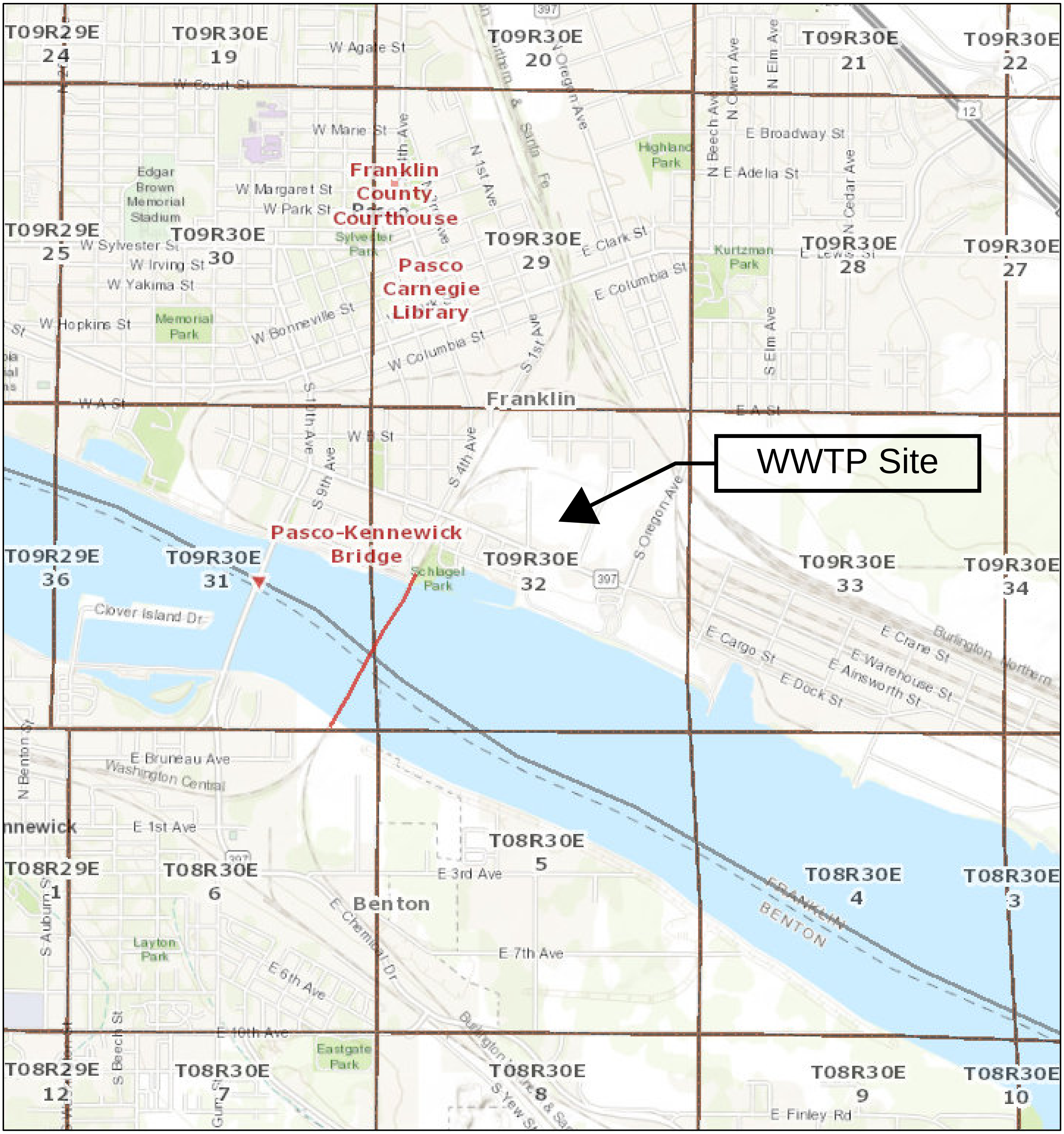
APPENDIX 2-9.1

Department of Archaeology and Historic Preservation



May 20, 2019

1:40,726

0 0.35 0.7 1.4 mi

0 0.5 1 2 km

Heritage Barns

Register Properties (Points)

Register Properties (Lines)

Register Properties (Polygons)

Register Districts

Township Range & Sections

County

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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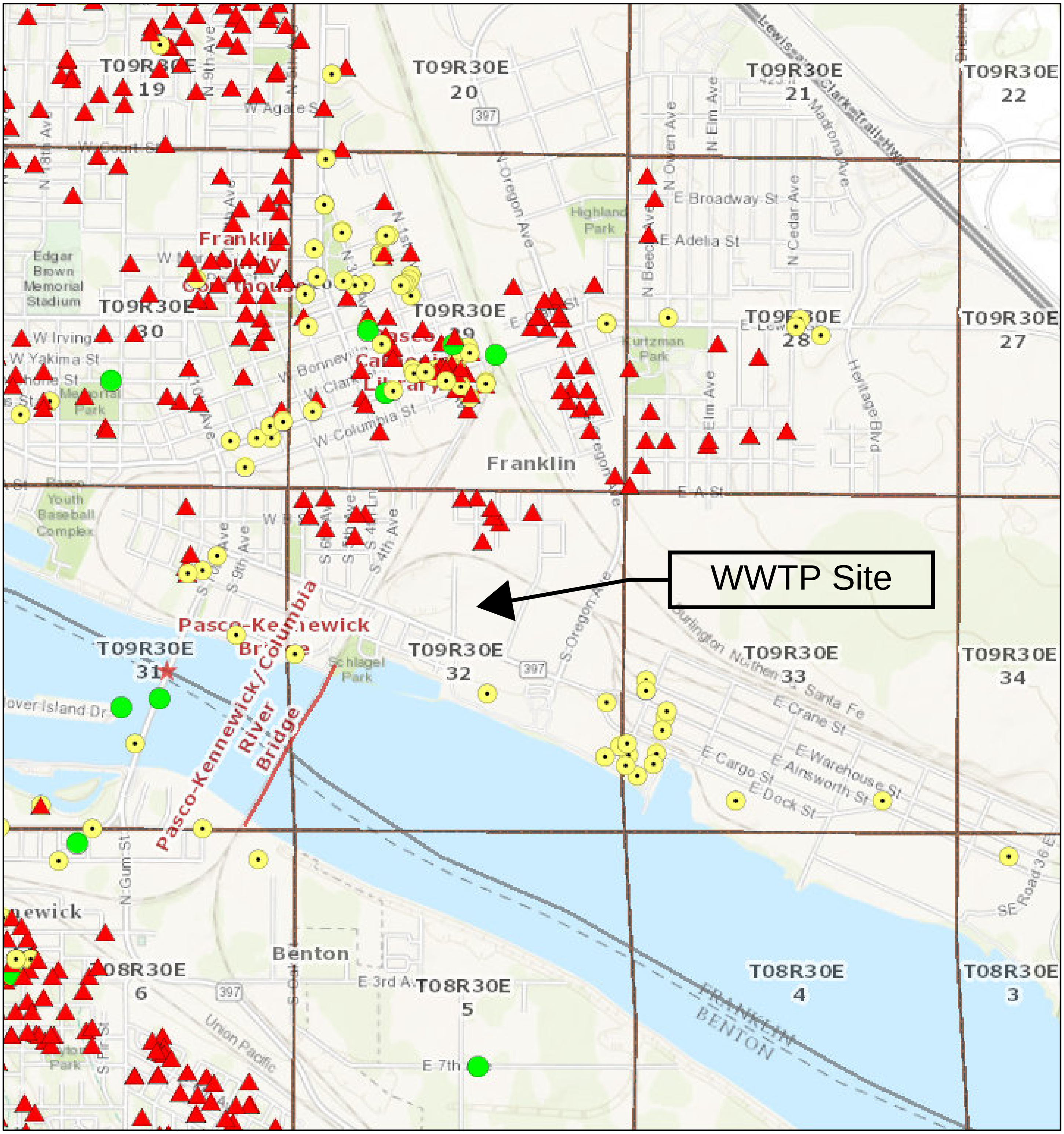
APPENDIX 2-9.2

Department of Archaeology and Historic Preservation



August 24, 2017

1:38,519

0 0.325 0.65 1.3 mi
0 0.5 1 2 km

- Determined Eligible
- Determined Not Eligible
- No Determination
- Heritage Barns
- Register Properties (Points)
- Register Properties (Lines)
- Register Properties (Polygons)
- Register Districts
- Township Range & Sections
- County

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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APPENDIX 2-10

DRAFT
BIOLOGICAL ASSESSMENT
CITY OF PASO, WA
WASTEWATER TREATMENT PLANT 2017 FACILITY PLAN
MAY, 2019

[ACTION AGENCY TRACKING NUMBER, IF APPROPRIATE]

Prepared for:
City of Pasco, WA
525 N. 3rd Avenue
Pasco, WA 99301

Prepared by:
Mark Cummings
Murraysmith, Inc.
345 Bobwhite Court, Suite 230
Boise, ID 83706
208-947-9033
December 2017

Biological Assessments & Biological Evaluations from the template provided by:
Provided by U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office,
Consultation and Technical Assistance Program
Revision Date: July 25, 2008

1.0 BACKGROUND/HISTORY

The purpose of this Biological Assessment (BA) is to address the effect of the City of Pasco's proposed construction activities described within the Wastewater Treatment Plant Facility Plan on ESA-listed species, listed as endangered or threatened under the Endangered Species Act (ESA), or their designated critical habitat. This BA also evaluates the presence of Essential Fish Habitat (EFH) as indicated by the Magnuson Stevens Fishery Conservation and Management Act (Magnuson Stevens Act). The project involves expansion of the WWTP on the existing WWTP site in Pasco, WA. The purpose of the proposed action is to upgrade the WWTP to accommodate future wastewater flow and loading.

This BA, prepared by the Murraysmith, Inc., addresses the proposed action in compliance with Section 7 of the ESA. Section 7 assures that, through consultation (or conferencing for proposed species) with the Service, federal actions do not jeopardize the continued existence of any threatened, endangered or proposed species, or result in the destruction or adverse modification of critical habitat.

2.0 DESCRIPTION OF THE ACTION & ACTION AREA

The City built their first wastewater treatment plant (WWTP) in 1954 and it has been upgraded and expanded the 1970's, the 1990's, the 2000's and 2010's. The WWTP was upgraded to increase the design capacity to accommodate anticipated growth of the City's service area.

The WWTP is located at 1015 South Grey Avenue near the bank of the Columbia River. The WWTP facility is shown in Figure 2-7.1. The site consists of approximately 27.5 acres

The proposed action includes improvements to the WWTP.

Future submittals will include lists of all projects at the WWTP which have not been determined to date. This section will also include a detailed description of what work that will be done, and how it will be accomplished, particularly for components that are reasonably likely to have impacts on protected species and/or their habitats. A description of measures (e.g. BMPs) to be taken to reduce or eliminate potential impacts from the action, as well as any proposed beneficial components of the project intended as offsetting actions for unavoidable potential adverse effects or as enhancement opportunities; e.g, habitat protection, wetland creation, restoration or enhancements, etc.

The action area includes the WWTP site located on S Grays Avenue and the outfall to the McNary Pool of the Columbia River. Future submittals will include more specific definition of the action area (e.g. geographic extent of all the projects).

3.0 LISTED SPECIES & CRITICAL HABITAT IN THE ACTION AREA

Table 1 summarizes the ESA-listed species that may occur within the action area, or may be affected by the proposed action *(dated 8/16/2017)*. See Appendix A for USFW ESA Species by County Report

Table 1: Summary ESA species listing for action area

Species	Listing Status	Designated Critical habitat within the Action Area
Yellow-billed Cuckoo *(Coccyzus americanus)*	Threatened	No
Bull Trout *(Salvelines confluentus)*	Threatened	No
White Bluffs bladderpod *(Physario douglasii ssp. tuplashensis)*	Threatened	No
Gray wolf *(Canis lupis)*	Endangered	No
Gray wolf *(Canis lupis)*	Recovery	No
Columbia Basin Pigmy Rabbits *(Brachylagus idahoensis)*	Endangered	No

The National Marine Fisheries Service (NMFS) is the lead federal agency responsible for the stewardship of marine resources and associated habitats. Based on the project location (i.e. in close proximity and in the Columbia River) the NMFS EFH for the project vicinity was reviewed. On May 14, 2019, the NMFS EFH mapping website was accessed to determine the presence/absence of EFH near the project action area. Chinook Salmon, Coho Salmon was identified in the area with all lifestages found at the location. See Appendix B for NMFS EFH Report

4.0 ENVIRONMENTAL BASELINE CONDITIONS

The proposed action area is contained within the existing WWTP site. The site is in the Columbia River drainage in Pasco, WA. The Columbia River flows westerly and intercepts many smaller rivers/tributaries before draining into the Pacific Ocean. The Columbia River contains suitable habitat, migration routes and spawning/rearing grounds for many varieties of aquatic species.

5.0 EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action and on the species and/or critical habitat. Factors considered in the analysis include: proximity of the action, distribution, timing, nature of the effect, duration, disturbance frequency, disturbance intensity, and disturbance severity.

Yellow-billed Cuckoo

The Yellow-billed Cuckoo is a slender, long-tailed bird that typically lives in deciduous woodlands with dense cover, shrubby areas, and most often with water nearby. For more information on this species, see Appendix A for the US fish and Wildlife Service Environmental Conservation Online System (ECOS) information. The proposed actions do not include disturbing any areas that are typical habitat for the Yellow-billed Cuckoo. Due to the lack of habitat within the action area, the proposed project actions have been determined to have “no effect” on Yellow-billed Cuckoo.

Bull Trout

The Bull Trout is a salmonid species that lives in two forms: resident and migratory. They typically live in cold clear water of northwestern North America. For more information on this species, see Appendix A for the US fish and Wildlife Service ECOS information. The proposed actions do not include any work in the Columbia River. The amount of WWTP effluent discharge or the quality of the effluent are anticipated to measure change as a result of the proposed actions. Due to the lack of habitat within the action area, the proposed project actions have been determined to have “no effect” on Bull Trout.

White Bluffs bladderpod

The White Bluffs bladderpod plant with small yellow flowers. It only lives along a narrow strip of federal land in the Columbia Basin roughly 50 to 75 miles northwest of the City of Pasco, WA. For more information on this species, see Appendix A for the US fish and Wildlife Service ECOS information. The habitat of the White Bluffs bladderpod is outside of the action area as seen in the ECOS for this species. Due to the lack of habitat within the action area, either the WWTP site or the outfall site, the proposed project actions have been determined to have “no effect” on White Bluffs bladderpod.

Gray Wolf

The Gray Wolf is a large wolf that lives through much of the northern hemisphere. It typically lives in packs with territories that cover very large areas. For more information on this species, see Appendix A for the US fish and Wildlife Service ECOS information. The identified action area of the project is within a developed city with urban, industrial and commercial areas which are not suitable for Gray Wolf habitat. Due to the lack of habitat within the action area, the proposed project actions have been determined to have “no effect” on Gray Wolf.

Columbia Basin Pigmy Rabbits

The Columbia Basin Pigmy Rabbits is the smallest species of rabbit in North America. It typically lives in areas of sagebrush with deep soil profiles where the rabbits dig burrows. For more information on this species, see Appendix A for the US fish and Wildlife Service ECOS information. The habitat of the Columbia Basin Pigmy Rabbits is outside of the action area as seen in the ECOS for this species. Due to the lack of habitat within the action area, the proposed project actions have been determined to have “no effect” on Columbia Basin Pigmy Rabbits.

6.0 CUMULATIVE EFFECTS (Formal consultation only)

This section will be added as needed for future submittals.

Describe all “non-Federal” actions reasonably certain to occur in the foreseeable future. Includes state, local, private, and tribal actions (e.g. residential developments, watershed enhancement, etc.). Section 7 regulations require the Federal action agency to provide an analysis of cumulative effects, along with other information, when requesting initiation of formal consultation. Note that ‘cumulative effects’ under the ESA is defined more narrowly than under NEPA[1].

7.0 CONCLUSIONS

In conclusion, we have determined that the proposed action as summarize in Table 2.

Table 2: Summary of Effect Determination for ESA listed species identified for the action area

Species	Effect Determination	Reason
Yellow-billed Cuckoo *(Coccyzus americanus)*	No Effect	Lack of suitable habitat within the action area
Bull Trout *(Salvelines confluentus)*	No Effect	Lack of suitable habitat within the action area
White Bluffs bladderpod *(Physario douglasii ssp. tuplashensis)*	No Effect	Lack of suitable habitat within the action area
Gray wolf	No Effect	Lack of suitable habitat

[1] “Cumulative impacts”, as defined by NEPA [40 C.F.R. §1508.7], are the impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts are distinct from “cumulative effects”, as defined by the ESA [50 C.F.R. § 402.02], which are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area.

(Canis lupis)		within the action area
Columbia Basin Pigmy Rabbits *(Brachylagus idahoensis)*	No Effect	Lack of suitable habitat within the action area

8.0 LITERATURE CITED

U.S. Fish and Wildlife Service. Environmental Conservation Online System. Accessed 08/22/2017
Yellow-billed Cuckoo (Coccyzus americanus)
https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=B06R
Bull Trout (Salvelines confluentus)
https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E065
White Bluffs bladderpod (Physario douglasii ssp. tuplashensis)
https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=Q3HR
Gray wolf (Canis lupis)
https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A00D
Columbia Basin Pigmy Rabbits (Brachylagus idahoensis)
https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A0GG

U.S. Fish and Wildlife Service. Environmental Conservation Online System. Accessed 08/16/2017 and 5/14/219
https://ecos.fws.gov/ecp0/reports/species-by-current-range-county?fips=53021

National Oceanic and Atmospheric Administration. Essential Fish Habitat. Access on 08/16/2017.
http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html

Wastewater Treatment Plant Facility Plan

Figure 2-7.1
WWTP Site

September 2017 16-1916

Appendix A

U.S. Fish & Wildlife Service

ECOS

ECOS / Species Reports / Species By County Report

Species By County Report

The following report contains Species that are known to or are believed to occur in this county. Species with range unrefined past the state level are now excluded from this report. If you are looking for the Section 7 range (for Section 7 Consultations), please visit the IPaC application.

County: Franklin, Washington

CSV

Need to contact a FWS field office about a species? Follow this link to find your local FWS Office.

Group	Name	Population	Status	Lead Office	Recovery Plan	Recovery Plan Action Status	Recovery Plan Stage
Birds	Yellow-billed Cuckoo (*Coccyzus americanus*)	Western U.S. DPS	Threatened	Sacramento Fish and Wildlife Office			
Fishes	Bull Trout (*Salvelinus confluentus*)	U.S.A., conterminous, lower 48 states	Threatened	Idaho Fish and Wildlife Office	Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus)	Implementation Progress	Final
Flowering Plants	White Bluffs bladderpod (*Physaria douglasii ssp. tuplashensis*)	Wherever found	Threatened	Washington Fish and Wildlife Office			
Mammals	Gray wolf (*Canis lupus*)	U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA. Mexico.	Endangered	Assistant Regional Director-Ecological Services			
Mammals	Gray wolf (*Canis lupus*)	Northern Rocky Mountain DPS	Recovery	Office of the Regional Director			
Mammals	Columbia Basin Pygmy Rabbit (*Brachylagus idahoensis*)	Columbia Basin DPS	Endangered	Washington Fish and Wildlife Office	Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (Brachylagus idahoensis)	Implementation Progress	Final

U.S. Fish & Wildlife Service

ECOS

Yellow-Billed Cuckoo (Coccyzus americanus)

Current Range | Federal Register | Recovery | Critical Habitat | Conservation Plans | Petitions | Life History

Taxonomy: View taxonomy in ITIS

Listing Status: Threatened

General Information

Yellow-billed Cuckoos are fairly large, long, and slim birds. The mostly yellow bill is almost as long as the head, thick and slightly downcurved. They have a flat head, thin body, and very long tail. Wings appear pointed and swept back in flight. Yellow-billed Cuckoos are warm brown above and clean whitish below. Their blackish face mask is accompanied by a yellow eyering. In flight, the outer part of the wings flash rufous. From below, the tail has wide white bands and narrower black ones.

References cited in Species Profile

- Cornell Lab of Ornithology. 2015. Yellow-billed Cuckoo. All About Birds. http://www.allaboutbirds.org/guide/Yellow-billed_Cuckoo/id
- Hughes, Janice M. 2015. Yellow-billed Cuckoo (Coccyzus americanus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/418
- Laymon, S. A. 1998. Yellow-billed Cuckoo (Coccycus americanus). In The Riparian Bird Conservation Plan:a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html
- Partners in Flight. 2012. Species assessment database. http://rmbo.org/pifassessment/Database.aspx
- USGS Patuxent Wildlife Research Center. 2012. North American Breeding Bird Survey 1966-2010 analysis. http://www.mbr-pwrc.usgs.gov/bbs/specl10.html

Current Listing Status Summary

Status	Date Listed	Lead Region	Where Listed
Threatened	11/03/2014	California/Nevada Region (Region 8)	Western DPS: U.S.A. (AZ, CA, CO (western), ID, MT (western), NM (western), NV, OR, TX (western), UT, WA, WY (western)); Canada (British Columbia (southwestern); Mexico (Baja California, Baja California Sur, Chihuahua, Durango (western), Sinaloa, Sonora) Additional species information

» Current Range

Population(s)

☑ *Western U.S. DPS*

Zoom in! Some species' locations may be small and hard to see from a wide perspective. To narrow-in on locations, check the state and county lists (below) and then use the zoom tool.

- **States/US Territories** in which the Yellow-Billed Cuckoo, Western U.S. DPS is known to or is believed to occur: Arizona , California , Colorado , Idaho , Montana , Nevada , New Mexico , Oregon , Texas , Utah , Washington , Wyoming
- **US Counties** in which the Yellow-Billed Cuckoo, Western U.S. DPS is known to or is believed to occur: View All

- **USFWS Refuges** in which the Yellow-Billed Cuckoo, Western U.S. DPS is known to occur: Bill Williams River National Wildlife Refuge , Bosque del Apache National Wildlife Refuge , Browns Park National Wildlife Refuge , Butte Sink Wildlife Management Area , Cibola National Wildlife Refuge ... Show All Refuges
- **Countries** in which the the Yellow-Billed Cuckoo, Western U.S. DPS is known to occur: Canada , Mexico , United States

» Federal Register Documents

Federal Register Documents

Show 10 entries

Date	Citation Page	Title
12/02/2014	79 FR 71373 71375	Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo (Coccyzus americanus)
11/12/2014	79 FR 67154 67155	Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo (Coccyzus americanus)
10/03/2014	79 FR 59991 60038	Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cu (Coccyzus americanus)
08/15/2014	79 FR 48547 48652	Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo
04/10/2014	79 FR 19860 19861	Proposed Threatened Status for the Western Distinct Population Segment of the Yellow-Billed Cuckoo (Coccyzus americanus)
12/26/2013	78 FR 78321 78322	Proposed Threatened Status for the Western Distinct Population Segment of the Yellow-Billed Cuckoo (Coccyzus americanus)
10/03/2013	78 FR 61621 61666	Proposed Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus); Proposed Rule
11/21/2012	77 FR 69993 70060	Review of Native Species That Are Candidates for Listing as Endangered or Threatened; Annual Notice Findings on Resubmitted Petitions; Annual Description of Progress on Listing Actions

Showing 1 to 10 of 33 entries

‹ Previous 1 2 3 4 Next ›

» Recovery

- Recovery Plan Information Search
- Information Search FAQs

No recovery information is available for the Yellow-Billed Cuckoo.

» Critical Habitat

Critical Habitat Spatial Extents

Population(s)

Proposed Western U.S. DPS

Show 10 entries

Date	Citation Page	Title	Document Type	Sta
08/15/2014	79 FR 48547 48652	Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo	Proposed Rule	I

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

To learn more about critical habitat please see http://ecos.fws.gov/crithab

» Conservation Plans

Habitat Conservation Plans (HCP) (learn more)

Show 10 entries

HCP Plan Summaries
Western Riverside MSHCP (One permit w/ 22 permittees)
San Luis Valley
San Joaquin County Multi-Species Habitat Conservation and Open Space Plan
Salt River Project Roosevelt Lake Habitat Conservation Plan
Salt River Project Horseshoe and Bartlett HCP
Pima County Multi-Species Conservation Plan, under Sonoran Desert Conservation Plan
Malpai Borderlands
Lower Colorado River Multi-Species Conservation Plan (LCR MSCP)
Lower Colorado River MSCP
Clark County Multiple Species HCP (7 permittees)

Showing 1 to 10 of 11 entries

‹ Previous 1 2 Next ›

» Petitions

Show 10 entries

Showing 1 to 2 of 2 entries

‹ Previous 1 Next ›

» Life History

Habitat Requirements

Yellow-billed Cuckoos use wooded habitat with dense cover and water nearby, including woodlands with low, scrubby, vegetation, overgrown orchards, abandoned farmland, and dense thickets along streams and marshes. In the Midwest, look for cuckoos in shrublands of mixed willow and dogwood, and in dense stands of small trees such as American elm. In the central and eastern U.S., Yellow-billed Cuckoos nest in oaks, beech, hawthorn, and ash. In the West, nests are often placed in willows along streams and rivers, with nearby cottonwoods serving as foraging sites.

Food Habits

Caterpillars top the list of Yellow-Billed Cuckoo prey: individual cuckoos eat thousands of caterpillars per season. On the East coast, periodic outbreaks of tent caterpillars draw cuckoos to eat as many as 100 caterpillars in one sitting. Fall webworms and the larvae of gypsy, brown-tailed, and white-marked tussock moths are also part of the cuckoos lepidopteran diet, often supplemented with beetles, ants, and spiders. They take advantage of the annual outbreaks of cicadas, katydids and crickets, and will hop to the ground to chase frogs and lizards. In summer and fall, cuckoos forage on small wild fruits, including elderberries, blackberries and wild grapes. In winter, fruit and seeds become a larger part of their diet.

Movement / Home Range

Yellow-billed Cuckoos breed throughout much of the eastern and central U.S., winter almost entirely in South America east of the Andes, and migrate through Central America. The western subspecies (C.a. occidentalis) has disappeared over much of the western U.S. and now occurs as a rare breeder in California, Arizona, New Mexico, and west Texas.

Reproductive Strategy

The male and female Yellow-billed Cuckoo build a flat, oblong platform nest together constructed of loose sticks, using twigs collected from the ground or snapped from nearby trees and shrubs. The pair may line the nest sparingly with strips of bark or dried leaves. The male sometimes continues bringing in nest materials after incubation has begun. Pairs may visit prospective nest sites multiple times before building a nest together.

Other

In the West, much of the Yellow-Billed Cuckoos riparian habitat has been converted to farmland and housing, leading to population declines and the possible extirpation of cuckoos from British Columbia, Washington, Oregon, and Nevada. Once common in the California Central Valley, coastal valleys, and riparian habitats east of the Sierra Nevada, habitat loss now constrains the California breeding population to small numbers of birds. As long-distance, nocturnal migrants, Yellow-Billed Cuckoos are also vulnerable to collisions with tall buildings, cell towers, radio antennas, wind turbines, and other structures.Yellow-billed Cuckoo populations declined by 1.6 percent per year between 1966 and 2010. Partners in Flight estimates the global breeding population at about 9 million, with 84 percent breeding in the U.S., 10 percent in Mexico, and none in Canada. For more information on this species, including occurence, conservation strategies and recovery actions in specific states or regions, refer to the following resource:

- Laymon, S. A. 1998. Yellow-billed Cuckoo (Coccycus americanus). In The Riparian Bird Conservation Plan:a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. http://www.prbo.org/calpif/htmldocs/riparian_v-2.html

» Other Resources

NatureServe Explorer Species Reports -- NatureServe Explorer is a source for authoritative conservation information on more than 50,000 plants, animals and ecological communtities of the U.S and Canada. NatureServe Explorer provides in-depth information on rare and endangered species, but includes common plants and animals too. NatureServe Explorer is a product of NatureServe in collaboration with the Natural Heritage Network.

ITIS Reports -- ITIS (the Integrated Taxonomic Information System) is a source for authoritative taxonomic information on plants, animals, fungi, and microbes of North America and the world.

FWS Digital Media Library -- The U.S. Fish and Wildlife Service's National Digital Library is a searchable collection of selected images, historical artifacts, audio clips, publications, and video.

U.S. Fish & Wildlife Service
ECOS

ECOS / Species Profile for Bull Trout (Salvelinus confluentus)

Bull Trout (Salvelinus confluentus)

Current Range | Federal Register | Recovery | Critical Habitat | Conservation Plans | Petitions | Life History

Taxonomy: View taxonomy in ITIS

Listing Status: Threatened and **Experimental Population, Non-Essential**

General Information

Bull trout (Salvelinus confluentus) are members of the family Salmonidae and are char native Washington, Oregon, Idaho, Nevada, Montana and western Canada. Compared to other salmonids, bull trout have more specific habitat requirements that appear to influence their distribution and abundance. They need cold water to survive, so they are seldom found in waters where temperatures exceed 59 to 64 degrees (F). They also require stable stream channels, clean spawning and rearing gravel, complex and diverse cover, and unblocked migratory corridors. Bull trout may be distinguished from brook trout (Salvelinus fontinalis) by several characteristics: spots never appear on the dorsal (back) fin, and the spots that rest on the fish's olive green to bronze back are pale yellow, orange or salmon-colored. The bull trout's tail is not deeply forked as is the case with lake trout (Salvelinus namaycush). Bull trout exhibit two forms: resident and migratory. Resident bull trout spend their entire lives in the same stream/creek. Migratory bull trout move to larger bodies of water to overwinter and then migrate back to smaller waters to reproduce. An anadromous form of bull trout also exists in the Coastal-Puget Sound population, which spawns in rivers and streams but rears young in the ocean. Resident and juvenile bull trout prey on invertebrates and small fish. Adult migratory bull trout primarily eat fish. Resident bull trout range up to 10 inches long and migratory forms may range up to 35 inches and up to 32 pounds. Bull trout are currently listed coterminously as a threatened species.

Population detail

The FWS is currently monitoring the following populations of the Bull Trout

Current Listing Status Summary

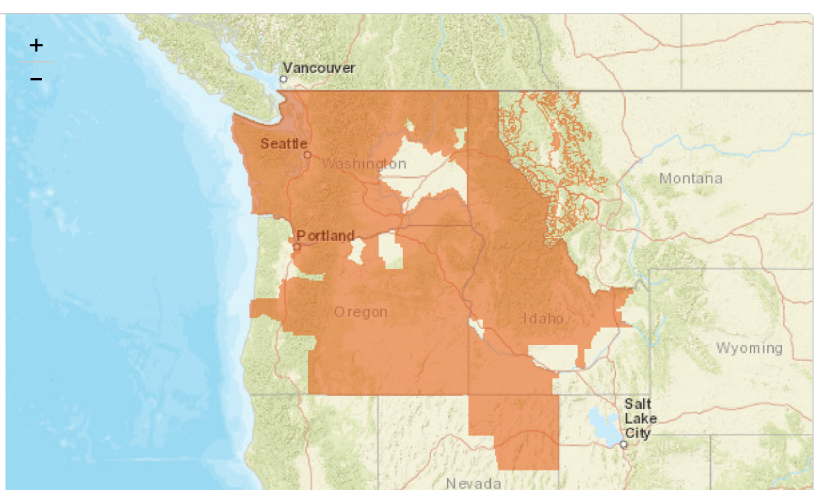
Status	Date Listed	Lead Region	Where Listed
Threatened	06/10/1998	Pacific Region (Region 1)	U.S.A., conterminous, (lower 48 states) Additional species information
Experimental Population, Non-Essential	12/09/2009	Pacific Region (Region 1)	Clackamas River subbasin and the mainstem Willamette River, from Willamette Falls to its points of confluence with the Columbia River, including Multnomah Channel

» Current Range

Population(s)

☑ *U.S.A., conterminous, lower 48 states*

Zoom in! Some species' locations may be small and hard to see from a wide perspective. To narrow-in on locations, check the state and county lists (below) and then use the zoom tool.



- **Population location:** U.S.A., conterminous, (lower 48 states)

  Listing status: Threatened

  - **States/US Territories** in which this population is known to or is believed to occur: Idaho , Montana , Nevada , Oregon , Washington
  - **US Counties** in which this population is known to or is believed to occur: View All
  - **USFWS Refuges** in which this population is known to occur: Benton Lake Wetland Management District , Grays Harbor National Wildlife Refuge , Julia Butler Hansen Refuge for the Columbian White-Tailed Deer , Kootenai National Wildlife Refuge , Lewis and Clark National Wildlife Refuge ... Show All Refuges
  - **Countries** in which the this population is known to occur: United States

- **Population location:** Clackamas River subbasin and the mainstem Willamette River, from Willamette Falls to its points of confluence with the Columbia River, including Multnomah Channel

  Listing status: Experimental Population, Non-Essential

  - **USFWS Refuges** in which this population is known to occur: Northwest Montana Wetland Management District-Flathead County

» Federal Register Documents

Federal Register Documents

Show 10 entries

Date	Citation Page	Title
07/24/2017	82 FR 34326 34329	Notice of Intent To Prepare a Draft Environmental Impact Statement for the Proposed Deschutes River Bas Habitat Conservation Plan in Oregon
09/30/2015	80 FR 58767 58768	Recovery Plan for the Coterminous United States Population of Bull Trout; Notice of Availability
06/04/2015	80 FR 31916 31918	Endangered and Threatened Wildlife and Plants; Revised Draft Recovery Plan for the Coterminous United Population of Bull Trout and Draft Recovery Unit Implementation Plans
09/04/2014	79 FR 52741 52743	ETWP; Revised Draft Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus)
03/06/2012	77 FR 13248 13251	5-Year Status Reviews of 46 Species in Idaho, Oregon, Washington, Nevada, Montana, Hawaii, Guam, and Northern Mariana Islands:Notice of initiation of reviews; request for information.
06/21/2011	76 FR 35979 35995	Establishment of a Nonessential Experimental Population of Bull Trout in the Clackamas River Subbasin, C
10/18/2010	75 FR 63898 64070	Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; Final Rule
01/14/2010	75 FR 2270 2431	Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; announcement of p hearing, and announcement of availability of draft economic analysis.
12/09/2009	74 FR 65045 65056	Establishment of a Nonessential Experimental Population of Bull Trout in the Clackamas River Subbasin, C

Showing 1 to 10 of 56 entries

‹ Previous 1 2 3 4 5 6 Next ›

Special Rule Publications

Show 10 entries

Date	Citation Page	Title
04/08/1999	64 FR 17110 17125	ETWP; Determination of Threatened Status for the Jarbidge River Population Segment of Bull Trout.
06/10/1998	63 FR 31647 31674	ETWP; Determination of Threatened status for the Klamath River and Columbia River Distinct Population S of Bull Trout

Showing 1 to 2 of 2 entries

‹ Previous 1 Next ›

» Recovery

- Recovery Plan Information Search
- Information Search FAQs

Current Recovery Plan(s)

Show 10 entries

Date	Title	Plan Action Status	Plan Status
09/30/2015	Coastal Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final
09/30/2015	Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final
09/30/2015	Klamath Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final
09/30/2015	Mid-Columbia Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final
09/30/2015	St. Mary Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final
09/30/2015	Upper Snake Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final
09/30/2015	Coastal Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final
09/30/2015	Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout (Salvelinus confluentus)	View Implementation Progress	Final

Showing 1 to 10 of 13 entries

‹ Previous 1 2 Next ›

Other Recovery Documents

Show 10 entries

Date	Citation Page	Title	Document Type
09/30/2015	80 FR 58767 58768	Recovery Plan for the Coterminous United States Population of Bull Trout; Notice of Availability	• Notice Final R Plan Availabili
06/04/2015	80 FR 31916 31918	Endangered and Threatened Wildlife and Plants; Revised Draft Recovery Plan for the Coterminous United States Population of Bull Trout and Draft Recovery Unit Implementation Plans	• Notice Draft R Plan Availabili
09/04/2014	79 FR 52741 52743	ETWP; Revised Draft Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus)	• Notice Draft R Plan Availabili
03/06/2012	77 FR 13248 13251	5-Year Status Reviews of 46 Species in Idaho, Oregon, Washington, Nevada, Montana, Hawaii, Guam, and the Northern Mariana Islands:Notice of initiation of reviews; request for information.	• Notice 5-year Initiation
07/01/2004	69 FR 39951 39952	Draft Recovery Plan for the Jarbidge River Distinct Population Segment of Bull Trout (Salvelinus confluentus)	• Notice Recove Avail.
07/01/2004	69 FR 39950 39951	Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (Salvelinus confluentus), Volumes 1 and 2	• Notice Recove Avail.
04/13/2004	69 FR 19449 19450	5-Year Review of the Bull Trout	• Notice 5-year

Showing 1 to 8 of 8 entries

‹ Previous 1 Next ›

Five Year Review

Show 10 entries

Date	Title
11/13/2015	2015 Bull Trout 5-year Review
04/25/2008	Bull Trout Completed 5-yr Review

Showing 1 to 2 of 2 entries

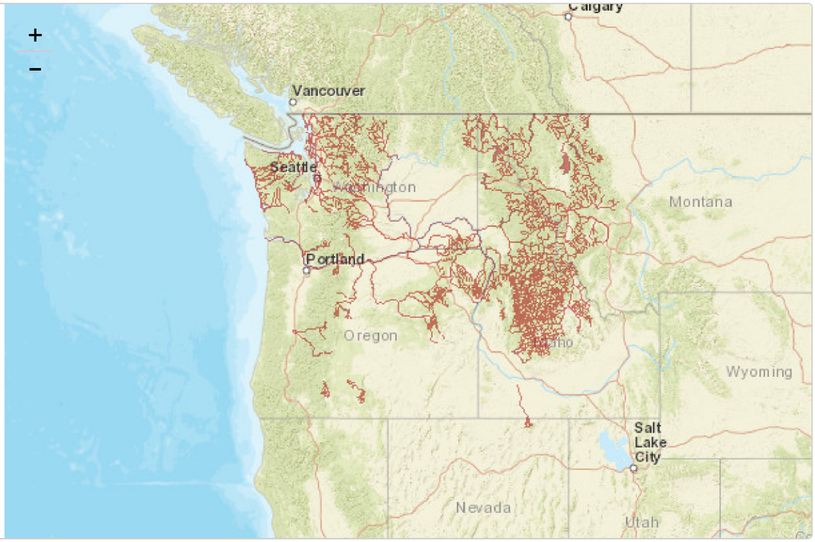
‹ Previous 1 Next ›

» Critical Habitat

Critical Habitat Spatial Extents

Population(s)

U.S.A., conterminous, lower 48 states



Show 10 entries

Date	Citation Page	Title	Document Type	Stat
10/18/2010	75 FR 63898 64070	Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; Final Rule	Final Rule	F d
09/26/2005	70 FR 56212 56311	Endangered and Threatened Wildlife Plants; Designation of Critical Habitat for the Bull Trout; Final Rule	Final Rule	N R
10/06/2004	69 FR 59996 60076	Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Klamath River and Columbia River Populations of Bull Trout; Final Rule	Final Rule	N R
11/29/2002	67 FR 71236 71438	Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout	Proposed Rule	N R

Showing 1 to 4 of 4 entries

‹ Previous 1 Next ›

To learn more about critical habitat please see http://ecos.fws.gov/crithab

» Conservation Plans

Habitat Conservation Plans (HCP) (learn more)

Show 10 entries

HCP Plan Summaries
West Fork Timber HCP, Amendment (Addition of Bull Trout and Lynx)
WDNR Forest Practices HCP
WDNR Forest Lands HCP, Amendment (Bull Trout Addition)

Washington Department of Natural Resources (WDNR) Low-effect HCP for Commercial Geoduck Fishery
Storedahl's Daybreak Mine Expansion and Habitat Enhancement Project HCP
Stimson Lumber Company
Stimson Lumber Company
Simpson Timber NW Operations (Green Diamond Resource Company)
Plum Creek Timber I-90 HCP, Amendment (Bull Trout Addition)
Plum Creek Timber I-90 HCP Amendment (addition of Canada lynx and Puget Sound/Coastal DPS of bull trout)

Showing 1 to 10 of 16 entries

‹ Previous 1 2 Next ›

Candidate Conservation Agreements (CCA): (learn more)

Show 10 entries

CCA Plan Summaries
Conservation Agreement for bull trout in the South Fork of the Flathead River (Montana)

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

» Petitions

Show 10 entries

Showing 1 to 4 of 4 entries

‹ Previous 1 Next ›

» Life History

No Life History information has been entered into this system for this species.

» Other Resources

NatureServe Explorer Species Reports -- NatureServe Explorer is a source for authoritative conservation information on more than 50,000 plants, animals and ecological communtities of the U.S and Canada. NatureServe Explorer provides in-depth information on rare and endangered species, but includes common plants and animals too. NatureServe Explorer is a product of NatureServe in collaboration with the Natural Heritage Network.

ITIS Reports -- ITIS (the Integrated Taxonomic Information System) is a source for authoritative taxonomic information on plants, animals, fungi, and microbes of North America and the world.

FWS Digital Media Library -- The U.S. Fish and Wildlife Service's National Digital Library is a searchable collection of selected images, historical artifacts, audio clips, publications, and video.

U.S. Fish & Wildlife Service

ECOS

ECOS / Species Profile for White Bluffs bladderpod (Physaria douglasii ssp. tuplashensis)

White Bluffs bladderpod (Physaria douglasii ssp. tuplashensis)

Current Range | Federal Register | Recovery | Critical Habitat | Conservation Plans | Petitions | Life History

Taxonomy: View taxonomy in ITIS

Listing Status: Threatened

Where Listed: WHEREVER FOUND

Current Listing Status Summary

Status	Date Listed	Lead Region	Where Listed
Threatened	05/23/2013	Pacific Region (Region 1)	Wherever found

» Current Range

Population(s)

☑ *Wherever found*

Zoom in! Some species' locations may be small and hard to see from a wide perspective. To narrow-in on locations, check the state and county lists (below) and then use the zoom tool.

- **States/US Territories** in which the White Bluffs bladderpod, Wherever found is known to or is believed to occur: Washington
- **US Counties** in which the White Bluffs bladderpod, Wherever found is known to or is believed to occur: View All
- **USFWS Refuges** in which the White Bluffs bladderpod, Wherever found is known to occur: Hanford Reach National Monument/Saddle Mountain National Wildlife Refuge

» Federal Register Documents

Federal Register Documents

Show 10 entries

Date	Citation Page	Title
12/20/2013	78 FR 76995 77005	Threatened Status for Eriogonum codium (Umtanum Desert Buckwheat) and Physaria douglasii subsp. tup (White Bluffs Bladderpod) and Designation of Critical Habitat
11/22/2013	78 FR 70001	Threatened Status and Designation of Critical Habitat for Eriogonum codium (Umtanum Desert Buckwheat Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod); Delay of Effective Dates
06/28/2013	78 FR 38895 38897	Threatened Status and Designation of Critical Habitat for Eriogonum codium (Umtanum Desert Buckwheat Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod)

05/23/2013	78 FR 30839 30841	Threatened Status and Designation of Critical Habitat for Eriogonum codium (Umtanum Desert Buckwheat Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod); Reopen of Comment Period
05/23/2013	78 FR 30772	Threatened Status and Designation of Critical Habitat for Eriogonum codium (Umtanum Desert Buckwheat Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod); Delay of effective dates
04/23/2013	78 FR 24007 24032	Designation of Critical Habitat for Eriogonum codium (Umtanum Desert Buckwheat) and Physaria douglasii tuplashensis (White Bluffs Bladderpod); Final Rule
04/23/2013	78 FR 23983 24005	Threatened Status for Eriogonum codium (Umtanum Desert Buckwheat) and Physaria douglasii subsp. tup (White Bluffs Bladderpod); Final Rule
05/15/2012	77 FR 28704 28740	Threatened Status for Eriogonum codium (Umtanum Desert Buckwheat)and Physaria douglasii subsp. tupl (White Bluffs Bladderpod)and Designation of Critical Habitat

Showing 1 to 10 of 19 entries

‹ Previous 1 2 Next ›

» Recovery

- Recovery Plan Information Search
- Information Search FAQs

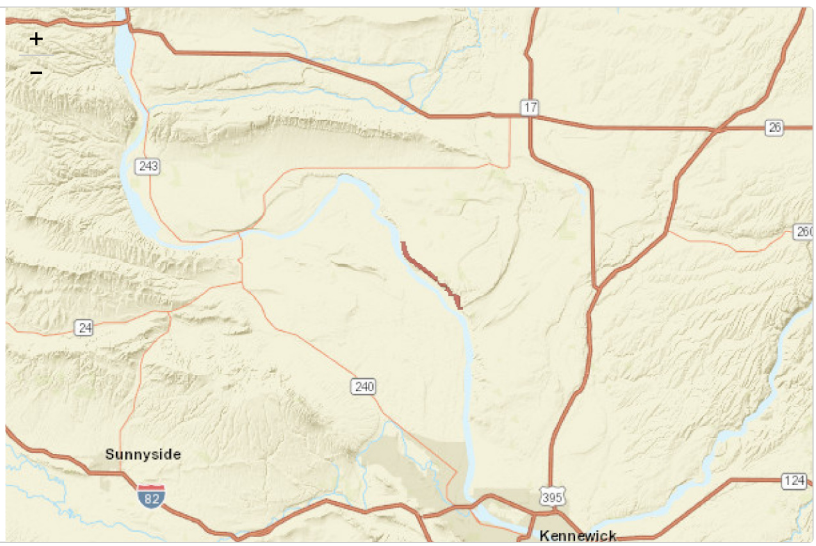
No recovery information is available for the White Bluffs bladderpod.

» Critical Habitat

Critical Habitat Spatial Extents

Population(s)

Wherever found



Show 10 entries

Date	Citation Page	Title	Document Type	Stat
12/20/2013	78 FR 76995 77005	Threatened Status for Eriogonum codium (Umtanum Desert Buckwheat) and Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod) and Designation of Critical Habitat	Final Rule	F d
04/23/2013	78 FR 24007 24032	Designation of Critical Habitat for Eriogonum codium (Umtanum Desert Buckwheat) and Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod); Final Rule	Final Rule	N R
05/15/2012	77 FR 28704 28740	Threatened Status for Eriogonum codium (Umtanum Desert Buckwheat)and Physaria douglasii subsp. tuplashensis (White Bluffs Bladderpod)and Designation of Critical Habitat	Proposed Rule	N R

Showing 1 to 3 of 3 entries

‹ Previous 1 Next ›

To learn more about critical habitat please see http://ecos.fws.gov/crithab

» Conservation Plans

No conservation plans have been created for White Bluffs bladderpod.

» Petitions

Show 10 entries

Showing 1 to 1 of 1 entries

Previous 1 Next

» Life History

No Life History information has been entered into this system for this species.

» Other Resources

NatureServe Explorer Species Reports -- NatureServe Explorer is a source for authoritative conservation information on more than 50,000 plants, animals and ecological communtities of the U.S and Canada. NatureServe Explorer provides in-depth information on rare and endangered species, but includes common plants and animals too. NatureServe Explorer is a product of NatureServe in collaboration with the Natural Heritage Network.

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U.S. Fish & Wildlife Service

ECOS

ECOS / Species Profile for Gray wolf (Canis lupus)

Gray wolf (Canis lupus)

Current Range | Federal Register | Recovery | Critical Habitat | Conservation Plans | Petitions | Life History

Taxonomy: View taxonomy in ITIS

Listing Status: Endangered (and others listed below)

General Information

The Gray Wolf, being a keystone predator, is an integral component of the ecosystems to which it typically belongs. The wide range of habitats in which wolves can thrive reflects their adaptability as a species, and includes temperate forests, mountains, tundra, taiga, and grasslands. Gray wolves were originally listed as subspecies or as regional populations of subspecies in the contiguous United States and Mexico. In 1978, we reclassifed the gray wolf as an endangered population at the species level (C. lupus) throughout the contiguous United States and Mexico, except for the Minnesota gray wolf population, which was classified as threatened. Gray wolf populations in Idaho and Montana were delisted due to recovery in 2011.

Population detail

The FWS is currently monitoring the following populations of the Gray wolf

Current Listing Status Summary

Status	Date Listed	Lead Region	Where Listed
Endangered	03/09/1978	Mountain-Prairie Region (Region 6)	U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA as follows: (1) Northern AZ (that portion north of the centerline of Interstate Highway 40); (2) Northern NM (that portion north of the centerline of Interstate Highway 40); (3) Western OR (that portion of OR west of the centerline of Highway 395 and Highway 78 north of Burns Junction and that portion of OR west of the centerline of Highway 95 south of Burns Junction); (4) Most of Utah (that portion of UT south and west of the centerline of Highway 84 and that portion of UT south of Highway 80 from Echo to the UT/WY Stateline); and (5) Western WA (that portion of WA west of the centerline of Highway 97 and Highway 17 north of Mesa and that portion of WA west of the centerline of Highway 395 south of Mesa). Mexico. Additional species information
Threatened	03/09/1978	Great Lakes-Big Rivers Region (Region 3)	U.S.A. (MN) Additional species information
Delisted due to Recovery	03/09/1978	Mountain-Prairie Region (Region 6)	Northern Rocky Mountain Distinct Population Segment: Montana, Idaho, Wyoming, eastern Washington, eastern Oregon, and north central Utah Additional species information

» Current Range

Population(s)

U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA. Mexico.

MN

Northern Rocky Mountain DPS

Zoom in! Some species' locations may be small and hard to see from a wide perspective. To narrow-in on locations, check the state and county lists (below) and then use the zoom tool.

- **Population location:** U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA as follows: (1) Northern AZ (that portion north of the centerline of Interstate Highway 40); (2) Northern NM (that portion north of the centerline of Interstate Highway 40); (3) Western OR (that portion of OR west of the centerline of Highway 395 and Highway 78 north of Burns Junction and that portion of OR west of the centerline of Highway 95 south of Burns Junction); (4) Most of Utah (that portion of UT south and west of the centerline of Highway 84 and that portion of UT south of Highway 80 from Echo to the UT/WY Stateline); and (5) Western WA (that portion of WA west of the centerline of Highway 97 and Highway 17 north of Mesa and that portion of WA west of the centerline of Highway 395 south of Mesa). Mexico.

  Listing status: Endangered

  This population has been proposed for delisting
  - **States/US Territories** in which this population is known to or is believed to occur: California , Michigan , Oregon , Washington , Wisconsin
  - **US Counties** in which this population is known to or is believed to occur: View All
  - **USFWS Refuges** in which this population is known to occur: Crane Meadows National Wildlife Refuge , J. Clark Salyer National Wildlife Refuge , J. Clark Salyer Wetland Management District , Seney National Wildlife Refuge
  - **Countries** in which the this population is known to occur: United States

- **Population location:** U.S.A. (MN)

  Listing status: Threatened
  - **States/US Territories** in which this population is known to or is believed to occur: Minnesota
  - **US Counties** in which this population is known to or is believed to occur: View All
  - **USFWS Refuges** in which this population is known to occur: Agassiz National Wildlife Refuge , Detroit Lakes Wetland Management District , Fergus Falls Wetland Management District , Hamden Slough National Wildlife Refuge , Litchfield Wetland Management District ... Show All Refuges

- **Population location:** Northern Rocky Mountain Distinct Population Segment: Montana, Idaho, Wyoming, eastern Washington, eastern Oregon, and north central Utah

  Listing status: Delisted due to Recovery
  - **States/US Territories** in which this population is known to or is believed to occur: Idaho , Montana , Oregon , Utah , Washington , Wyoming
  - **US Counties** in which this population is known to or is believed to occur: View All
  - **USFWS Refuges** in which this population is known to occur: Lost Trail National Wildlife Refuge , National Bison Range , Northwest Montana Wetland Management District-Flathead County

» Federal Register Documents

Federal Register Documents

Show 10 entries

Date	Citation Page	Title
05/02/2017	82 FR 20284 20285	Endangered and Threatened Wildlife and Plants; Reinstatement of Removal of Federal Protections for Gra in Wyoming
07/01/2015	80 FR 37568 37579	90-Day Findings on 31 Petitions
02/20/2015	80 FR 9218 9229	ETWP; Reinstatement of Final Rules for the Gray Wolf in Wyoming and the Western Great Lakes in Compl With Court Orders
01/16/2015	80 FR 2488 2512	ETWP; Endangered Status for the Mexican Wolf; Final Rule
01/16/2015	80 FR 2512 2567	ETWP; Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf; Fina

07/25/2014	79 FR 43358 43373	ETWP; Proposed Revision to the Nonessential Experimental Population of the Mexican Wolf: Proposed rul revisions and notice of availability of a draft environmental impact statement; reopening of public comment and announcement of public hearings.
02/10/2014	79 FR 7627 7629	Endangered and Threatened Wildlife and Plants; Removing the Gray Wolf (Canis lupus) From the List of Endangered and Threatened Wildlife and Maintaining Protections for the Mexican Wolf (Canis lupus baileyi Listing It as Endangered; Proposed rule; notice of availability and reopening of comment period.
10/28/2013	78 FR 64192 64193	Endangered and Threatened Wildlife and Plants; Extending the Public Comment Periods and Reschedulin Hearings Pertaining to the Gray Wolf (Canis lupus) and the Mexican Wolf (Canis lupus baileyi)

Showing 1 to 10 of 74 entries

‹ Previous 1 2 3 4 5 … 8 Next ›

Special Rule Publications

Show 10 entries

Date	Citation Page	Title
01/28/2008	73 FR 4720 4736	Revision of Special Regulation for the Central Idaho and Yellowstone Area Nonessential Experimental Pop of Gray Wolves in the Northern Rocky Mountains
07/06/2007	72 FR 36942 36949	Proposed Revision of Special Regulation for the Central Idaho and Yellowstone Area Nonessential Experim Populations of Gray Wolves in the Northern Rocky Mountains
12/12/1985	50 FR 50792 50793	Regulations Governing Gray Wolf in Minnesota; 50 FR 50792-50793
08/10/1983	48 FR 36256 36266	Regulations Governing Gray Wolf in Minn.; 48 FR 36256-36266
07/05/1978	43 FR 29019 29021	Proposed Regulations for the Eastern Timber Wolf
03/09/1978	43 FR 9607 9615	Reclassification of the Gray Wolf in the U.S. and Mexico with Determination of Critical Habitat in Michigan a Minnisota
06/09/1977	42 FR 29527 29532	Proposed Reclassification of Gray wolf in U.S. and Mexico,Proposed Critical Habitat, Michigan and Minnes FR 29527 29532 (Canis lupus)

Showing 1 to 7 of 7 entries

‹ Previous 1 Next ›

» Recovery

- Recovery Plan Information Search
- Information Search FAQs

Current Recovery Plan(s)

Show 10 entries

Date	Title	Plan Action Status	Plan Status
01/31/1992	Recovery Plan for the Eastern Timber Wolf - Revised	View Implementation Progress	Final Revisi
01/31/1992	Recovery Plan for the Eastern Timber Wolf - Revised	View Implementation Progress	Final Revisi
08/03/1987	Northern Rocky Mountain Wolf Recovery Plan	View Implementation Progress	Final Revisi

Showing 1 to 3 of 3 entries

‹ Previous 1 Next ›

Other Recovery Documents

Show 10 entries

Date	Citation Page	Title	Document Type
05/02/2017	82 FR 20284 20285	Endangered and Threatened Wildlife and Plants; Reinstatement of Removal of Federal Protections for Gray Wolves in Wyoming	• Final Delisting Recovered

02/10/2014	79 FR 7627 7629	Endangered and Threatened Wildlife and Plants; Removing the Gray Wolf (Canis lupus) From the List of Endangered and Threatened Wildlife and Maintaining Protections for the Mexican Wolf (Canis lupus baileyi) by Listing It as Endangered; Proposed rule; notice of availability and reopening of comment period.	• Notice Doc. A • Notice Reope Comment
06/13/2013	78 FR 35663 35719	Removing the Gray Wolf(Canis lupus) From the List of Endangered and Threatened Wildlife and Maintaining Protections for the Mexican Wolf (Canis lupus baileyi) by Listing It as Endangered; Proposed Revision to the Nonessential Experimental Population of the Mexican Wolf; Proposed Rules	• Proposed Del Original Data Not a listable
09/10/2012	77 FR 55530 55604	Endangered and Threatened Wildlife and Plants; Removal of the Gray Wolf in Wyoming From the Federal List of Endangered and Threatened Wildlife and Removal of the Wyoming Wolf Population's Status as an Experimental Population	• Final Delisting Recovered
12/28/2011	76 FR 81666 81726	Endangered and Threatened Wildlife and Plants; Revising the Listing of the Gray Wolf (Canis lupus) in the Western Great Lakes	• Final Delisting Recovered
10/05/2011	76 FR 61782 61823	Endangered and Threatened Wildlife and Plants, Removal of the Gray Wolf in	• Proposed Del

Showing 1 to 10 of 25 entries

‹ Previous 1 2 3 Next ›

Five Year Review

Show 10 entries

Date	Title
02/29/2012	Lower 48 State and Mexico C. lupus listing, as revised. 5 YSR

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

Delisting Documents

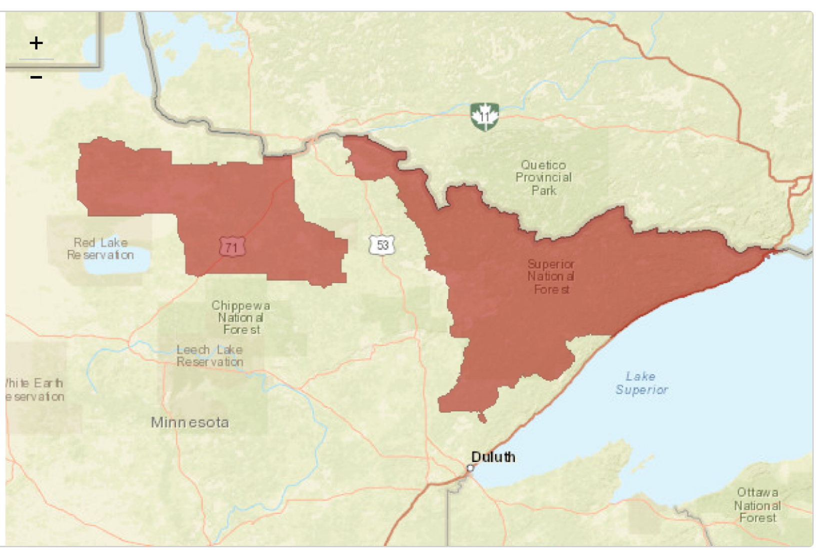
Date	Title
06/04/2007	Draft Post Delisting Monitoring Plan

» Critical Habitat

Critical Habitat Spatial Extents

Population(s)

MN



Show 10 entries

Date	Citation Page	Title	Document Type	Sta

03/09/1978	43 FR 9607 9615	Reclassification of the Gray Wolf in the U.S. and Mexico with Determination of Critical Habitat in Michigan and Minnisota	Final Rule	F d

Showing 1 to 2 of 2 entries

‹ Previous 1 Next ›

To learn more about critical habitat please see http://ecos.fws.gov/crithab

» Conservation Plans

Habitat Conservation Plans (HCP) (learn more)

Show 10 entries

HCP Plan Summaries
West Fork Timber HCP (formerly Murray Pacific)
WDNR Forest Lands HCP
Plum Creek Timber I-90 Land Exchange
Plum Creek Timber Central Cascades HCP (aka I-90 HCP)
City of Tacoma, Tacoma Water HCP
Cedar River Watershed HCP

Showing 1 to 6 of 6 entries

‹ Previous 1 Next ›

Safe Harbor Agreements (SHA): (learn more)

Show 10 entries

SHA Plan Summaries
Paterson, Thomas W. and Caroline H. (Spur Ranch)

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

» Petitions

Show 10 entries

Showing 1 to 10 of 22 entries

‹ Previous 1 2 3 Next ›

» Life History

Habitat Requirements

Wolves are habitat generalists and lived thorughout the northern hemisphere. They only require ungulate prey and human-casued mortality rates that are not excessive.

Food Habits

Ungulates [wild and domestic] are the typical prey of wolves, but wolves also readily scavenge. Beaver are among the smallest important prey but wolves can utilize smaller mamals, birds, and fish.

Movement / Home Range

Wolves packs defend their territories from other wolves. Territory size is a function of prey density and can range from 25-1,500 square miles. Both male and female wolves disperse at equal rates and equal distances, sometimes >600 miles.

Reproductive Strategy

Normally first breed as yearings and once a year in February. One to 10 pups [normally ~5] are born 63 days later. Pups normally stay with pack until > 1 year old.

» Other Resources

NatureServe Explorer Species Reports -- NatureServe Explorer is a source for authoritative conservation information on more than 50,000 plants, animals and ecological communtities of the U.S and Canada. NatureServe Explorer provides in-depth information on rare and endangered species, but includes common plants and animals too. NatureServe Explorer is a product of NatureServe in collaboration with the Natural Heritage Network.

ITIS Reports -- ITIS (the Integrated Taxonomic Information System) is a source for authoritative taxonomic information on plants, animals, fungi, and microbes of North America and the world.

FWS Digital Media Library -- The U.S. Fish and Wildlife Service's National Digital Library is a searchable collection of selected images, historical artifacts, audio clips, publications, and video.

U.S. Fish & Wildlife Service

ECOS

ECOS / Species Profile for Columbia Basin Pygmy Rabbit (Brachylagus idahoensis)

Columbia Basin Pygmy Rabbit (Brachylagus idahoensis)

Current Range | Federal Register | Recovery | Critical Habitat | Conservation Plans | Petitions | Life History

Taxonomy: View taxonomy in ITIS

Listing Status: Endangered

General Information

The Pygmy Rabbit, Brachylagus idahoensis, is smallest species of rabbit in North American, and is one of only two rabbit species in North America to dig its own burrow. The Pygmy Rabbit differs significantly from species within either the Lepus or Sylvilagus genera and is generally considered to be within the monotypic genus Brachylagus.

Current Listing Status Summary

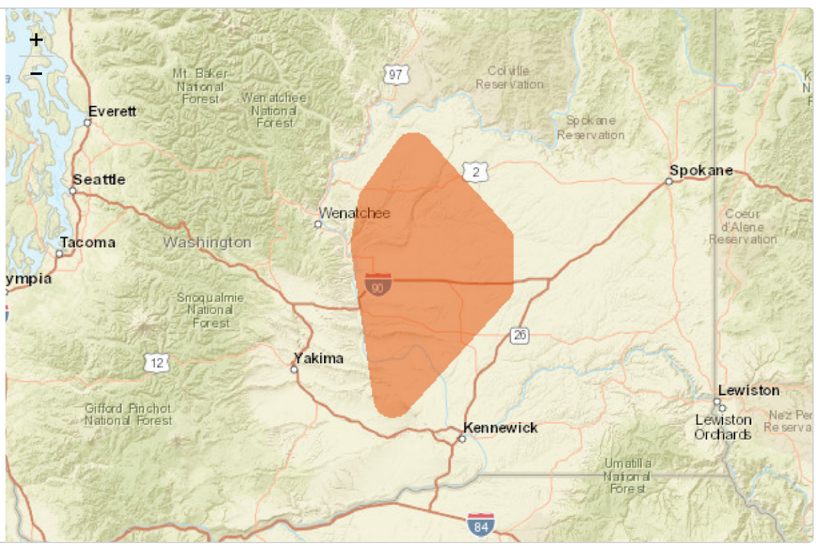
Status	Date Listed	Lead Region	Where Listed
Endangered	11/30/2001	Pacific Region (Region 1)	U.S.A. (WA-Douglas, Grant, Lincoln, Adams, Benton Counties)

» Current Range

Population(s)

Columbia Basin DPS

Zoom in! Some species' locations may be small and hard to see from a wide perspective. To narrow-in on locations, check the state and county lists (below) and then use the zoom tool.



- **States/US Territories** in which the Columbia Basin Pygmy Rabbit, Columbia Basin DPS is known to or is believed to occur: Washington
- **US Counties** in which the Columbia Basin Pygmy Rabbit, Columbia Basin DPS is known to or is believed to occur: View All

» Federal Register Documents

Federal Register Documents

Show 10 entries

Date	Citation Page	Title
01/23/2013	78 FR 4865 4866	NOA: Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (Brachylagu idahoensis)
06/29/2011	76 FR 38203 38204	Amendment to the Draft Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy I Notice of availability; request for comment

09/30/2010	75 FR 60516 60561	12-Month Finding on a Petition to List the Pygmy Rabbit as Endangered or Threatened; Proposed Rule
04/08/2010	75 FR 17947 17950	5-Year Status Reviews of 69 Species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Mariana Islands
10/08/2008	73 FR 58975 58976	Receipt of an Application for an Enhancement of Survival Permit for the Columbia Basin Pygmy Rabbit
01/08/2008	73 FR 1312 1313	90-Day Finding on a Petition To List the Pygmy Rabbit (Brachylagus idahoensis) as Threatened or Endang
09/07/2007	72 FR 51461 51462	Draft Recovery Plan for Columbia Basin Distinct Population Segment of the Pygmy Rabbit (Brachylagus ida
04/25/2007	72 FR 20557 20558	Receipt of Applications for Endangered Species Act Enhancement of Survival Permits Developed in Accor With a Template Safe Harbor Agreement for the Columbia Basin Pygmy Rabbit
09/07/2006	71 FR 52816 52818	Draft Template Safe Harbor Agreement, Draft Environmental Assessment, and Receipt of Applications for Enhancement of Survival Permits

Showing 1 to 10 of 18 entries

‹ Previous 1 2 Next ›

» Recovery

- Recovery Plan Information Search
- Information Search FAQs

Current Recovery Plan(s)

Show 10 entries

Date	Title	Plan Action Status	Plan Statu
01/23/2013	Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (Brachylagus idahoensis)	View Implementation Progress	Fin

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

Other Recovery Documents

Show 10 entries

Date	Citation Page	Title	Document Type
01/23/2013	78 FR 4865 4866	NOA: Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (Brachylagus idahoensis)	• Notice Final R Plan Availabili
06/29/2011	76 FR 38203 38204	Amendment to the Draft Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit; Notice of availability; request for comment	• Notice Draft R Plan Availabili
04/08/2010	75 FR 17947 17950	5-Year Status Reviews of 69 Species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands	• Notice 5-year Initiation
09/07/2007	72 FR 51461 51462	Draft Recovery Plan for Columbia Basin Distinct Population Segment of the Pygmy Rabbit (Brachylagus idahoensis)	• Notice Draft R Plan Availabili

Showing 1 to 4 of 4 entries

‹ Previous 1 Next ›

Five Year Review

Show 10 entries

Date	Title
09/29/2010	Columbia Basin Distinct Population Segment of the Pygmy Rabbit, 5-Year Review Summary and Evaluation

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

» Critical Habitat

No critical habitat rules have been published for the Columbia Basin Pygmy Rabbit.

» Conservation Plans

Habitat Conservation Plans (HCP) (learn more)

Show 10 entries

HCP Plan Summaries
Douglas County Multiple Species General Conservation Plan (Foster Creek Conservation District)

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

Safe Harbor Agreements (SHA): (learn more)

Show 10 entries

SHA Plan Summaries
Columbia Basin Pygmy Rabbit Template SHA

Showing 1 to 1 of 1 entries

‹ Previous 1 Next ›

» Petitions

No petitions have been received for this species.

» Life History

No Life History information has been entered into this system for this species.

» Other Resources

NatureServe Explorer Species Reports -- NatureServe Explorer is a source for authoritative conservation information on more than 50,000 plants, animals and ecological communtities of the U.S and Canada. NatureServe Explorer provides in-depth information on rare and endangered species, but includes common plants and animals too. NatureServe Explorer is a product of NatureServe in collaboration with the Natural Heritage Network.

ITIS Reports -- ITIS (the Integrated Taxonomic Information System) is a source for authoritative taxonomic information on plants, animals, fungi, and microbes of North America and the world.

FWS Digital Media Library -- The U.S. Fish and Wildlife Service's National Digital Library is a searchable collection of selected images, historical artifacts, audio clips, publications, and video.

EFH Data Notice: Essential Fish Habitat (EFH) is defined by textual descriptions contained in the fishery management plans developed by the regional Fishery Management Councils. In most cases mapping data can not fully represent the complexity of the habitats that make up EFH. This report should be used for general interest queries only and should not be interpreted as a definitive evaluation of EFH at this location. A location-specific evaluation of EFH for any official purposes must be performed by a regional expert. Please refer to the following links for the appropriate regional resources.

West Coast Regional Office
Alaska Regional Office

Query Results

Degrees, Minutes, Seconds: Latitude = 46º12'26" N, Longitude = 120º55'53" W
Decimal Degrees: Latitude = 46.21, Longitude = -119.07

The query location intersects with spatial data representing EFH and/or HAPCs for the following species/management units.

EFH

Show	Link	HUC Name	Species/Management Unit	Lifestage(s) Found at Location	Management Council	FMP
		Upper Columbia-Priest Rapids	Chinook Salmon, Coho Salmon	All	Pacific	Pacific Coast Salmon Plan

HAPCs

No Habitat Areas of Particular Concern (HAPC) were identified at the report location.

EFH Areas Protected from Fishing

No EFH Areas Protected from Fishing (EFHA) were identified at the report location.

Spatial data does not currently exist for all the managed species in this area. The following is a list of species or management units for which there is no spatial data. ****For links to all EFH text descriptions see the complete data inventory: open data inventory -->**
Pacific Coastal Pelagic Species, Jack Mackerel, Pacific (Chub) Mackerel, Pacific Sardine, Northern Anchovy - Central Subpopulation, Northern Anchovy - Northern Subpopulation, **Pacific Highly Migratory Species**, Bigeye Thresher Shark - North Pacific, Bluefin Tuna - Pacific, Dolphinfish (Dorado or Mahimahi) - Pacific, Pelagic Thresher Shark - North Pacific, Swordfish - North Pacific, **West Coast Salmon**, All species and stocks

APPENDIX 2-11

N
W
E
S
WWTP Site
LEGEND
URBAN GROWTH BOUNDARY
CITY_LIMITS
RS-20 SUBURBAN
RS-12 SUBURBAN
R-S-1 SUBURBAN
R-S-1/PUD SUBURBAN PLANNED-UNIT DEVELOPMENT
R-1 LOW DENSITY RESIDENTIAL
R-1/PUD LOW DENSITY RESIDENTIAL PLANNED-UNIT DEVELOPMENT
R-1-A LOW DENSITY RESIDENTIAL ALTERNATE
R-1-A2 LOW DENSITY RESIDENTIAL ALTERNATE
R-2 MEDIUM DENSITY RESIDENTIAL
R-3 MEDIUM DENSITY RESIDENTIAL
R-4 HIGH DENSITY RESIDENTIAL
RP RESIDENTIAL PARK
RT RESIDENTIAL TRANSITION
"O" OFFICE
BP BUSINESS PARK
C-1 RETAIL BUSINESS
C-2 CENTRAL BUSINESS
C-3 GENERAL BUSINESS
CR REGIONAL COMMERCIAL
I-1 LIGHT INDUSTRIAL
I-2 MEDIUM INDUSTRIAL
I-3 HEAVY INDUSTRIAL
City of Pasco
Zoning
March 2017
NOTICE: NO WARRANTY OF ACCURACY
The information shown on the attached map was compiled for use by the City of Pasco, its employees and consultants. The City of Pasco does not warrant the accuracy of anything set forth on the map. Any person or entity requesting a copy should conduct an independent inquiry regarding the information shown on the map, including but not limited to, the location of any property lines, zones, streets, subdivisions, or other geographic features. Such features may or may not exist and may or may not exist at the location shown. Neither the City of Pasco nor its employees or officers shall be liable for information shown on this map, nor for any oral representation provided based upon said map.
UPDATED:3/13/2017
BY: J DILGER IS/GIS

murraysmith

APPENDIX 3-1

Appendix 3-1

Existing WWTP Condition Assessment and Capacity Evaluation

3-1.1 Introduction

This technical memorandum summarizes the existing condition of the City of Pasco's Wastewater Treatment Plant (WWTP). Murraysmith performed an on-site evaluation of the major unit processes and systems to identify specific areas for improvements, which are summarized in the sections to follow.

This memorandum includes an existing WWTP Condition Evaluation and Summary of Recommended Improvements.

3-1.2 Existing Wastewater Treatment Plant Condition Evaluation

The following sections detail each unit process and summarizes City staff and/or Murraysmith recommendations for keeping the facility in good working order, optimizing performance, and improving operations and maintenance.

A discussion of the major WWTP components are summarized below and described in detail in the sections that follow.

- **General Site**: Parking Lot, Fencing, Landscaping, Site Lighting, and Stormwater
- **Preliminary Treatment**: Headworks, Influent Screening, and Grit Removal
- **Primary Treatment**: Primary Clarifiers
- **Secondary Treatment**: Trickling Filter, Intermediate Clarifier, Aeration Basins and Secondary Clarifiers
- **Disinfection and Outfall**: Disinfection System and Outfall
- **Miscellaneous Site Utility Systems**: Utility Water System
- **Solids Treatment**: Primary Digester, Secondary Digester, Sludge Pumping, Dewatering, and Sludge Drying Beds

- **Miscellaneous Site Buildings**: Administration/Laboratory, Machine Shop
- **General Electrical**: Service Entrance Equipment, Main Switchgear, and Motor Control Centers
- **General SCADA**: Local Control Panels and control infrastructure

3-1.2.1 Condition Evaluation

A team of Murraysmith engineers visited the WWTP to assess existing conditions on October 16, 2017 (site, structural, and mechanical systems) and March 9, 2018 (electrical and instrumentation systems). The teams walked the plant with City plant staff to discuss and document existing conditions.

Processes were given ratings of 1 to 4 on Condition, Criticality, and Serviceability by City plant staff. **Tables 3-1.1 through 3-1.3** describe the definition given to the various ratings used.

Table 3-1.1
Condition Rating Guide

Score	Description
1	Good to Very Good: well maintained, some degradation but performance and reliability is not significantly affected, expected to remain reliable for more than 10 years
2	Fair to Good: performance and reliability is still acceptable but some rehabilitation or replacement in the next 5-10 years is needed to maintain performance and/or reliability at acceptable levels
3	Poor: performance and/or reliability has significantly decreased, maintenance rehabilitation or replacement needed to restore performance or reliability to acceptable levels. Failure (no longer functions) is likely within 3 to 5 years if not rehabilitated or replaced
4	Very poor: performance and/or reliability has significantly decreased, and failure is probable within 3 years if rehabilitation or replacement is not performed

Table 3-1.2
Criticality Rating Guide

Score	Description
1	Not critical: failure would not significantly affect unit operation
2	Somewhat critical: could marginally upset operations or decrease safety
3	Critical but redundant: unit operation cannot continue without a currently-installed redundant component
4	Critical: unit operation could not operate upon failure

**Pertains to component criticality/impact on system operation*

Table 3-1.3
Serviceability Rating Guide

Score	Description
1	Very good: parts are readily available, and component is easily accessed.
2	Fair: parts are available but can be difficult to get and/or item is somewhat difficult to access
3	Poor: component is no longer supported by the manufacturer and parts must be customized and/or component is difficult to access.
4	Very poor: a safety issue exists.

**Pertains to component criticality/impact on system operation*

3-1.3 Summary of Existing WWTP Condition

The Condition Rating, Criticality Rating and Serviceability Rating of each unit process at the WWTP is summarized in **Table 3-1.4** below. These ratings were determined by WWTP operations staff during onsite investigation.

Table 3-1.4
Screen Condition, Criticality and Serviceability Rating

Area	Unit	Condition	Criticality	Serviceability
General Site	Overall Site	2	1	1
General Site	Asphalt	2	1	1
General Site	Stormwater	2	1	1
General Site	Landscaping	1	1	1
Preliminary Treatment	Headworks Building	1	4	2
Preliminary Treatment	Inlet Channel	2	3	2
Preliminary Treatment	Screen 1	1	3	1
Preliminary Treatment	Screen 2	2	3	1
Preliminary Treatment	Screen 3	1	3	1
Preliminary Treatment	Screenings Washing Compactor 1	2	3	2
Preliminary Treatment	Screenings Washing Compactor 2	2	3	2
Preliminary Treatment	Grit Chamber 1	2	2	2
Preliminary Treatment	Grit Chamber 2	2	2	2

Area	Unit	Condition	Criticality	Serviceability
Preliminary Treatment	Grit Pump 1	2	2	1
Preliminary Treatment	Grit Pump 2	1	2	1
Preliminary Treatment	Grit Classifier 1	1	2	1
Preliminary Treatment	Grit Classifier 1	1	2	1
Primary Treatment	Primary Clarifier 1	2	2	2
Primary Treatment	Primary Clarifier 2	2	2	2
Primary Treatment	Primary Clarifier 3	1	2	1
Primary Treatment	Primary Clarifier 4	1	2	1
Primary Treatment	Primary Sludge Pump 1	1	1	3
Primary Treatment	Primary Sludge Pump 2	1	1	3
Primary Treatment	Primary Sludge Pump OLD 1 (Backup)	2	1	1
Primary Treatment	Primary Sludge Pump OLD 1 (Backup)	2	1	1
Primary Treatment	Ferric Chloride Storage and Pumping	1	3	1
Primary Treatment	Primary Effluent Box	4	4	1
Secondary Treatment	Trickling Filter Pump Station Pump 1	3	2	2
Secondary Treatment	Trickling Filter Pump Station Pump 2	3	2	2
Secondary Treatment	Trickling Filter	3	4	4
Secondary Treatment	Intermediate Clarifier	3	4	4
Secondary Treatment	Intermediate Clarifier Sludge Pump Station Pump 1	2	2	1
Secondary Treatment	Intermediate Clarifier Sludge Pump Station Pump 2	2	2	1
Secondary Treatment	Caustic Treatment	2	3	2
Secondary Treatment	Lime Treatment	3	3	2
Secondary Treatment	Chlorine Room	4	2	3

Area	Unit	Condition	Criticality	Serviceability
Secondary Treatment	Intermediate Clarifier Effluent Box	4	4	1
Secondary Treatment	Aeration Basin Influent Distribution	1	3	1
Secondary Treatment	Aeration Basin Train 1	1	3	2
Secondary Treatment	Aeration Basin Train 2	1	3	2
Secondary Treatment	Diffusers	2	4	3
Secondary Treatment	Blower Building	2	4	2
Secondary Treatment	Blower 1	4	2	2
Secondary Treatment	Blower 2	4	2	2
Secondary Treatment	Blower 3	1	2	1
Secondary Treatment	Blower 4	1	2	1
Secondary Treatment	Aeration Basin Effluent Flow Distribution	2	3	2
Secondary Treatment	Secondary Clarifier 1	2	4	2
Secondary Treatment	Secondary Clarifier 2	2	4	2
Secondary Treatment	RAS/WSA Pump Station Building	1	1	1
Secondary Treatment	RAS Pump 1	1	1	2
Secondary Treatment	RAS Pump 2	1	1	2
Secondary Treatment	RAS Pump 3	1	1	2
Secondary Treatment	WAS Pump 1	2	2	2
Secondary Treatment	WAS Pump 2	2	2	2
Secondary Treatment	WAS Pump 3	2	2	4
Secondary Treatment	DAFT	3	4	4
Disinfection and Outfall	UV Building	2	4	4
Disinfection and Outfall	UV System	1	4	1

Area	Unit	Condition	Criticality	Serviceability
Disinfection and Outfall	Effluent Flow Measurement	1	3	1
Disinfection and Outfall	Outfall	2	4	2
Miscellaneous Site Utility Systems	Plant Recycle Water Pump Station	1	1	1
Miscellaneous Site Utility Systems	Plant Recycle Water Pump Station Recycle Water Pump 1	1	1	1
Miscellaneous Site Utility Systems	Plant Recycle Water Pump Station Recycle Water Pump 2	1	1	1
Solids Treatment	Anaerobic Digester Building	1	1	1
Solids Treatment	Hot Water System – Boiler 1	2	2	1
Solids Treatment	Hot Water System – Boiler 1	2	2	2
Solids Treatment	Primary Digester 1	2	3	3
Solids Treatment	Primary Digester 2	2	3	3
Solids Treatment	Primary Digester Mixer 1	3	4	4
Solids Treatment	Primary Digester Mixer 2	1	4	4
Solids Treatment	Primary Digester Heat Exchanger 1	1	1	1
Solids Treatment	Primary Digester Heat Exchanger 2	1	1	1
Solids Treatment	Primary Digester Heat Exchanger 3	1	1	1
Solids Treatment	Primary Digester Mix Pump 1	1	1	1
Solids Treatment	Primary Digester Mix Pump 2	1	1	1
Solids Treatment	Primary Digester Mix Pump 3	1	1	1
Solids Treatment	Gas Holding Digester	2	4	2
Solids Treatment	Gas Piping/Valves	4	4	4
Solids Treatment	Flare	2	1	4
Solids Treatment	Sludge Holding Digester	2	4	2
Solids Treatment	Primary Digester Sludge Grinder	2	2	1
Solids Treatment	Sludge Transfer Pump 1	1	1	1
Solids Treatment	Sludge Transfer Pump 2	1	1	2
Solids Treatment	Sludge Transfer Pump 3	2	2	2
Solids Treatment	Solids Thickening Building	1	1	1
Solids Treatment	Rotary Drum Thickener	1	4	1
Solids Treatment	Thickened Digested Sludge Pump	1	3	1
Solids Treatment	Drying Beds	2	2	2
Solids Treatment	Solids Drying Building	1	4	1
Miscellaneous Site Buildings	Administration building	1	4	1
Miscellaneous Site Buildings	Laboratory	1	4	1
Miscellaneous Site Buildings	Machine Shop	1	1	1

Area	Unit	Condition	Criticality	Serviceability
Miscellaneous Site Buildings	Equipment Building	1	1	1
General Electrical	Main Distribution Switchgear	1	4	1
General Electrical	MCC-1100 - Sludge Thickening/Biosolids	1	4	1
General Electrical	MCC-140A/B - Operations Building Lower Level	1	4	1
General Electrical	MCC-941A/B - New Digester Control Building	1	4	1
General Electrical	MCC-240 - Trickling Filter Pump Station Room	2	4	2
General Electric	MCC-1 - Old Digester Control Building	1	4	1
General Electric	MCC-640A/B - Blower Building	1	4	1
General Electric	MCC-840A/B - UV/NPWP Building	1	4	1
General SCADA	SCADA Local Control Panels	3	4	3

The following sections include a summary of the WWTP unit processes and comments received regarding their condition from plant staff.

3-1.3.1 General Site

This section describes the condition of appurtenances within the site that are not directly associated with the unit processes required for treatment. The administration building parking lot needs a FOG coat or new asphalt and curb and gutter. The WWTP needs additional site lighting for operations staff safety while working. The fencing around the WWTP needs repair in locations. The catch basin east of anaerobic digester number 1 fills with water and must be pumped out because it is not connected to any under drain systems. The landscaping at the WWTP is well taken care of.

3-1.3.2Preliminary Treatment

WWTP preliminary treatment includes screens and grit removal. The headworks building does not have an accurate influent flow measurement system. The headworks building's Heating, Ventilation and Air Conditioning system (HVAC) needs replacement and the duct work is in poor condition. The manual gates in the inlet channels need to be replaced.

3-1.3.2.1 Screens

The influent screening process within the headworks building consists of three parallel mechanical screens. The backup screen needs to be replaced to match the other two units for increased capacity, reliability and redundancy.

3-1.3.2.2 Grit Removal

The grit removal system includes two vortex grit chambers, grit pumps, and grit auger classifiers. Captured grit is pumped from the grit chamber to a Wemco grit classifier by a Wemco Type C pump. Grit is disposed of into a dumpster and sent to landfill. The disconnects for grit cyclone number 2 need to be replaced. The grit chamber electrical, PLC, and MCCs are old and serviceable but could be replaced.

3-1.3.3 Primary Treatment

The WWTP primary treatment system consists of four rectangular primary clarifiers. Two of the primary clarifiers were installed in 1953 and two are much newer and were installed in 2015.

3-1.3.3.1 Primary Clarifier 1 and 2

The north two primary clarifiers were the first of the two clarifiers constructed. These two clarifiers are beginning to show their age and concrete is starting to show signs of degradation, seam joints may be leaking, and metal parts need to be cleaned and repainted.

3-1.3.3.2 Primary Clarifier 3 and 4

The two southern clarifiers are new and as such are in good condition.

3-1.3.3.3 Primary Sludge Pumps

The primary sludge pumps convey primary sludge from the underdrain of the clarifiers to the anaerobic digesters. The system consists of two newer rotary lobe pumps and two older backup plunger pumps. The new pumps have had several problems due to seal failures. The HVAC in the compressor room where the older backup pumps are installed is not adequate in winter to heat the compressor room. The homestead valves in the older primary sludge pumping area are worn out and need to be replaced.

3-1.3.3.4 Ferric Chloride Storage and Pumping

The ferric chloride system is used to enhance removal in the primary clarifiers. The system is new and as such in good condition.

3-1.3.3.5 Old Primary Effluent Box

From the primary clarifiers, flow passes through an effluent box and then through either the trickling filter pump station or the Intermediate Clarifier Junction (ICE) Box. The effluent box is in poor condition due to concrete degradation.

3-1.3.4 Secondary Treatment

Secondary treatment at the WWTP consists of a tricking filter, intermediate clarifier, two-train aeration basin and two secondary clarifiers. Once primary effluent, trickling filter effluent, and RAS flow reach the aeration basin; it is distributed between two aeration basin trains and then to the secondary clarifiers.

3-1.3.4.1 Trickling Filter Pump Station

The trickling filter pump station consists of two vertical turbine pumps and normal operation of the pump station includes only one pump operating.

3-1.3.4.2 Trickling Filter

The 120-foot diameter rock media trickling filter has operated continuously for as long as the current operation staff has worked at the WWTP. The distribution arms need adjustment and the metal work needs painting.

3-1.3.4.3 Intermediate Clarifier

The intermediate clarifier separates trickling filter sloughed solids by gravity. The clarifier is in poor condition, there is some cracking in walls with seepage in the same area and the center arm bearing needs to be replaced.

3-1.3.4.4 Intermediate Clarifier Sludge Pump Station

The intermediate clarifier sludge pump station pumps sludge from the intermediate clarifier underdrain to solids treatment with piston pumps. The electrical system needs replacement because no parts are available.

3-1.3.4.5 Caustic Treatment

The caustic treatment system is used for pH control of the wastewater. The system is fairly new and as such is in good condition. The caustic tank is filled every 7 days with a 50 percent solution. Operations prefers this system to lime.

3-1.3.4.6 Lime Treatment

The hydrated lime system was used historically for pH control. The system was difficult for operations and is no longer utilized on a regular basis. If the system is to be used more regularly in the future, a new control system, control panel and tank level sensors will be needed. The lime silo is also showing corrosion.

3-1.3.4.7 Chlorine Room

Chemicals and spare parts are all stored in the southern portion of the trickling filter recirculation pump station. The chemical feed hose pump needs to be replaced and a redundant pump with chemical containment provided. Due to the presence of chemicals and the mixed use of the building, a safety audit is recommended.

3-1.3.4.8 Intermediate Clarifier Junction (ICE) Box

From the Old Primary Effluent Box and Trickling Filter/Intermediate Clarifier, flow passes through the Intermediate Clarifier Junction (ICE) Box towards the aeration basins. Within the ICE Box, flow from the primary clarifier is consolidated with the trickling filter effluent. Historically, lime was also added at this point and mixing was accomplished with coarse bubble diffusers. Currently, caustic is added at the ICE box rather than lime. The ICE box is stated as being in poor condition and the air diffuser needs service or replacement.

3-1.3.4.9 Aeration Basin Influent Distribution

The Aeration Basin Influent Distribution splits flow to the two aeration basin trains. The system needs new lights because many do not work.

3-1.3.4.10 Aeration Basin

The aeration basin consists of two trains for aerobic treatment of wastewater. There is also a very small aerobic selector cell at the beginning of both trains. The trains have poor length to width ratio and are slightly shallower than most aeration basins. Operations has had issues with EIM airflow control valves and air supply laterals have been a problem. All membrane diffusers and retainer rings in the aeration basin need replacement. The Return Activated Sludge (RAS) splitter butterfly valves need replacement and the existing grating at RAS recycle grating should be replaced with checker plate.

3-1.3.4.11 Blower Building

The equipment that provides air for the aeration basins is housed in the blower building. Over the past several years, WWTP staff have been replacing the older centrifugal blowers with turbo blowers. The HVAC of the building needs to be evaluated because heat can be an issue in the summer which would overheat and damage equipment (e.g. VFDs). Also, the ABS blower intake is too small and could lead to freezing in the winter. The instrumentation and controls in the building need to be upgraded. The pressure transmitter on the discharge header needs to be replaced. The ACH System located in the building needs spill containment. Blower #1 should be replaced because the motor burned out and unit does not work. The building needs an internal suction plenum.

3-1.3.4.12 Aeration Basin Effluent Flow Distribution

The aeration basin effluent flow distribution collects flow from the end of both aeration basin trains and directs it to the secondary clarifiers. The spray bars are broken and need repair or replacement.

3-1.3.4.12 Secondary Clarifiers

The two secondary clarifiers are 95-foot diameter circular structures with a 14-foot sidewater depth. The system consists of a central drive unit, scum scrapers, a scum box, arm rakes, weirs, and launder. The floor of the clarifiers are rough because they received no floor grout when they were originally installed. There is some cracking of clarifier walls visible in the RAS/WAS pump station. The metal coating of the mechanism needs to be replaced. The gear boxes on the mechanism needs to be rebuilt.

3-1.3.4.13 RAS/WAS Pump Station

The RAS/WAS pump station is located underground between the two secondary clarifiers. There are some significant condition deficiencies in the RAS/WAS pump station. There is leaking through hatches and cracks in roof, exhaust fan EF-704 in stairwell access is not serviceable, and the Reznor air handling unit needs to be replaced. The hatches in the roof are also not placed well for equipment access or removal and leads to difficult access and moving of pumps when equipment needs to be serviced.

3-1.3.4.14 DAFT

The DAFT operates 24-hours per day and has no redundancy. The ancillary equipment and appurtenances also do not have redundancy, but they can be replaced fairly quickly to keep the system operational.

3-1.3.5 Disinfection and Outfall

Secondary effluent leaves the secondary clarifier and flows into the UV building. Once the water has reached the end of the UV contact chamber and achieved disinfection, it leaves the WWTP site to the west. The effluent flows through an outfall pipeline and to a submerged diffuser in the Columbia River. This discharge point lies approximately 900-feet from shore.

3-1.3.5.1 UV Building

The WWTP's disinfection system is in the ultraviolet (UV) building, located immediately south of the western secondary clarifier. The building roof needs new coating but is in good condition overall.

3-1.3.5.2 Disinfection System

The WWTP disinfection system utilizes UV light as its primary disinfecting agent. The system is comprised of 12 modules in total separated evenly is two parallel trains. While the current UV system works well for disinfection, it is maintenance and labor intensive because the automatic cleaning system does not work well and requires manual cleaning once per month.

3-1.3.5.3 Plant Recycle Pump Station

The Plant Recycle Pump Station consists of three pumps housed in the UV building that pull final effluent prior to the effluent flow meter for use within the WWTP. The system is reported to work well.

3-1.3.5.4 Outfall and Effluent Flow Meter

WWTP effluent passes through three outfall manholes before reaching the McNary Pool of the Columbia River. There is a modified weir flow meter in a plastic effluent manhole located just west of the UV building within the treatment plant fence. The second outfall manhole is located in Grays Avenue just west of the UV Building. The third and final outfall manhole is directly south of the manhole in Grays Avenue and was recently rediscovered. A 24-inch outfall pipe carries effluent from the final manhole to the into 24-inch diffuser where It is discharged through three 8-inch ports. The outfall pipeline and diffuser have not been maintained and little data has been recorded on their condition through time.

3-1.3.6 Solids Treatment

The WWTP's solids handling consists of two primary anaerobic digesters, two old repurposed anaerobic digesters which are now used for gas holding and solids holding, solids thickening, and drying beds. After the digested sludge has been adequately dewatered, it is collected, stored in the solids handling building and hauled away for land application.

3-1.3.6.1 Anaerobic Digester Building

The anaerobic digester building needs new roof membrane or coating. There is no filtration on air intake for the building.

3-1.3.6.2 Anaerobic Digesters

Anaerobic digestion occurs using two parallel primary digesters and two old repurposed anaerobic digesters which are now used for gas holding and solids holding. It takes primary sludge from the primary clarifier and thickened WAS and digests them under mesophilic conditions. This process provides significant destruction of the volatile solids and production of gas. Primary mixing is accomplished using two mechanical mixers mounted on the roof.

Mesophilic temperature conditions are maintained in the primary digesters using three sludge circulation pumps in conjunction with three heat exchangers. The circulation pumps route the sludge from the digestion tanks through the heat exchangers. The heat exchangers are spiral-type Alfa Laval model 1H-SW-1. The heat exchangers are fed hot water from the Cleaver Brooks boilers.

3-1.3.6.3 Gas Holding, Gas Piping and Flare

Digester gas is produced from anaerobic digestion of biosolids. It is collected from the upper portion of the digesters and stored in one of the old digesters using a double membrane gas system. The stored gas is then split between the boiler system and the waste flare.

The gas handling equipment includes various piping, valves, flame arresters, and pressure regulators, which facilitate safe operation of the waste flare and the boiler system. All the equipment is in good condition, but several valves are frozen, some in the open position and some closed.

The waste flare burns off excess digester gas and is located northeast of the anaerobic digesters. The flare is showing visible signs of age and corrosion. The ground surface surrounding the flare is recessed and piping and electrical in this area is not up to current code. The panel door on the flare control does not close securely due to a conflict inside the box.

3-1.3.6.4 Solids Holding

The southern old digester is used for solids holding and generally works well for this purpose.

3-1.3.6.5 Rotary Drum thickener

The FKC rotary drum thickener is a robust system for thickening digester biosolids. Operations has noted that the programming of this unit is difficult to use. The system uses polymer which is pumped from totes. There is no redundancy in the polymer pump skid.

3-1.3-6.6 Digested Sludge Pumping

The thickened digested sludge is pumped through a positive displacement piston pump to the drying beds. The system consists of one pump and an additional pump is kept “on the shelf” as a complete redundant pump.

3-1.3.6.7 Drying Beds

The plant has 15 sludge drying beds. These beds cover a significant portion of the WWTP site. Flow between basins is controlled utilizing quarter turn valves that are difficult to operate. In general, the asphalt lining is in good condition, but appears to be thinning in some areas. One of the drying beds is not available for use because of a partially complete screw press building, which should be demolished and made into drying bed again.

3-1.3.6.8 Solids Drying Building

The solids drying building is a large volume steel building that is open on the south side. Dried biosolids are stored here until they are taken offsite to land application. The roof of the building has leaked in the past and the decomposing biosolids have self-ignited due to heat generated through additional anaerobic digestion. The solids drying building needs to have the roof inspected and repaired. The building should also have a fire suppression system installed. The interior of the building needs lights to allow work in low light mornings and afternoons. The building has dust issues during loading of dried biosolids.

3-1.3.7 Miscellaneous Site Buildings

There are several miscellaneous buildings on-site that indirectly support the day-to-day operation of the WWTP. These buildings include administration, laboratory, machine shop and chemical storage. The following section discusses the condition of these buildings.

3-1.3.7.1 Administration Building

The administration building is in the northwest portion of the WWTP. It was constructed as part of the mid-1990’s upgrades. It contains offices, a training room, a locker room, digester room, and the plants laboratory. The HVAC system needs to be upgraded because the outside air supply can pull in exhaust from the hot water heater and digester gas. The interior waterlines have leaked in the past and the plant hot water lines are in unknown condition and the water has not been conditioned for many years. The building has little storage for operations staff. Modifications of the administration building are needed to comply with National Fire Protection Association (NFPA) 820 for physical separation between the old digester room and occupied space of the administration building. Modifications to the HVAC, lighting and other building support systems will may also be needed to accommodate the change in occupied spaces as noted above.

3-1.3.7.2 Laboratory

The administration building holds the laboratory. The lab has counters lining the walls with an island in the middle. This space is where most of the lab work is performed and contains most of the testing equipment required for day-to-day operation.

The lab is in good general condition and kept very orderly and clean. The lab is functional, but it is small and additional laboratory staff would be beneficial for completing the number of tests that are required at the WWTP. A new fume hood is needed because it negatively interacts with the HVAC and can pull in digester gas to the lab/lab office. The lab balance needs to be replaced. The furnace is not able to heat the lab space during cold spells and the furnace needs to be replaced and upsized.

3-1.3.7.3 Machine Shop

The machine shop is east of the biosolids dying building. The structure is a steel building. The building is in good condition.

3-1.3.8 General Electrical

The facility is served by a 12.47-kilovolt, 3-phase, 3-wire electrical power distribution system from two separate Franklin PUD substations. The main switchgear was upgraded in 1997 and is located between the intermediate clarifier and the blower building, east of the public works building. The facility power distribution system consists of two separate utility feeds, two 750KVA utility transformers that step down the voltage from 12.47-kilovolt to 480-volt, 3-phase, 4 wire power distribution, metering, main distribution switchgear with a main-tie-main breaker configuration, motor control centers (MCC), 480-volt power panels, lighting transformers and 120/208-volt lighting panels.

The majority of the MCCs were installed between 1995 and 1997. Exceptions include MCC-1100 (solid thickening/biosolids building) installed in 2008, MCC-240 (trickling filter pump station) installed in 1971, and MCC-1 (old digester control/primary pump room) installed in 1971 and retrofitted with new buckets in 2017. **Figure 3-3** shows the Electrical Site Plan with the location of the service entrance equipment and MCCs. Further descriptions and assessments of the facility electrical equipment follow in the sections below.

3-1.3.8.1 Main Distribution Switchgear

The main switchgear is a GE Power Break Switchboard family installed between 1995 and 1997. This main switchboard is a 480/277-volt, 3-phase, 4-wire, 1,600-amp bus, 65-kAIC rated equipment with five vertical sections and a main-tie-main breaker configuration to be able to transfer the loads from one of the 750KVA utility transformers to the other should one of them fail.

The GE power breakers in the main switchgear were last tested by the manufacturer in 2015 and are due for another test by the end of 2018. The switchgear appeared to be in good condition and properly maintained. The usual life time for this type of equipment is about 30 to 35 years when properly maintained and tested. However, during the assessment it was noted that the displays of seven MicroVersaTrip units were not displaying the setting information of the corresponding power breakers unless an external battery pack is connected to trip units to supply external power. This issue does not affect the proper operation of the power breakers but the capability to read the breaker setting values. Also, the equipment lacks arc flash stickers in front of the breakers to make everyone aware of the potential incidental energy stored inside each breaker compartment.

The main switchgear is fed from two 750KVA, 12.4KV-480Y/277 utility transformers which are fed from two separate substations that provide redundant power. The utility transformers are located just west of the main switchgear and feed the switchgear with three sets of 500MCM, three sets of 4/0 neutrals, and three sets of 4/0 ground cables each transformer. The main switchgear distributes the power to eleven MCC's located around the WWTP site. **Figure 3-4** in the Facility Plan shows the Electrical One-Line Diagram which includes the service entrance equipment and MCCs fed from it.

Recommendations include:

- Test the main switchgear and its components per manufacturer's recommendations.
- Replace the main A power breaker with a new breaker with a Kirk Key lock to help ensure that there will not be current back feeding through the tie breaker in case of a power outage on one of the utility transformers occurs.
- Perform a complete arc flash study for the electrical infrastructure to comply with OSHA standard 1910.269 made mandatory and put into effect on July 10, 2014.

3-1.3.8.2 MCC-1100 - Sludge Thickening/Biosolids Building Electrical Room

MCC-1100 is an Allen Bradley Centerline 2100 model, 600-Amp bus rated MCC with two vertical sections installed in 2008 and located inside the sludge thickening electrical room. This MCC is fed through a 200-Amp Automatic Transfer Switch (ATS), also installed in 2008, that provides redundant power to the MCC from the plant main switchgear. The MCC line-up seemed to be in good condition and should not be due for a replacement at least for another 15 to 20 years.

During the site visit, it was observed that the electrical room is kept clean and in good condition. However, important modifications need to be made to fully comply with NEC standards, OSHA regulations, and good practices for electrical rooms. The room lacks an exit sign with emergency lights on top of the exit door, panic hardware on the exit door, and fire detection equipment. Also, the MCC line-up is not grounded and a storage rack is in front of the 208Y/120-volt panel L-1100, thus encroaching on the recommended minimum clear distance of 3-ft in front of the panel.

Recommendations include:

- Properly ground the MCC line-up.
- Install panic door assembly on exit door.
- Install exit sign and emergency lights to illuminate path of egress.
- Relocate the storage rack from in front of panel L-1100.
- Install fire detection equipment inside the room.
- Perform a complete arc flash study for the electrical infrastructure to comply with OSHA standard 1910.269 made mandatory and put into effect on July 10, 2014.

3-1.3.8.3 MCC-140A/B - Operations Building Lower Floor

MCC-140A and MCC-140B are General Electric 8000 model, 600-Amp bus rated MCCs with five and four vertical sections respectively. These MCCs were installed in 1997 and seem to be in good condition. A replacement should not be due at least for another 10 years. During the site visit it was observed that this electrical room was warmer than the other MCC rooms even though the outside temperature was about 50 degrees Fahrenheit. This MCC was the busiest electrical room in the plant and has very limited space.

The main issue with these MCCs are the main 300-Amp circuit breaker sections in both were presumably ordered as top fed units, when they are actually bottom fed. Instead of ordering appropriately configured units, this situation apparently prompted the electrical contractor to install additional lugs in the main breaker sections to make up the feeder connections. These extra lug connections and cable terminations are almost touching the section doors making unsafe for the workers. It appears as if a section of a neoprene rain jacket was installed in between the lugs and the cabinet door to keep them from touching.

Although the electrical room has two exit doors, they open in the direction of ingress instead of egress, and lack required exit signs and panic hardware. Furthermore, a light fixture is in front of MCC-140B which encroaches on the recommended minimum work space distance of 4-ft in front of the MCC.

Recommendations include:

- Improve cooling of the electrical room.
- Reconfigure MCC main feeder connections to eliminate the exposure of live parts with the front doors.
- Install exposed CAT-5 network cables in a conduit. Exposed network cables come to and from local control panel LCP-400.
- Relocate light fixture from in front of MCC-140B to provide required clear space.
- Install panic door assemblies and exit signs on exit doors to allow worker egress from the electrical room in the event of an emergency.
- Reconfigure exit doors so that they open in the direction of egress from the area.
- Perform a complete arc flash study for the electrical infrastructure to comply with OSHA standard 1910.269 made mandatory and put into effect on July 10, 2014.

3-1.3.8.4 MCC-941A/B - New Digester Control Building Electrical Room

MCC-941A and MCC-941B are General Electric 8000 model, 600-Amp bus rated MCCs located side by side with three vertical sections in each line-up. These MCCs were installed in 1995 and seem to be in good condition. A replacement should not be due at least for another 10 years.

During the site visit, it was observed that the electrical room is kept clean and in good condition. However, important modifications need to be made to fully comply with NEC standards, OSHA regulations, and good practices for electrical rooms. The room lacks an exit sign and panic hardware for the exit door. Also, the emergency lights are in front of MCC-941A which encroach on the recommended minimum work space distance of 4-ft in front of the MCC.

Recommendations include:

- Relocate emergency lights from in front of MCC-941A to provide required clear space.
- Install a panic door assembly and exit sign on the exit door to allow worker egress from the electrical room in the event of an emergency.
- Perform a complete arc flash study for the electrical infrastructure to comply with OSHA standard 1910.269 made mandatory and put into effect on July 10, 2014.

3-1.3.8.5 MCC-240 - Trickling Filter Pump Station Room

MCC-240, also known as MCC-2, is a General Electric 7700 model, 600-Amp rated MCC with three vertical sections installed in 1971 and located inside the trickling filter pump station room. This is one of the two oldest MCCs in the WWTP (along with MCC-1) and should be considered for replacement. The 7700 line of MCCs is one of the first MCC models manufactured by General Electric. Since then, General Electric has released three MCC models such as 8000 line, Spectra Series, and Evolution E9000 line. Both model 8000 and Spectra series buckets are back compatible with 7700 line buckets.

The electrical room has two exit doors that open in the direction of ingress instead of egress. Also, the doors lack exit signs and panic hardware. An arc flash analysis was performed on this MCC and the results are forthcoming.

Recommendations include:

- Consider replacing the whole 7700 MCC line-up with a newer GE MCC model or retrofit the unit with 8000 line buckets for safety, reliability, and standardization throughout the WWTP.
- Install panic door assembly on exit doors.
- Install exit signs and emergency lights to illuminate path of egress.

- Reconfigure exit doors so that they open in the direction of egress from the area.

3-1.3.8.6 MCC-1 - Old Digester Control Building/Primary Pump Room

MCC-1 is a General Electric 7700 model, 600-Amp rated MCC with four vertical sections installed in 1971 and located inside the old digester control building or primary pump room. This MCC is fed from MCC-941B and is one of the oldest MCCs in the plant along with MCC-240. The buckets were retrofitted in 2017 with GE 8000 line buckets. During the visit, it was observed that the exit door was lacking required panic hardware and that fire detection equipment was not installed.

Recommendations include:

- Install panic door assembly on exit door.
- Install fire detection equipment inside the room.
- Perform a complete arc flash study for the electrical infrastructure to comply with OSHA standard 1910.269 made mandatory and put into effect on July 10, 2014.

3-1.3.8.7 MCC-640A/B - Blower Building Electrical Room

MCC-640A and MCC-640B are General Electric 8000 model, 600-Amp bus rated MCCs with five and four vertical sections respectively. These MCCs were installed between 1995 and 1997 and seem to be in good condition. Therefore, a replacement should not be due at least for another 10 years.

During the site visit it was observed that the double-door exit did not have a panic door assembly. Also, it appears that after replacing the across the line starters for aeration blower BL-603 and BL-604 (both in MCC-640B) VFDs, the Motor Circuit Protection (MCP) in the motor starter combination bucket did not get replaced with a Circuit Breaker (CB) to provide proper protection for the VFDs and the wires feeding them. Per NEC, MCPs shall only be used in motor starter combinations and shall not be used for any other purpose. MCPs only provide thermal protection whereas CBs provide thermal and magnetic protection. Therefore, when a VFD is installed in place of a motor starter, the bucket should be replaced with a bucket that comes with a CB. It was also verified that the blower VFD vendor package came with a non-fused disconnect switch.

Recommendations include:

- Replace MCP with CB to protect the blower VFDs and feeders.
- Install panic door assembly on exit door.
- Perform a complete arc flash study for the electrical infrastructure to comply with OSHA standard 1910.269 made mandatory and put into effect on July 10, 2014.

3-1.3.8.7 MCC-840A/B - UV Treatment Building Electrical Room

MCC-840A and MCC-840B are General Electric 8000 model, 600-Amp bus rated MCCs with seven and five vertical sections respectively. These MCCs were installed between in 1997 and seem to be in good condition. Therefore, a replacement should not be due at least for another 10 years.

During the site visit it was observed that the exit door did not have a panic door assembly. Also, it appears that after replacing the across the line starters for the DAF sludge pump P-709 in MCC-840B and the NPW pump 1 P-801 in MCC-840A, the MCP in the motor starter combination bucket did not get replaced with a CB to provide proper protection for the VFDs and the wires feeding them. Per NEC, MCPs shall only be used in motor starter combinations and shall not be used for any other purpose. MCPs only provide thermal protection whereas CBs provide thermal and magnetic protection. Therefore, when a VFD is installed in place of a motor starter, the bucket should be replaced with a bucket that comes with a CB.

Furthermore, for P-709, it was observed that the control wires from the PLC local control panel LCP-800 are still wired to the motor starter instead of being wired directly to the VFD. Also, the 112.5KVA 480-208/120-volt transformer in front of MCC-840A does not comply with the minimum clear distance of 4-ft required by the NEC. Consider replacing the transformer as the UV loads originally being fed from this transformer are now being fed from another transformer. This transformer can be replaced with a unit that is smaller in capacity and footprint that will comply with the minimum clear distance of 4-ft in front of the MCC. Also, an arc flash analysis was performed on this MCC and the results are forthcoming.

Recommendations include:

- Install panic door assembly on exit door.
- Replace MCP with CB to protect P-709 and P-801 VFDs and feeders.
- Consider running control wires and conduit from LCP-800 to P-709 VFD and removing the motor starter in location D10 in MCC-840B to create a spare bucket.
- Relocate the 112.5KVA transformer in front of MCC-840A or consider decreasing the capacity and size of the transformer.

3-1.3.9 SCADA System

The WWTP SCADA system consists of a Main Control Panel (MCP-1000), eight Local Control Panels (LCPs), and two stand-alone vendor control panels located in different areas of the plant. The panel identification, communication, and location in the plant are shown on **Figure 3-5** in the Facility Plan and listed below:

- MCP-1000 located in the admin/operations building
- LCP-400 located in the admin/operations building lower level

- LCP-942 located in the new digester control building electrical room
- LCP-410 located in the tricking filter pump station room
- LCP-600 located in the blower building electrical room
- LCP-800 located in the UV/NPWP electrical room
- LCP-941 located in the old digester control building/primary pump room
- LCP-121 located in the headworks building
- LCP-1100 located in the solid thickening/biosolids building electrical room
- Dystor LCP located on the secondary digester roof (vendor)
- Ozonia UV LCP located in the UV treatment building (vendor)

During the onsite evaluation of the existing SCADA system, consistent equipment was found inside the Local Control Panels including Programmable Logic Controllers (PLCs), Operator Interface Modules (OIM), small digital readouts, and typical components including circuit breakers, wiring, fuses, terminals, indicator lights, selector switches, etc. Except for the stand-alone Dystor LCP, the rest of the LCPs in the WWTP and their corresponding equipment are nearing obsolesce. Because of this, keeping the existing SCADA system operable will become increasingly difficult. LCPs with their corresponding PLC manufacturer are as follows:

- LCPs-400, 941, and 800 have a Siemens Simatic 505 PLC processor, first released in 1994.

- MCP-1000, LCPs-410, and 600 have a Control Technology Inc. (CTI) 2500 series PLC processor, first released in 2008.

- LCPs-942 and 1100 have a Koyo “brick” Direct Logic 06 PLC processor, first released in 2002.

- LCP-121 has an Allen Bradley MicroLogix 1400 series PLC processor, first released in 2008.

- Vendor stand-alone Ozonia UV LCP has an Allen Bradley SLC-500 series PLC processor, that is discontinued.

- Vendor stand-alone Dystor LCP has an Allen Bradley Compact Logix L30 PLC processor.

The above-mentioned PLC processors, except for the Dystor LCP, appear to be operating adequately and in fair condition, however, they are considered legacy equipment by their manufacturers. This means there is limited manufacturer support, and while replacement parts may be available currently, the products are scheduled for discontinuation in the near future.

The communication between MCP-1000, different LCPs, and stand-alone vendor control panels is achieved by using Profibus, Ethernet and radio communications. The Profibus serial network consists of two main trunks that include LCPs-400 and 410 in one trunk; and LCPs-941, 600, and 800 in the second trunk. The total length for trunk one from MCP-1000 to LCP-410 is about 505-ft, and total length for trunk two from MCP-1000 to LCP-800 is about 1,470-ft. LCPs-942, 121, 1100, and the Dystor LCP use Ethernet to communicate with MCP-1000; whereas the Ozonia UV LCP and two aeration blowers communicate over radio transmission. Profibus uses serial communication interface which is outdated and slow. Upgrading to Ethernet protocol for data transmission should be considered.

Though it is difficult to predict when the PLC processor modules and parts will stop working, the costs associated with operating and maintaining this equipment is expected to increase until support is no longer available. The state of the current SCADA system makes the WWTP's automation, reporting, and alarms vulnerable should a component fail. Replacement parts may not be available for timely repair.

The City has expressed the desire to replace the above-mentioned PLCs with new Allen Bradley (AB) Control Logix PLCs. AB PLCs are provided by Rockwell Automation (RA) which is the leading automation supplier in the United States. Their equipment and software are currently used by many municipal and Industrial customers. RA's support and service structure are extensive and cover the Pasco area well, and nearly all Systems Integrators and Automation Contractors are familiar with RA products.

Recommendations include:

- Replace all LCPs with legacy PLCs and parts with new Allen Bradley PLCs and parts.
- Replace PLC Profibus serial communication with Ethernet over fiber-optic for faster data transmission.

3-1.4 Summary of WWTP Condition Related Improvements

The preliminary list of recommended improvements is included below for reference and includes upgrades identified in the condition assessment to maintain facility performance and simplify operations. The recommended improvements are listed from highest priority to lowest priority based on the ratings present in Table 3-1.4.

Section 8 of this Facility Plan includes a phased implementation plan that incorporates capacity and condition related improvements to the WWTP. Those age and condition related improvements that are not addressed as part of larger scale capacity improvements at the WWTP are included as separate projects during the planning horizon.

Table 3-1.5
Screen Condition, Criticality and Serviceability Rating

Area	Unit	Rank	Projects
Solids Treatment	Gas Piping/Valves	1	Replace frozen valves in gas handling room.
Secondary Treatment	Trickling Filter	2	Adjust trickling filter distribution arm. Paint trickling filter distribution arm metal components.
Secondary Treatment	Intermediate Clarifier	2	Rehabilitate intermediate clarifier concrete. Replace intermediate clarifier center arm bearing.
Secondary Treatment	DAFT	2	An important unit process that relies on old equipment without a redundant unit. Must have "on the shelf" redundant system components (air compressor, etc.) available to make repairs quickly.
Solids Treatment	Primary Digester Mixer 1	2	Rebuild or replace anaerobic digester mixer.
Disinfection and Outfall	UV Building	3	Replace UV Building roof membrane.
General SCADA	SCADA Local Control Panels	3	Replace all SCADA System LCPs with legacy PLCs and parts with new Allen Bradley PLCs and parts. Replace SCADA System PLC Profibus serial communication with Ethernet over fiber-optic.
Primary Treatment	Primary Effluent Box	4	Rehabilitate primary effluent box concrete.
Secondary Treatment	Chlorine Room	4	Replace chlorine room hose pumps. Install redundant pumps with containment in chlorine room.
Secondary Treatment	Diffusers	4	Replace membrane air diffusers and retainer rings in the aeration basins.
Secondary Treatment	Lime Treatment	5	Replace lime treatment control system, control panel and tank level sensors. Rehabilitate lime silo components that are corroded.
Secondary Treatment	Blower Building	5	Evaluate Blower Building HVAC and replace if necessary. Replace pressure transmitter on discharge header of aeration system. Provide Blower Building internal suction plenum.
Secondary Treatment	Blower 1	5	Replace Blower 1 motor because it burned out and unit does not work. Replace old centrifugal blowers with ABS turbo blowers.
Secondary Treatment	Blower 2	5	Replace old centrifugal blowers with ABS turbo blowers.

Area	Unit	Rank	Projects
Secondary Treatment	Secondary Clarifier 1	5	Grout floors of secondary clarifiers because they received no floor grout when they were originally installed. Rehabilitate deteriorated secondary clarifier concrete walls. Recoat/repaint secondary clarifier mechanism metal. Rehabilitate/rebuilt secondary clarifier mechanism gear boxes.
Secondary Treatment	Secondary Clarifier 2	5	Grout floors of secondary clarifiers because they received no floor grout when they were originally installed. Rehabilitate deteriorated secondary clarifier concrete walls. Recoat/repaint secondary clarifier mechanism metal. Rehabilitate/rebuilt secondary clarifier mechanism gear boxes.
Disinfection and Outfall	Outfall	5	The outfall pipeline and diffuser have not been maintained and little data has been recorded on their condition through time. Complete CCTV assessment of the pipeline and diffuser.
General Electrical	MCC-240 - Trickling Filter Pump Station Room	5	At MCC-240, line-up with a newer GE MCC model or retrofit the unit with 8000 line buckets.
Preliminary Treatment	Headworks Building	6	Construct reliable method to measure WWTP influent flow. Replace headworks building HVAC.
Preliminary Treatment	Inlet Channel	6	Replace the manual gates in the headworks inlet channels.
Solids Treatment	Flare	6	Replace corroded flare. Reconfigure flare control panel to eliminate conflict inside the box.
Preliminary Treatment	Screen 2	7	Replace headworks screen number 2.
Preliminary Treatment	Grit Chamber 1	7	Replace grit chamber electrical, PLC, and MCCs.
Preliminary Treatment	Grit Chamber 2	7	Replace the disconnects for grit cyclone number 2. Replace grit chamber electrical, PLC, and MCCs.

Area	Unit	Rank	Projects
Primary Treatment	Primary Clarifier 1	7	Rehabilitate concrete in primary clarifier 1 and 2. Paint metal parts in primary clarifier 1 and 2.
Primary Treatment	Primary Clarifier 2	7	Rehabilitate concrete in primary clarifier 1 and 2. Paint metal parts in primary clarifier 1 and 2.
Secondary Treatment	Aeration Basin Train 1	7	Replace lights in the vicinity of the aeration basin. Study and potentially replace EIM airflow control valves which have had issues in the past. Study and determine problems with the aeration laterals which have been problematic in the past. Replace membrane air diffusers and retainer rings in the aeration basins. Replace RAS splitter butterfly valves.
Secondary Treatment	Aeration Basin Train 2	7	Replace lights in the vicinity of the aeration basin. Study and potentially replace EIM airflow control valves which have had issues in the past. Study and determine problems with the aeration laterals which have been problematic in the past. Replace membrane air diffusers and retainer rings in the aeration basins. Replace RAS splitter butterfly valves.
Disinfection and Outfall	UV System	7	Study and investigate why automatic cleaning system on UV modules does not work well.
Solids Treatment	Rotary Drum Thickener	7	Install redundant polymer skid pump for the Rotary Drum Thickener.
Solids Treatment	Drying Beds	7	Study drying bed asphalt liner condition and begin replacement program if necessary. Remove partially constructed screw press from the northwestern-most drying beds.
Solids Treatment	Solids Drying Building	7	Inspect and repair solids drying building roof. Install solids drying building fire suppression system. Install interior area light at the solids drying building. Remove surplus storage from solids drying building.
Miscellaneous Site Buildings	Administration building	7	Study HVAC in the primary sludge pump station compressor room to determine if it is undersized and replace if necessary. Inspect condition of the interior waterlines and replace based on inspection report. Install storage systems in the administration building.

Area	Unit	Rank	Projects
Miscellaneous Site Buildings	Laboratory	7	Expand laboratory space. Provide additional staffing for laboratory. Replace laboratory fume hood. Replace laboratory balance. Replace laboratory heating system.
General Electrical	Main Distribution Switchgear	7	Test the main switchgear and its components per manufacturer's recommendations.
General Electrical	MCC-140A/B - Operations Building Lower Level	7	Improve cooling of the electrical room in the operations building lower floor. Install exposed CAT-5 network cables in a conduit in the operation building lower floor.
General Electrical	MCC-941A/B - New Digester Control Building	7	In the New Digester Control Building Electrical Room, relocate emergency lights from in front of MCC-941A to provide required clear space.
General Electric	MCC-640A/B - Blower Building	7	Replace MCC-640A/B with CB to protect the blower VFDs and feeders.
General Electric	MCC-840A/B - UV/NPWP Building	7	Replace MCC-840A/B with CB to protect P-709 and P-801 VFDs and feeders. Running control wires and conduit from LCP-800 to P-709 VFD and removing the motor starter in location D10 in MCC-840B to create a spare bucket. Relocate the 112.5KVA transformer in front of MCC-840A or consider decreasing the capacity and size of the transformer.
Primary Treatment	Primary Sludge Pump 1	8	Work with manufacturer to determine why the new Primary Sludge Pumps have had a number of problems due to seal failures.
Primary Treatment	Primary Sludge Pump 2	8	Work with manufacturer to determine why the new Primary Sludge Pumps have had a number of problems due to seal failures.
Secondary Treatment	Intermediate Clarifier Sludge Pump Station Pump 1	8	Replace intermediate clarifier sludge pump station electrical system.
Secondary Treatment	Intermediate Clarifier Sludge Pump Station Pump 2	8	Replace intermediate clarifier sludge pump station electrical system.

Area	Unit	Rank	Projects
Secondary Treatment	Aeration Basin Influent Distribution	8	Replace grating at RAS recycle with checker plate.
General Site	Overall Site	9	Construct additional site lighting for operations staff safety while working. Replace as necessary, and repair fencing around the WWTP. Perform chemical storage safety audit and provide spill containment to ACH System.
General Site	Asphalt	9	Fog coat administration building parking lot or install new asphalt and curb and gutter.
General Site	Stormwater	9	Connect the catch basin east of anaerobic digester number 1, which fills with water and much be pumped out, to a seepage bed.
Primary Treatment	Primary Sludge Pump OLD 1 (Backup)	9	Replace homestead valves in the older primary sludge pumping area.
Primary Treatment	Primary Sludge Pump OLD 1 (Backup)	9	Replace homestead valves in the older primary sludge pumping area.
Solids Treatment	Anaerobic Digester Building	10	Anaerobic Digester Building roof membrane needs coating. Provide filtration on air intake for the Anaerobic Digester Building.

The review teams also documented a few potential code compliance and/or safety concerns during their age and condition assessment of the WWTP. A review of code compliance and safety was not the focus of this work, so the items listed should not be considered fully comprehensive or indicative of actual code compliance or safety issues at the WWTP. However, since this information was documented, it is summarized and presented for City review and consideration in **Table 3-1.6** below.

It is suggested that the City review this information and complete a WWTP code compliance and safety review/audit and risk assessment to identify areas of the treatment plant that have the potential for fire loss and/or staff injury.

Table 3-1.6
Potential Code Compliance and Safety Items

Area	Unit	Projects
General Electrical	Multiple Locations	Perform a complete arc flash study to comply with OSHA standard 1910.269 made mandatory and put into effect on July 10, 2014 for all major electrical equipment except for MCCs 240 and 840A and B. Install panic door assemblies, exist lights, exit signs on all electrical room exit doors to allow worker egress from all electrical rooms in the event of an emergency. Install fire detection equipment in all electrical rooms.
Secondary Treatment	Chlorine Room	Complete safety audit of chlorine room.
General Electrical	MCC-240 - Trickling Filter Pump Station Room	Trickling Filter Pump Station Electrical Room, reconfigure exit doors so that they open in the direction of egress from the area.
Solids Treatment	Flare	Bring flare electrical and piping up to code.
Misc Site Buildings	Administration building	Replace administration building HVAC system and relocate building air intake away from sources of noxious fumes. Modify the administration building to comply with National Fire Protection Association (NFPA) 820 for physical separation between the digester room and occupied space of the administration building.
General Electrical	Main Distribution Switchgear	Replace the main A power breaker with a new breaker with a Kirk Key lock to help ensure that there will not be current back feeding through the tie breaker in case of a power outage on one of the utility transformers occurs.
General Electrical	MCC-1100 - Sludge Thickening/Biosolids	Properly ground the MCC line-up on MCC-1100 Relocate the storage rack from in front of panel L-1100.
General Electrical	MCC-140A/B - Operations Building Lower Level	Reconfigure MCC-140A/B main feeder connections to eliminate the exposure of live parts with the front doors. Relocate light fixture from in front of MCC-140B to provide required clear space. Reconfigure exit doors of the electrical room in the operations building lower floor so that they open in the direction of egress from the area.
General Site	Overall Site	Construct additional site lighting for operations staff safety while working. Perform chemical storage safety audit and provide spill containment to ACH System.

APPENDIX 4-1

Primary Clarifier Performance Testing

City of Pasco Wastewater Treatment Plant

Pasco, Washington
February 28, 2018

Contents

Tables

Figures

Appendices

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1 Executive Summary

On December 19 through 22, HDR Engineering performed a series of sampling and analytical tests focused on the operation of the primary clarifiers (PCs) at the City's wastewater treatment plant (WWTP). The purpose of these tests was to determine the removal efficiency of PC 3 and 4 compared to PC 1 and 2. If possible, a predicted capacity of the clarifiers was also to be determined.

Testing was carried out in a manner to produce directly comparable results based on the actual flows and wastewater characteristics encountered at the WWTP. These conditions were also compared to the conditions forming the basis of design for PC 3 and 4 in order to assess the applicability of those design assumptions.

Testing indicated that the performance of PC 3 and 4 exceeded the objectives set out in their design, with observed solids removal efficiencies of 72 percent under normal operation and 68 percent when stressed. Under stressed conditions, PC 4 outperformed PC 1 by three percent while receiving 50 percent more flow than PC 1.

Reviewing the as-built plans for PC 3 and 4, the original engineering report and the analytical testing conducted in 2014, there are three significant differences relevant to the evaluation of PC performance:

- Wastewater quality parameters indicate a significantly higher non-settleable solids (NSS) component than the original design anticipated. A higher NSS would tend to decrease performance of the clarifiers compared to design in that a higher portion of the raw wastewater is not amenable to physical settling.
- Current operation of the WWTP includes the use of chemicals such as Ferric Chloride to improve the removal of solids, primarily as a result of differing influent quality than expected and historically experienced. While this change seems to be primarily due to a higher than expected non-domestic wastewater contribution, the actual cause was not investigated. Based on the expectation of continued non-domestic wastewater flows, the use of Ferric Chloride should continue and the use of polymer as a flocculent could also be investigated.
- The initially planned retrofit of PC 1 and 2 to include advanced baffling was not performed as part of the construction project. These baffles were recommended to better balance the performance of the primary clarification process as a whole and to specifically improve the performance of PC 1 and 2. The addition of baffles should further improve the operation and capacity of PC 1 and 2.

Based on current actual operations and influent water quality, the apparent capacity of PC 3 and 4 exceed the design capacity of 7 mgd. When considering the stressed operation of PC 4 at 4.9 mgd and 68 percent removal, the combined capacity of PC 3 and 4 should be approximately 10 mgd. If the design removal target of 55 percent is factored in, PC 3 and 4 could reach approximately 12 mgd. When combined with existing PC 1 and 2 capacity (5.5 mgd), the approximate capacity of the WWTP primary clarification process exceeds 2031 flow projections by more than 6 mgd.

2 Introduction and Background

The City of Pasco protects public health and the environment by providing wastewater treatment service for the City's service area. The City oversees wastewater management for the 48 square mile area with a 2016 population of approximately 70,000. The Wastewater Treatment Plant (WWTP) has been operating since the 1950s and has undergone multiple upgrades and modifications to improve treatment quality and serve an expanding service base.

In 2015-17, the City of Pasco improved operating capabilities at the Pasco WWTP through the addition of Primary Clarifiers (PC) 3 and 4. HDR Engineering (HDR) was responsible for the engineering design, Clearwater Construction built the facility as general contractor (GC) and Gray & Osborne was hired by the City to perform services during construction (SDC) including Construction Management (CM).

When HDR undertook the design, an extremely tight site and limited budgetary resources mandated that the clarifier design utilize understanding of clarifier performance and fluid dynamics not traditionally considered. Specifically, a "copy and paste" approach to design (i.e., "make the new ones look like the old ones") would not result in a project that could be built without significant and costly construction considerations.

Upon completion of the project by the GC and as part of a separate WWTP Facility Planning activity, some questions were brought up about the adequacy of the new PCs to treat the design flows. It appears that these questions arose from a traditional empirical understanding of clarifier design without a complete understanding of advanced design techniques used for the clarifiers. Adding to the complexity, the WWTP flows have changed from the initial design flows, primarily as a result of accepting a relatively high portion of flows with a very low soluble and organic loading.

As a result of this non-clarity, the City requested that HDR design and perform an objective testing regime to determine the performance of PC 3 and 4.

2.1 Clarifier Design Approach

The typical design and analysis approach for primary clarifier is to use surface overflow rates established in typical design criteria, such as the Orange Book. Typical empirical overflow rates range from 800 to 1,200 gallons per day per square foot (gpd/sf) at average flow (design) conditions and 2,000 to 3,000 gpd/sf at peak flow (design) conditions. At these loading rates, a well-designed and properly operated primary clarifier should remove 30 to 35 percent of the BOD and 50 to 60 percent of the suspended solids from raw domestic wastewater, with the most efficient performance at the average flow/design conditions. The overflow rate reflects the anticipated settling velocity of the wastewater solids.

Due to the extremely constrained physical conditions and in the interest of providing a more economical constructed facility, HDR utilized an alternate approach to design based on measurement of actual settling velocities of the solids entering the clarifier and the use of computational fluid dynamics (CFD) analysis to simulate the primary clarifier. Using this approach, removal performance was predicted and a more cost-effective size for the facilities can be determined. Ecology guidelines allow for use of higher overflow rates when performance can be demonstrated and the practice of utilizing CFD and field settling analysis is now widely accepted.

In order to utilize this alternate approach, field testing was completed to determine the settling characteristics of the solids entering PC 1 and 2. By determining rates of settlement and ultimate settling parameters (the percentage of the solids that can be removed by gravity), PC 3 and 4 were sized to reflect the characteristics of the actual solids entering the plant.

This alternate approach was also intended to provide a more robust system that greatly reduces overloading of the clarifiers and consequent carry-over of solids to the secondary process. By providing basins with the appropriate depth and hydraulic baffling features, and testing these physical features with plant specific settling data in a CFD model, the clarifier solids removal rate can be more accurately determined at high flow conditions. The resulting design is more robust and protects the plant from the current condition of having a clarifier with a seemingly low overflow rate, but one that in reality has solids carry over due to depth limitations and scouring.

2.2 Design Flows

The design of PC 3 and 4 was based on an analysis of the plant influent flow data for three years (2011-2013). The design objective was to provide hydraulically efficient tanks allowing for greater flow with a smaller footprint while maintaining high solids removal efficiency. The design flow of 7 MGD was the average design condition determined in accordance with the Washington State Department of Ecology (DOE) Criteria for Sewage Works Design (Orange Book), 2007.

The hydraulic design of PC 3 and 4 was based on existing primary clarifier (PC 1 and 2) flows and the projected 2031 flows from the City's *Comprehensive Sewer Plan*. In addition, plant influent data from 2011-2013 was reviewed and plant staff targets for redundancy and treatment capability were factored into the design.

As a result of the preliminary engineering evaluation, the total hydraulic capacity of the new and existing systems, based on an annual average flow design condition and the applied peaking factors, was expected to exceed the 2031 WWTP projected flows per the comprehensive plan.

Design hydraulic flow data for all clarifiers is shown in table 2-1.

Table 2-1. Design Hydraulic Flow Conditions for all Primary Clarifiers

Parameter	Average Annual	Maximum Month	Peak Hour
Primary Clarifiers 3 and 4			
Flow	7 mgd	7.9 mgd	14.0 mgd
Flow Peaking Factor	--	1.13	2.00
Primary Clarifiers 1 and 2			
Flow	5.5 mgd	6.0 mgd	9.6 mgd
Flow Peaking Factor	--	1.09	1.76
Total Design Primary Clarifier Capacity			
Flow	12.5 mgd	13.9 mgd	23.6 mgd

Adopted design criteria for PC 3 and 4 is presented in table 2-2

Table 2-2. Primary Clarifier Design Criteria (PC 3 and 4)

Parameter	Value
Tanks/Bays, no.	2
Length, ft.	100
Width, ft.	18
Ave Side Water Depth, ft.	15
Freeboard (above weir), ft	2
Total Surface Area, square feet (per clarifier)	1800
Annual Average Flow, mgd	7
Annual Average Overflow Rate, gpd/sf (PC 3 and 4)	1,950
Project TSS removal (annual average flow), percent	>55
Maximum Month Flow, mgd	7.92
Maximum Month Overflow Rate, gpd/sf (PC 3 and 4)	2,200
Project TSS Removal (maximum month flow), percent	55
Peak Hour Flow, mgd	14
Peak Hour Overflow Rate, gpd/sf (PC 3 and 4)	3,900
Project TSS Removal (peak hour flow), percent	42

The design overflow rates were higher than typically recommended and were based on testing and modeling results performed during the preliminary design of the clarifiers. These tests and model results are fully described in the *Wastewater Treatment Plant – Engineering Report for Primary Clarifier Improvements* (HDR, 2015). Figure 2-1 is reproduced from that report and depicts projected suspended solids removal used in the design.

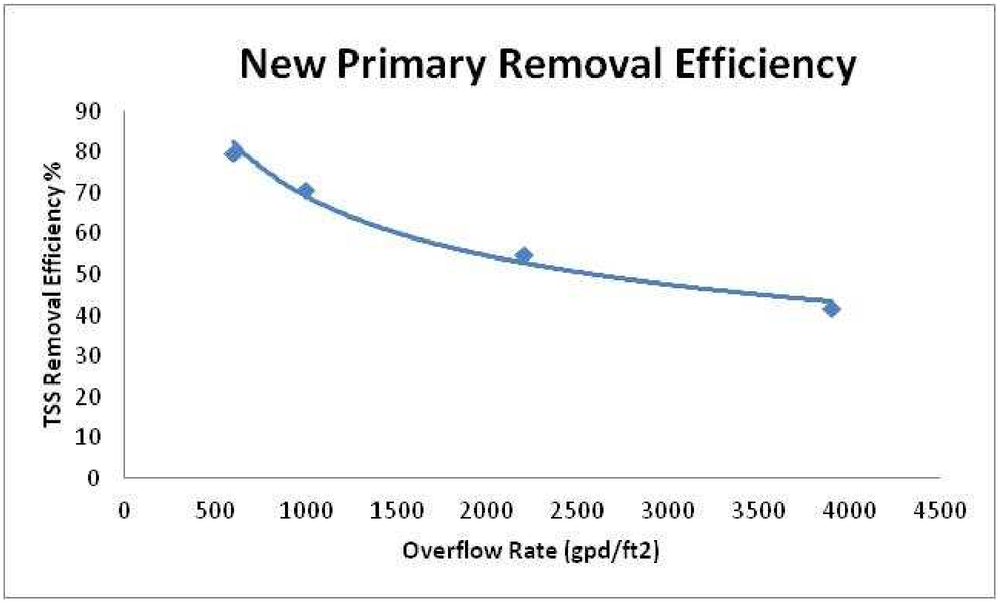


Figure 2-1. Projected Suspended Solids Removal vs. Overflow Rate
(reproduced from 2015 engineering report)

The design for PC 3 and 4 were designed initially with even flow distribution as stated in 3.2 of the *Engineering Report for Primary Clarifier Improvements* (HDR, 2015), however, the design later incorporated a flow split at the influent baffles that had slightly more flow (approximately 60%) directed to PC 3 and 4.

2.3 As-Built versus As-Designed Considerations

As is the case in most infrastructure construction projects, the constructed facility differs from the initial design in ways that vary from the purely aesthetic to the operationally significant. These differences are normally adjudicated through a process intended to manage GC requests and see that the affected parties (owner, GC and designer) all have an opportunity to weigh in from their perspectives and interests.

In the case of PC 3 and 4, the design engineer was not engaged to perform CM or SDC services and design engineer exposure to proposed and actual changes was very limited. Based on a review of the *Engineering Report for Primary Clarifier Improvements* (HDR. 2015) and the Record Drawings dated February 2017, the following significant changes to the design assumptions occurred:

- Wastewater quality parameters indicate a significantly higher non-settleable solids (NSS) component than the original design anticipated. A higher NSS would tend to decrease performance of the clarifiers compared to design in that a higher portion of the raw wastewater is not amenable to physical settling.
- Current operation of the WWTP includes the use of chemicals such as Ferric Chloride to improve the removal of solids, primarily as a result of differing influent quality than expected and historically experienced. While this change seems to be primarily due to a higher than expected non-domestic wastewater contribution, the

actual cause was not investigated. Based on the expectation of continued non-domestic wastewater flows, the use of Ferric Chloride should continue and the use of polymer as a flocculent could also be investigated.

- The initially planned retrofit of PC 1 and 2 to include advanced baffling was not performed as part of the construction project. These baffles were recommended to better balance the performance of the primary clarification process as a whole and to specifically improve the performance of PC 1 and 2.

3 Clarifier Performance Testing

From December 19 through 22, 2017 HDR collected samples of PC influent and effluent in order to have laboratory and field tests performed. Laboratory testing was performed by the water quality lab at the Benton-Franklin Health District; field testing was performed onsite using a modified Kemmerer sampler and a Phipps & Bird Six Paddle jar-testing apparatus.

This testing was performed to analyze the settling characteristics of the actual influent received at the plant under normal and heavily-loaded ("stressed") conditions. In addition, the testing provided an opportunity to verify the assumptions made during the design phase against the actual flows being seen at the WWTP.

Testing was performed in the same manner as the original 2014 testing so that results would be directly comparable.

Sample locations are shown on Figure 3-1.

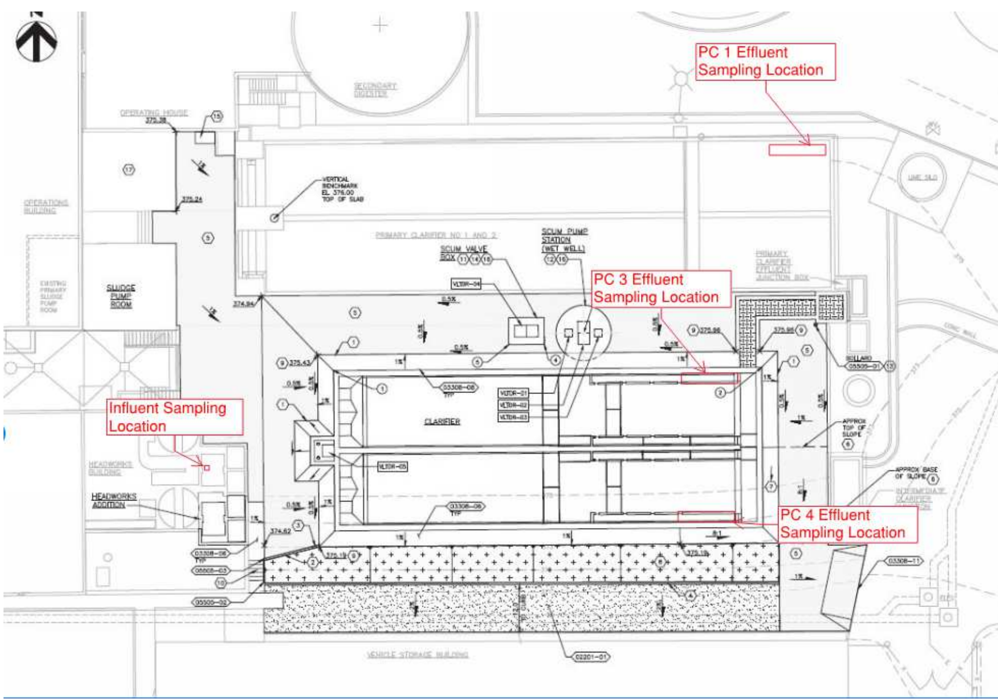


Figure 3-1. Sampling Locations

This section discusses the testing protocol, activities and analytical results of that sampling.

3.1 Testing Protocol

HDR developed a testing protocol to support the work under this project. The primary intent of the protocol was to establish clear and unambiguous testing procedures that whose results could be independently reviewed and repeated. The protocol formalizes the procedure and laboratory testing methods to be used.

A significant effort of this testing was the performance of tests in the field at the WWTP. The objective of these field tests was to determine certain influent parameters, the settling characteristics of the influent suspended solids and to evaluate the primary clarifier performance at the WWTP. Three types of field tests were conducted:

- Settling Velocity Distribution (SVD) tests
- Non-settleable solids (NSS) tests
- Flocculated non-settleable solids (FNSS) tests

The following discussion summarizes the testing protocol. The detailed protocol is provided in this report as Appendix 1.

While the field tests were being conducted, grab and composite samples were collected for laboratory analysis of Total Suspended Solids (TSS) and Total Biochemical Oxygen Demand (BOD5). Laboratory testing was performed using the analytical methods described in *Standard Methods for the Examination of Water and Wastewater, 21st Edition*. Laboratory results are attached as Appendix 2.

3.1.1 Settling Velocity Distribution (SVD) Test

The settling velocity distribution testing was performed to determine changes in suspended solids settling velocities between current conditions and 2014.

A series of settling tests were performed to determine the SVD of the primary influent suspended solids. A “modified” 4.2 liter Kemmerer sampler (see Figure 3.1) was used to determine the settling characteristics of the influent suspended solids at specified time intervals (0.5, 1.0, 2.0, 4.0, 8.0, 16.0, 32.0 and 60.0).

Effluent grab samples were also collected to measure TSS at 30 minute intervals throughout the testing. These grabs were taken from a consistent location and provide a definite value to determine actual removals during the testing period.

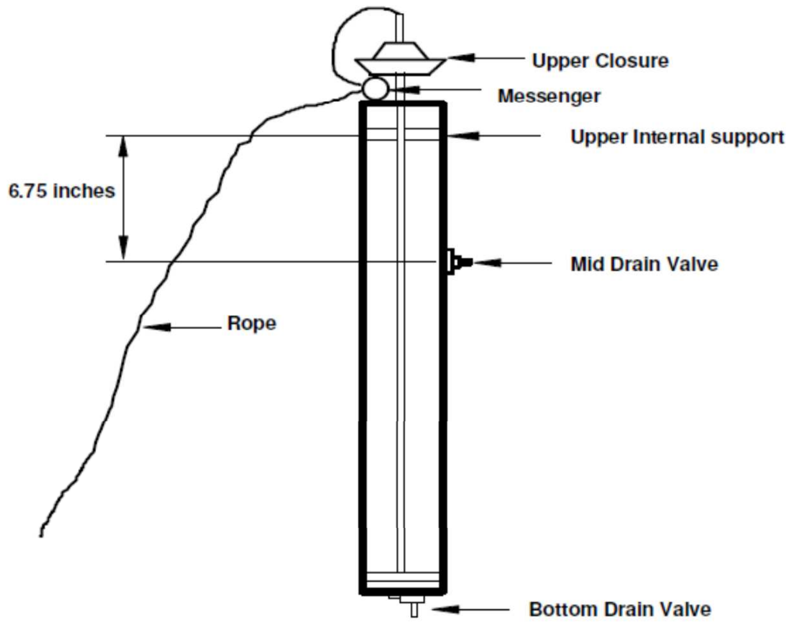


Figure 3-2. Kemmerer Sampler Schematic

3.1.2 Non-Settleable Solids (NSS) Test

The non-settleable solids concentration is operationally defined as the supernatant concentration after 60 minutes of settling. This test is used to quantify the amount of non-settleable suspended solids in the influent so that a more accurate assessment of removal efficiency can result.

3.1.3 Flocculated Non-Settleable Solids (FNSS) Test

The flocculated non-settleable solids concentration is defined as the supernatant concentration after 30 minutes of gentle mixing (50 rpm) followed by 60 minutes of settling in a 2-liter flocculation jars. This test is used to quantify the flocculation potential of the influent suspended solids.

Field testing was conducted over a baseline and stress period performed at various frequencies. On the first two days of testing, the plant operated in “normal” mode as determined by plant operations staff, with PC 1, 3 and 4 in service. For stress testing over one day, PC 1 and PC 4 remained online to simulate performance under stressed conditions. Effluent samples were collected from PC 1 as well as PC 3 and 4 during testing.

Samples of PC influent and effluent collected during testing were subjected to total suspended solids (TSS) analysis and some were also tested for total biochemical oxygen demand (tBOD). Table 3-1 shows the number of samples and frequency of sampling.

Table 3-1. Sampling Schedule and Frequency with BOD Designation

Day and Sample Method	Number of Samples	TSS	BOD (total)
Day 1 – NSS	2	All	2
Day 1 – FNSS	2	All	None
Day 2 – SVD	14	All	8
Day 2 – ESS	11 + 2 (PC 1)	All	6
Day 3 – SVD	16	All	8
Day 3 – ESS	12 + 2 (PC 1)	All	6
Day 4 – NSS	4	All	4
Day 4 – FNSS	2	All	None

The samples were sent to a third party laboratory (the Benton-Franklin Health District) for analysis on December 19 through 22, 2017 to test for TSS and tBOD. All analyses were performed using methods outlined in *Standard Methods for the Examination of Water and Wastewater, 21st edition*.

3.2 Analytical Results

The results of the testing were received from the Benton-Franklin Health District via email on January 2, 2018. Please see the report with the testing results located in Appendix 2. The results of the sampling and testing activities were compiled and analyzed for each sampling day and test type.

3.2.1 Settling Velocity Distribution (SVD) Testing Results

The SVD testing results consisted of wastewater influent samples that were taken at different times in throughout the morning and afternoon on two separate days. The results of the SVD testing are shown in Figure 3-3 and Figure 3-4 below. These charts also show the average results of the 2014 testing and indicate the following:

- The level of non-settleable solids is much lower than in 2014, even with the addition of ferric chloride. It appears that the ferric addition has reduced the level of non-settleable solids, but that level is still higher than encountered in the 2014 testing.
- The settling rate in 2014 was higher than than 2017 despite the addition of ferric chloride. It appears that the ferric addition has increased the settling velocity, but the rate is slower than it was during the 2014 testing.

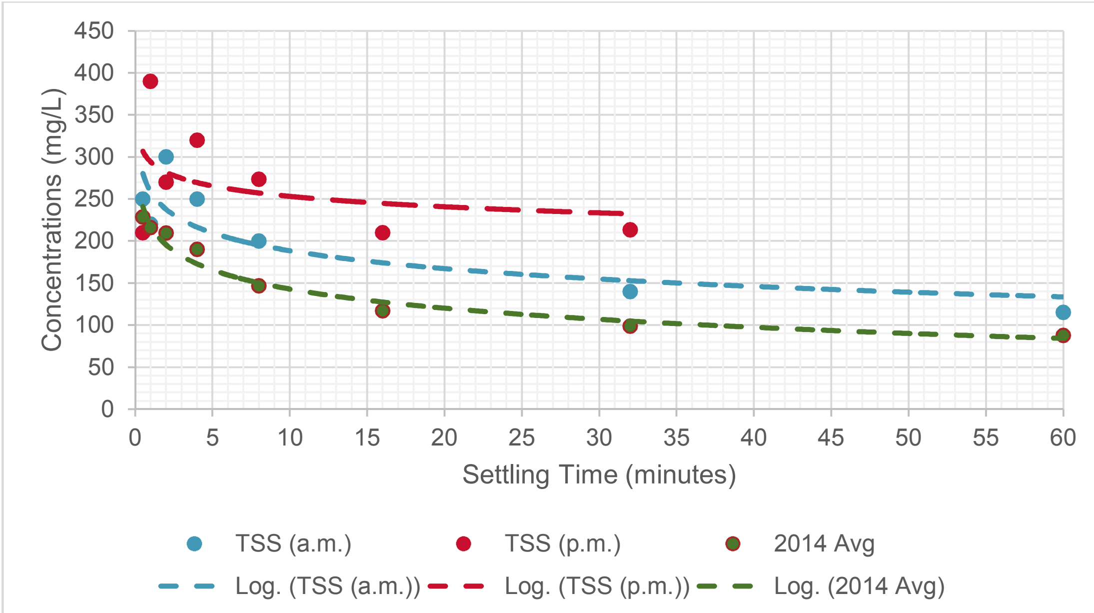


Figure 3-3. Results of SVD Testing – 12/20/17 ("Normal")

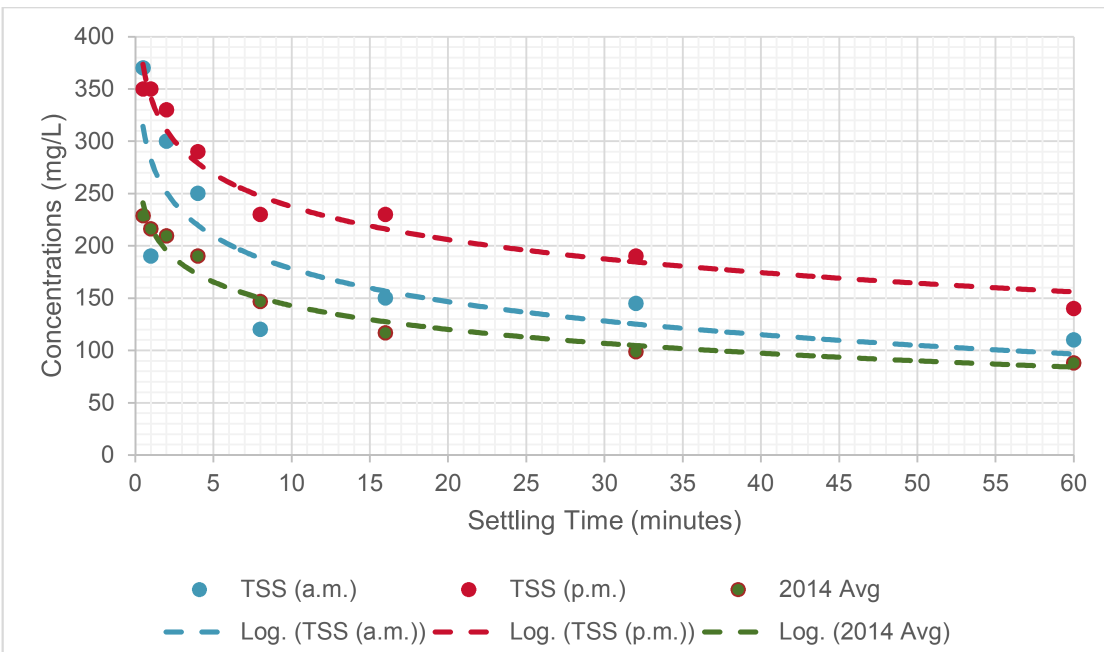


Figure 3-4. Results of SVD Testing – 12/21/17 ("Stressed")

Figures 3-3 and 3-4 show the relationship between the settling time and the TSS concentration in mg/L and settling time in minutes. Influent concentrations were comparable between the days, with afternoon solids slightly higher than morning. Over the two days, the average concentration of TSS in influent was approximately 320 mg/L. TSS decreases as allowed to settle over time and after 60 minutes the TSS has decreased to an average value of 125 mg/L.

At 8:30 am in the morning of Day 2 of testing, December 20, 2017 ("normal" operation), a sample of influent and PC effluent was taken. The influent was tested for suspended solids and the test indicated 250 mg/L of suspended solids. The tested effluent of the same time and day indicated 70 mg/L of suspended solids which indicated a removal efficiency of 72 percent. For the December 21, 2017 testing, influent TSS was 350 mg/L and effluent averaged approximately 115 mg/l, indicating a removal efficiency of 67 percent.

Based on the field results provided in the previous figures, and the insight they provide into settling times for the influent solids, analysis was conducted to determine the relationship between overflow rate and solids removal efficiency. The tank geometry for each tank and the flow split, approximately 40 percent for PC 1 and 2 versus 60 percent for PC 3 and 4, was considered while calculating the overflow rate and solids removal efficiency.

The stressed operation of the WWTP suspended solids removal in relation to overflow rate, was developed and is shown in Table 3-2.

Table 3-2. Comparison Between PC 1 and PC 4 During “Stressed” Operations (12/21/17))

Item Description	PC 1	PC 4
Area (ft2)	2738	1800
Flow Rate (mgd)*	2.84	4.26
Over Flow Rate (gpd/ft2)	1038	2368
Effluent ESS (mg/L)**	120	110
TSS Removal Efficiency* **	**65.7**	**68.6**

** Influent flow rate values are average from 1-2 PM while testing was taking place.*
*** Effluent values were taken at 1:45 pm*
**** TSS removal efficiency is based on the influent suspended solids of 350 mg/L*

Table 3-2 confirms that PC 3 and 4 are exceeding the removal efficiency of PC 1 and 2, under stress conditions. For all PCs, this is higher than normally expected for primary clarification, where values of approximately 55 percent are encountered. During routine operation of the WWTP, the City utilizes ferric chloride ($FeCl_3$) addition, which typically produces an increased removal of suspended solids depending on the characteristics of the wastewater. As a result, the higher observed removals are consistent with a ferric-treated raw influent. Greater removal efficiencies in PC 3 and 4 over PC 1 and 2, even at significantly higher overflow rates, is not affected by ferric addition.

3.2.2 Non-Settleable Solids (NSS) Testing Results

The results of NSS testing of PC influent indicated an initial range of 100-170 mg/L and, after 60 minutes of settling time, a final range of 67 to 136 mg/L. The analysis of the data for PC 3 and 4 indicated:

- The average NSS in the PC influent was 140 mg/L
- The average of NSS in the PC effluent was 89 mg/L

- Average NSS reduction was 36 percent.

The average level of non-settleable suspended solids (NSS) was observed to be 140 mg/L which is relatively high compared to other treatment facilities. The potential reasons for this are highly dependent on the influent quality; no work was done as part of this study to investigate cause of this relatively high value.

3.2.3 Flocculated Non-Settleable Solids (FNSS) Testing Results

The results of the testing of flocculated PC influent indicated a range of 50-104 mg/L. The analysis of the data for PC 3 and 4 indicated:

- The average of NSS in PC influent was 140 mg/L
- The average of FNSS in the primary clarifier influent = 79 mg/L
- The percentage of non-settleable solids from the influent was reduced by 43 percent when flocculated then allowed to settle. The flocculation provided another 7 percent removal over the average of the NSS in the PC effluent.

The results of FNSS testing indicate that additional solids removal could be attained through improvements to flocculation. These improvements could either be accomplished through additional chemical use or installation of baffles into PC 1 and 2. While the initial cost of installing baffles is a consideration, the cost of additional chemical addition is probably higher from a lifecycle perspective.

3.2.4 BOD Testing Results

The results of testing for total BOD are shown in Table 3-3. Analysis of the data shows:

- The initial BOD averaged 308.4 mg/L
- The average settled/effluent BOD was 199.5 mg/L
- The average settled/effluent BOD was 178.9 mg/L
- The average settling reduction in BOD was 35 percent.
- The average effluent reduction in BOD was 42 percent

These results show that the primary clarifiers are removing an appropriate portion of the BOD and that there are no abnormal water quality variables affecting the performance of the clarifiers.

Table 3-3. BOD Results

Date	Test Type	Time of Day	Average Initial BOD (mg/L)	Average Settled or Effluent BOD (mg/L)
12/19/2017*	NSS	-	-	602.3
12/20/2017	ESS	Morning	-	220.7
12/20/2017	ESS	Afternoon	-	181.1

Table 3-3. BOD Results

Date	Test Type	Time of Day	Average Initial BOD (mg/L)	Average Settled or Effluent BOD (mg/L)
12/20/2017	SVD	Morning	349.7	197.6
12/20/2017	SVD	Afternoon	324.5	227.0
12/21/2017	ESS	Morning	-	141.3
12/21/2017	ESS	Afternoon	-	172.7
12/21/2017	SVD	Morning	250.6	174.9
12/21/2017	SVD	Afternoon	308.7	229.3
12/22/2017	NSS	-	-	168.9

**12/19/17 data is considered an "outlier" and was not used in calculating the averages*

4 Qualitative Analysis

The review of PC 3 and 4 indicates performance consistent with that anticipated by the design. This is notable in that not only are these removals achieved in a smaller footprint than PC 1 and 2, the headworks hydraulics actually send a higher percentage of the flow (approximately 60 percent) to the newer clarifiers.

We observed the overflow rate of PC 4 to be 2,368 gpd/ft^2 with a removal efficiency under stressed conditions of 68.6 percent. The effluent TSS was predicted to be approximately 140 mg/L (assuming influent TSS of 350 mg/L) and was observed at approximately 90-110 mg/L under stress.

If the design removal target of 55 percent is factored in, PC 3 and 4 could reach a treatment capacity of approximately 12 mgd. When combined with existing PC 1 and 2 capacity (5.5 mgd), the approximate capacity of the WWTP primary clarification process exceeds 2031 flow projections by more than 6 mgd.

Current WWTP operations include the addition of ferric chloride ($FeCl_3$) to improve reduction of suspended solids. While this was not anticipated in the design of PC 3 and 4, the testing compared actual operations of both the older and newer clarifiers and affirmed them to performing as anticipated.

As mentioned above, the average level of NSS was estimated to be approximately 140 mg/L, which is relatively high compared to other treatment facilities. Without the use of ferric chloride ($FeCl_3$), it is anticipated that the non-suspended solids values may be much higher.

NSS observed during the current influent testing appeared to be much higher (approximately 50 percent) than the influent tested in 2014, which demonstrates that the wastewater characteristics have changed significantly. Without the use of ferric chloride, it is felt that influent NSS would be much higher, impacting the operation of any clarifier negatively. Continued use of coagulant is indicated.

Despite the change in the wastewater characteristics, the optimized design of PC 3 and 4 allows the WWTP to maintain better performance while occupying 35% less area than PC 1 and 2. The FNSS jar testing indicated that improving flocculation further would benefit PC 1 and 2 by potentially lower the effluent TSS concentration.

5 References

APHA. Standard Methods for the Examination of Water and Wastewater, 21st Ed. Washington, DC, New York: American Public Health Association; 2005.

Decker, Jay S.; Zahller, Jeffrey D.; Wastewater Treatment Plant Engineering Report for Primary Clarifier Improvements, 2014 HDR Engineering Inc.

State of Washington, Department of Ecology. Criteria for Sewage Works Design. Retrieved from https://fortress.wa.gov/ecy/publications/documents/9837.pdf, 2008.

Appendix 1

Testing Protocol

Primary Clarifier Testing Protocol

1. INTRODUCTION

The objectives of primary clarifier field tests are to determine the settling characteristics of the influent suspended solids and evaluate the primary clarifier performance at the WWTP. Three field tests will be performed at frequencies to be determined:

- Settling tests.
- Non-settleable solids (NSS) tests.
- Flocculated non-settleable solids (FNSS) tests.

The data obtained from field testing will be used to evaluate the performance of the primary clarifiers under operational conditions.

This testing protocol consists of two sections. The first section contains description of the testing methods used for conducting field tests. The second section outlines sampling requirements and frequency.

2. FIELD TESTING

Field testing will be conducted over a baseline and stress period. On the first four days of testing, the plant will operate in a “normal” mode as defined and determined by plant operations staff. For stress testing over one day, only one of the clarifiers three and four will be online to simulate performance under stressed conditions. The stress testing period should be greater than or equal to twice the hydraulic retention time of the tested clarifier. Samples of primary clarifier effluent will be collected during testing.

2.1 Settling Velocity Distribution (SVD) tests

A series of settling tests is performed to determine the settling velocity distribution of the primary influent suspended solids. A “modified” 4.2 liter Kemmerer sampler (see Figure 1.0) is used to determine the settling characteristics of the influent suspended solids. Following are the steps for conducting the settling tests:

1. Choose a sampling location as close as possible to the primary clarifier influent gate (usually in the primary clarifier split box). However, if sampling from splitter box is not feasible, samples could be collected from the clarifier center feed well. If the primary clarifier receives return sludge and/or any recycle stream, the sampling location must be downstream of the return stream mixing point.
2. Lower the Kemmerer sampler below the water surface.
3. Close the sampler using the messenger.
4. Bring the sampler to the surface.
5. Lower the water surface in the sampler to mid point of the upper support by opening the Kemmerer bottom valve. Collect the drained water in a 5-gallon bucket.
6. Allow the sample to settle for a predetermined amount of time.

7. Collect a 1-liter of the supernatant through a sampling port (see Figure 2.0) which is located 6.75 inches from mid point of the sampler upper support.
8. Analyze the sample for TSS.
9. Repeat steps 2 through 8 using different settling times. Settling times of 0.5, 1.0, 2.0, 4.0, 8.0, 16.0, and 32 minutes should be used.
10. Mix the contents of the 5-gallon bucket and collect a sample for TSS analysis. This sample is considered a composite sample of the influent suspended solids.
11. Repeat steps 2 through 10 twice on each testing day. For example, conduct one series of tests in the morning and another one in the afternoon.
12. Collect grab samples (once every 30 minutes) of the primary clarifier effluent suspended solids (ESS) throughout the testing.
13. Take one of the primary clarifier offline and repeat steps 1 through 12 on another day.

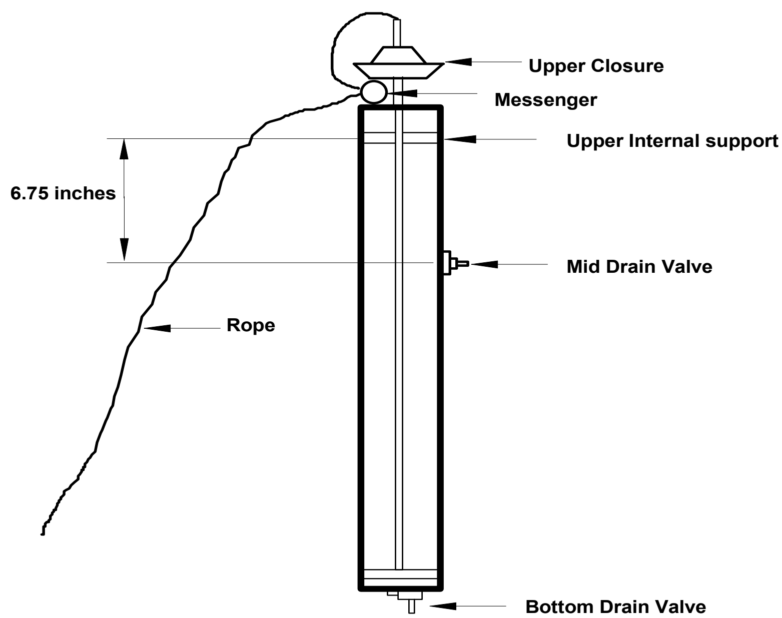


Figure 1.0 A schematic of the Kemmerer sampler

2.2 Non-settleable solids (NSS) test

The non-settleable solids concentration is operationally defined as the supernatant concentration after 60 minutes of settling in a Kemmerer sampler. This test is used to quantify the amount of non-settleable suspended solids in the influent. It should be noted that this test has to be performed at the same time the settling tests are conducted. Following are the steps for conducting the test:

1. Lower the Kemmerer sampler below the water surface (at the same sampling location where settling test samples were collected).
2. Close the sampler using the messenger.
3. Bring the sampler to the surface.

4. Lower the water surface in the sampler to mid point of the upper support by opening the Kemmerer bottom valve.
5. Allow the sample to settle for 60 minutes.
6. Collect a 1-liter of the supernatant through the sampling port (see Figure 2.0) which is located 6.75 inches from mid point of the sampler upper support.
7. Analyze the sample for TSS.
8. Repeat steps 1 through 7 twice during each series of settling tests.

2.3 Flocculated non-settleable solids (FNSS) test

The flocculated non-settleable solids concentration is defined as the supernatant concentration after 30 minutes of gentle mixing (50 rpm) followed by 60 minutes of settling in a 2-liter flocculation jars. This test is used to quantify the flocculation potential of the influent suspended solids. Following are the steps for conducting the test:

1. Collect a primary clarifier influent sample.
2. Pour the sample in the 2-liter flocculation jar (square jar is recommended). A Phipps and Bird jar tester can be used.
3. Apply gentle mixing (50 rpm) for 30 minutes.
4. Allow the sample to settle for 60 minutes.
5. Collect a supernatant sample (500 ml) and analyze for TSS.

2.4 Example

The settling and non-settleable solids tests were performed in a recent project for the City of Claremore, Oklahoma. The procedures described above were followed. Figure 2.0 shows the settling time/supernatant concentration raw data. It also shows the non-settleable solids concentration.

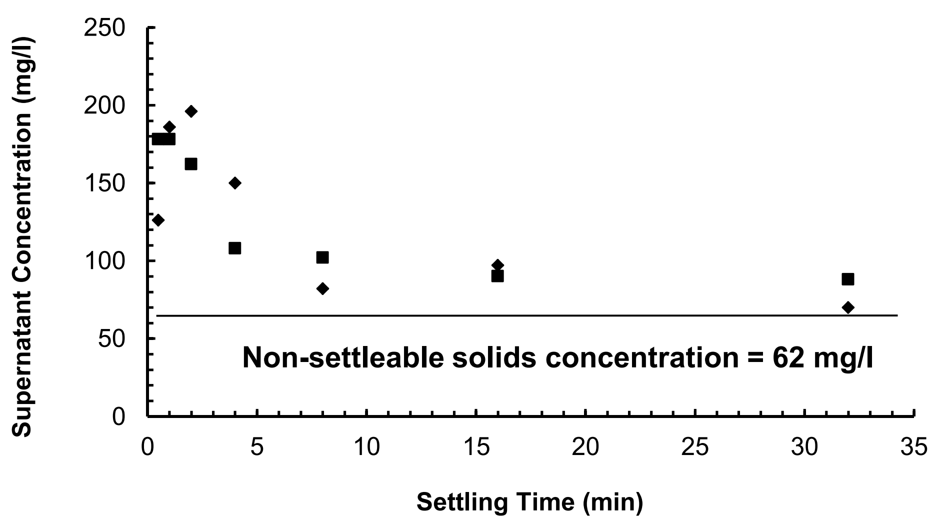


Figure 2.0 Example of relationship between settling time and supernatant concentration

3. Sampling

As outlined in the field testing sections, samples will be collected during each test. Also, samples of the primary clarifier effluent suspended solids (ESS) will be collected throughout the testing period. The ESS samples must be collected from the clarifier launder or right upstream of the effluent weir. All of the samples will be subject to total suspended solids (TSS) analysis and few will be subject to total biochemical oxygen demand (tBOD). Table 1 shows the number of samples and frequency of sampling.

Table 1 – Sampling frequency

Sample	Number of Samples	TSS	tBOD/sBOD
SVD (day one)	14	Yes	Yes (7 samples)/No
SVD (day three)	14	Yes	Yes (7 samples)/No
NSS (day two)	4	Yes	Yes/No
NSS (day four)	4	Yes	Yes/No
FNSS(day two)	2	Yes	No/No
FNSS (day four)	2	Yes	No/No
ESS (day one)	12	Yes	Yes (6 samples) /No
ESS (day three)	12	Yes	Yes (6 samples)/No

Appendix 2

Laboratory Results

PUBLIC HEALTH
Prevent • Promote • Protect
BENTON-FRANKLIN HEALTH DISTRICT

December 26, 2017

Tom Helgeson
HDR Engineering
2805 Saint Andrews Loop, Suite A
Pasco, WA 99301

Dear Mr. Helgeson:

The following results are from samples submitted to our laboratory for analysis on December 19-22, 2017. All analysis were performed using methods outlined in Standard Methods for the Examination of Water and Wastewater, 21st edition. If you need additional information regarding these methods or results please contact Britt Wilkins at (509) 460-4206.

Sample ID	Date Collected	Time Collected	TSS mg/L	BOD mg/L
NSS 1-1	12-19-17		160	614.9
NSS 1-2	12-19-17		250	589.6
FNSS 1-1	12-19-17		100	
FNSS 1-2	12-19-17		104	
SVD-2-1-30	12-20-17		250	352.3
SVD-2-1-1	12-20-17	8:30	220	347.0
SVD-2-1-2	12-20-17		300	
SVD-2-1-4	12-20-17		250	
SVD-2-1-8	12-20-17		200	
SVD-2-1-32	12-20-17		140	237.1
SVD-2-1-60	12-20-17		115	158.1
SVD-2-2-30	12-20-17		210	313
SVD-2-2-1	12-20-17		390	336.0
SVD-2-2-2	12-20-17		270	
ESS-2-1-N1	12-20-17	8:30	70	262.3
ESS-2-1-N2	12-20-17	9:30	66.7	211.4
ESS-2-1-N3	12-20-17	10:00	72.5	
ESS-2-1-N4	12-20-17	10:30	70	222.8
ESS-2-1-N5	12-20-17	11:00	72.5	
ESS-2-1-N6	12-20-17	11:30	83.3	186.2
ESS-2-2-N7	12-20-17	1:00	86.7	

Sample ID	Date Collected	Time Collected	TSS mg/L	BOD mg/L
ESS-2-2-N8	12-20-17	1:30	90	173.7
ESS-2-2-N9	12-20-17	2:00	106.7	179.6
ESS-2-2N10	12-20-17	2:30	130	182.6
SVD-2-2-4	12-20-17		320	
SVD-2-2-8	12-20-17		273.3	
SVD-2-2-16	12-20-17		210	218.0
SVD-2-2-32	12-20-17		213.3	235.9
ESS-2-1-E1	12-20-17	8:30	70	
ESS-2-2-E2	12-20-17	1:15	116.7	
ESS-2-2-N11	12-20-17	3:00	136	188.6
SVD-3-1-30	12-21-17	10:15	370	259.3
SVD-3-1-1	12-21-17	10:15	190	241.9
SVD-3-1-2	12-21-17		300	
SVD-3-1-4	12-21-17		250	
SVD-3-1-8	12-21-17	8:40	120	
SVD-3-1-16	12-21-17		150	
SVD-3-1-32	12-21-17		145	171.9
SVD-3-1-60	12-21-17	8:40	110	177.8
ESS-3-1-N1	12-21-17	8:30	73.3	137.1
ESS-3-1-N2	12-21-17	9:00	110	
ESS-3-1-N3	12-21-17	9:30	70	147.9
ESS-3-1-N4	12-21-17	10:00	112	
ESS-3-1-N5	12-21-17	10:30	66.7	138.9
ESS-3-1-N6	12-21-17	11:00	73.3	
ESS-3-1-E1	12-21-17	9:30	70	
SVD-3-2-30	12-21-17	1:00	350	308.2
SVD-3-2-1	12-21-17	1:00	350	309.2
SVD-3-2-2	12-21-17		330	
SVD-3-2-4	12-21-17		290	
SVD-3-2-8	12-21-17		230	
SVD-3-2-16	12-21-17		230	
SVD-3-2-32	12-21-17		190	230.5
SVD-3-2-60	12-21-17		140	228.1
ESS-3-2-N7	12-21-17	12:45	93.3	153.9
ESS-3-2-N8	12-21-17	1:15	96	
ESS-3-2-N9	12-21-17	1:45	110	174.9
ESS-3-2-N10	12-21-17	2:15	80	
ESS-3-2-N11	12-21-17	2:45	110	189.2
ESS-3-2-E2	12-21-17	1:45	120	
NSS-4-1	12-22-17		100	147.9
NSS-4-2	12-22-17		110	164.7
NSS-4-3	12-22-17		170	180.2

Sample ID	Date Collected	Time Collected	TSS mg/L	BOD mg/L
NSS-4-4	**12-22-17**		**170**	**182.6**
FNSS-4-1	**12-22-17**		**50**	
FNSS-4-2	**12-22-17**		**60**	

Sincerely,

Britt Wilkins
Laboratory Supervisor

murraysmith

APPENDIX 4-2

WASTEWATER MASTER PLAN
TECHNICAL MEMORANDUM

TO:	Teresa Reed-Jennings – City of Pasco	**DATE:**	January 16, 2017
FROM:	Craig Anderson - MSA	**CC:**	Tracy Cork - VE
PREPARED BY:	Craig Anderson - MSA		Dale Richwine - REI
SUBJECT:	Technical Memorandum No. 5 Pasco WWTP Hydraulic Capacity		

1 TABLE OF CONTENTS

2 EXECUTIVE SUMMARY

This memorandum documents an evaluation of the existing hydraulic conveyance capacity of the City's Wastewater Treatment Plant (WWTP). A summary of the analysis results is provided in Table 1. Without improvements, the plant is limited to a peak instantaneous (PI) flow of approximately 12.4 mgd. By adding 900 lineal feet of parallel 24-inch effluent piping a maximum PI flow of 14 mgd should be possible. At this improved PI flow, the hydraulic capacity of the plant would approximately equal the process capacity of the plant as determined in technical memos 6.1, 6.2, and 7.

Table 1

Pasco WWTP
Hydraulic Capacity Limit Summary (mgd)

Analysis	PI	PH	PW	MM	AA	Capacity Constraint
All On	12.4	10.54	7.31	7.13	5.99	UV Channel Depth
UV System FIRM	13.1	11.14	7.72	7.53	6.33	UV Channel Depth
Secondary Clarifier FIRM	15+	12.75+	8.84+	8.62+	7.25+	NA
Aeration Basin FIRM	15+	12.75+	8.84+	8.62+	7.25+	NA
Trickling Filter FIRM	15+	12.75+	8.84+	8.62+	7.25+	NA
Primary Clarifier FIRM	15+	12.75+	8.84+	8.62+	7.25+	NA
Grit Chamber FIRM	15+	12.75+	8.84+	8.62+	7.25+	NA
Screens FIRM	15+	12.75+	8.84+	8.62+	7.25+	NA
New Magnetic Flowmeter	12.5	10.63	7.37	7.19	6.04	UV Channel Depth
New parallel effluent pipe (STA 13+07 to 22+24)	14	11.90	8.25	8.05	6.76	MH (STA 13+17) overtopping

3 BACKGROUND

The capacity of an existing wastewater treatment plant (WWTP) is calculated by analyzing and determining the most limiting element within the WWTP. This memorandum documents the analysis of the existing mainline hydraulic backbone conveyance capacity of the WWTP. Technical memoranda 6.1 and 6.2 document the capacity evaluation completed on the WWTP solids treatment processes. Technical memorandum 7.0 documents the analysis completed on the liquid treatment processes.

To determine the conveyance limits, a hydraulic model of the plant was developed using the Visual Hydraulics software program. Visual Hydraulics is a hydraulic analysis tool that was specifically developed for modeling the hydraulic characteristics of water and wastewater treatment plants. The program follows the traditional method for analyzing water surface profiles: a downstream control point is selected, and the hydraulic profile is then determined upstream of that control point. A graphic representation of the hydraulic model that was used can be found in Attachment A.

For this analysis, hydraulic capacity was determined by increasing plant influent flows until either:

1. the modeled water surface can no longer be contained (i.e. – manhole rim or top of concrete wall overtopped), or
2. the predicted water level was high enough to prevent treatment failure (i.e. – UV lamp ballast submergence).

The modeled flow that occurs just prior to either of the above two conditions is characterized as the maximum allowable peak instantaneous (PI) flow capacity. This PI flow then adjusted down to an equivalent maximum month flow value using the historical peaking factors listed in technical memorandum 1.1 for comparison purposes to solids and liquid process capacity limits.

4 EXISTING CONDITION SCENARIOS

Two distinct types of hydraulic modeling were performed. The first, assumes that all unit processes are on-line and operational. This analysis was used to determine the maximum existing hydraulic capacity of the WWTP and is presented in section 4.1.

The second type of analysis that was performed, assumes that the largest of each unit process is taken off-line (one unit process at a time), to determine if there are secondary hydraulic constraints that could limit capacity if a unit process has to be taken completely off-line for maintenance or repair.

In each of these two types of analysis, only PI flows of up to 15 mgd were modeled. At PI flows above this, the capacity of the liquid or solids treatment processes (even with improvements) controls capacity. In all modelled scenarios, the following assumptions were also made:

1. The return activated sludge rate (RAS) is equal to the incoming wastewater flow rate.
2. The flow diversion to the trickling filter is a constant 2.5 mgd
3. The water elevation in the Columbia River McNary Pool is at the maximum recorded elevation of 343.15.

4.1 ALL ON

With all unit processes on-line, the existing treated effluent piping and outfall system were determined to control the capacity of the plant. At a PI flow of 11.5 mgd, the hydraulic model predicts that the effluent weir will start to become submerged and lose accuracy. However, since the flow is still contained and treatment of the wastewater is not impacted this PI flow was not considered as the hydraulic limit and higher flows were analyzed.

At a PI flow above 12.4 mgd, the water level in the UV disinfection system channels will exceed their maximum allowable level and render it inoperable. The associated average annual (AA), maximum month (MM), peak week (PW) and peak hour (PH) flows for this 12.4 mgd PI limit is shown in Table 2.

Table 2

Pasco WWTP
All On Hydraulic Capacity Limit Estimates (mgd)

PI	PH	PW	MM	AA	Capacity Constraint
12.4	10.54	7.31	7.13	5.99	UV Channel Depth

A detailed hydraulic analysis report for this hydraulic model scenario is included in Attachment B

4.2 FIRM CAPACITY ANALYSIS

4.2.1 UV CHANNELS

In this analysis only one of the two UV channels is assumed operational, all other unit processes are on-line, and the hydraulic constraint of the existing treated effluent piping and outfall system is ignored. At a PI flow above 13.1 mgd, the water level in the UV disinfection system channels are predicted to exceed their maximum allowable level and render it inoperable. The associated average annual (AA), maximum month (MM), peak week (PW) and peak hour (PH) flows for this 13.1 mgd PI limit is shown in Table 3.

Table 3

Pasco WWTP
UV Channel Firm Capacity Hydraulic Limit Estimates (mgd)

PI	PH	PW	MM	AA	Capacity Constraint
13.1	11.14	7.72	7.53	6.33	UV Channel Depth

4.2.2 SECONDARY CLARIFIERS

In this analysis only one of the two secondary clarifiers is assumed operational, all other unit processes are on-line, and downstream hydraulic constraints are ignored. At a PI flow of 13.1 mgd, the hydraulic model predicts that the secondary clarifier weirs will start to become submerged. Since the flow is still contained and treatment of the wastewater is not impacted this PI flow was not considered as the hydraulic limit and higher flows were analyzed. At PI flows of 15 mgd, no hydraulic capacity limits were found upstream.

4.2.3 AERATION BASINS

In this analysis only one of the two aeration basins is assumed operational, all other unit processes are on-line, and downstream hydraulic constraints are ignored. At PI flows of 15 mgd, no hydraulic capacity limits were found upstream.

4.2.4 TRICKLING FILTERS

In this analysis the trickling filter is taken off-line, all other unit processes are on-line, and downstream hydraulic constraints are ignored. At a PI flow of 14.7 mgd, the hydraulic model predicts that the primary clarifier weirs will start to become submerged. Since the flow is still contained and treatment of the wastewater is not impacted this PI flow was not considered as the hydraulic limit and higher flows were analyzed. At PI flows of 15 mgd, no hydraulic capacity limits were found upstream.

4.2.5 PRIMARY CLARIFIERS

In this analysis only three of the four primary clarifiers are assumed operational, all other unit processes are on-line, and downstream hydraulic constraints are ignored. At PI flows of 15 mgd, no hydraulic capacity limits were found upstream.

4.2.6 GRIT

In this analysis only one of the two grit chambers are assumed operational, all other unit processes are on-line, and downstream hydraulic constraints are ignored. At PI flows of 15 mgd, no hydraulic capacity limits were found upstream.

4.2.7 SCREENS

In this analysis only two of the three aeration basins are assumed operational, all other unit processes are on-line, and downstream hydraulic constraints are ignored. At PI flows of 15 mgd, no hydraulic capacity limits were found upstream.

5 CAPACITY IMPROVEMENT SCENARIOS

To try and address identified hydraulic limit constraints, two additional scenarios were modeled as described below.

5.1 NEW EFFLUENT FLOW METERING

While not technically a hydraulic capacity constraint as defined in section 3 of this report, alternate effluent flow measurement methods were reviewed. An effluent flume or weir measures flow by creating a headloss that can be accurately correlated to a flow if the downstream end of either device does not become submerged. While both are widely accepted means of flow measurement, the headloss they generate and their submergence constraints limits their effective capacity at the Pasco WWTP. To maximize the range of effluent flow that can be accurately measured, the installation of a magnetic flowmeter installed after a drop manhole was modeled. Magnetic flowmeters by themselves do not generate a headloss to measure flow and are not impacted by downstream submergence.

With this change, up to a PI flow of 12.5 mgd can be both measured and hydraulically conveyed before the water level in the UV disinfection system channels will exceed their maximum allowable level and render it inoperable. The associated average annual (AA), maximum month (MM), peak week (PW) and peak hour (PH) flows for this 12.5 mgd PI limit is shown in Table 4.

Table 4

Pasco WWTP
All On Magnetic Meter Hydraulic Capacity Limit Estimates (mgd)

PI	PH	PW	MM	AA	Capacity Constraint
12.5	10.63	7.37	7.19	6.04	UV Channel Depth

5.2 NEW PIPELINE SEGMENT

While the change in the effluent flowmeter to a magnetic flowmeter previously described did result in an increase in the maximum effluent flow that can be accurately measured, it unfortunately did not meaningfully impact the hydraulic capacity due to UV disinfection channel limits. As such, reductions in system headloss were looked at.

By installing a second 24-inch effluent line or an equivalent new larger single line from the manhole at Station 22+24 to Station 13+07, it was determined that a PI flow capacity of up to 14 mgd can be hydraulically conveyed before Station the 13+07 manhole is overtopped. Since this PI flow essentially equates to the maximum process capacity of the plant determined in the technical memorandum series 6 and 7 memos, no additional analysis was performed. The associated average annual (AA), maximum month (MM), peak week (PW) and peak hour (PH) flows for this 14 mgd PI limit is shown in Table 5.

Table 5

Pasco WWTP
All On New Effluent Pipeline Segment Hydraulic Capacity Limit Estimates (mgd)

PI	PH	PW	MM	AA	Capacity Constraint
14	11.90	8.25	8.05	6.76	MH (STA 13+17) overtopping

It should be noted that:

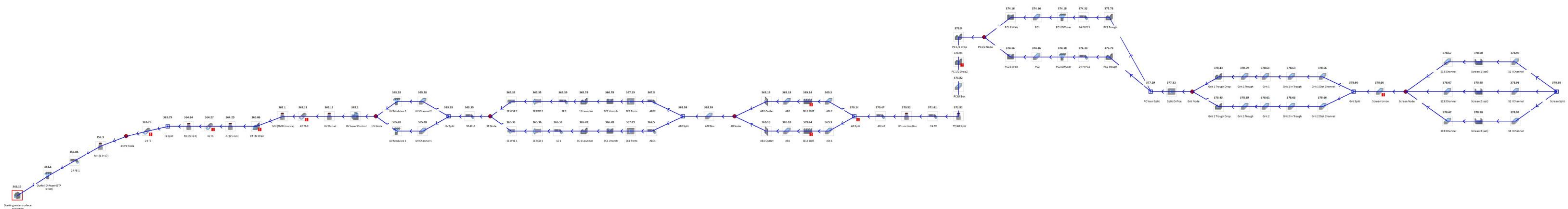
1. the outfall piping and diffuser analysis was done using general reference information and no detailed design or record drawings. As such, it is recommended that additional site investigation and analysis is performed to verify these model results before implementing improvements.

2. To be able to both convey and measure a flow of up to 14 mgd, both the new pipeline and magnetic flowmeter improvements will be necessary. If only the pipeline changes are implemented, the effluent flow measurement limit is approximately 12 mgd.

6 ATTACHMENTS

ATTACHMENT A

Hydraulic Model Graphic



ATTACHMENT B

Detailed Hydraulic Model Summary Report
(All On Scenario)

Visual Hydraulics Summary Report - Hydraulic Analysis

Project: **Pasco Immediate Needs - Exisitng WWTP All-On 343.vhf**
Company: **Murray Smith**
Date:

Current flow conditions

Forward Flow =	12.4 mgd
Return I Flow =	12.4 mgd
Return II Flow =	-----
Return III Flow =	-----

Section Description	**Water Surface Elevation**
Starting water surface elevation	**343.15**
Outfall Diffuser (STA 0+00)	**348.4**

2nd degree polynomial
Flow = 12.4 mgd
Overall head loss = 5.25 ft

24 FE-1 — **356.84**

Pipe shape = Circular
Diameter = 24 in
Length = 1317 ft
Flow = 12.4 mgd
Friction method = Hazen Williams
Friction factor = 110
Total fitting K value = 0
Pipe area = 3.14 ft²
Pipe hydraulic radius = 0.5
Age factor = 1
Solids factor = 1
Velocity = 6.11 ft/s
Friction loss = 8.44 ft
Fitting loss = 0 ft
Total loss = 8.44 ft

MH (13+17) — **357.3**

Manhole config. = two pipes in, one pipe out
Angle between pipes = not applicable
Diameter of pipe into manhole = 24 in

Section Description	Water Surface Elevation
Diameter of pipe out of manhole = 24 in	
Flow through manhole = 12.4 mgd	
Velocity of pipe out of manhole = 6.11 ft/s	
Manhole configuration K value = 0.8	
Overall head loss = 0.46 ft	
24 FE Node	
24 FE	**363.79**
Channel shape = Circular	
Manning's 'n' = 0.013	
Channel length = 907 ft	
Channel width/diameter = 2 ft	
Flow = 12.4 mgd	
Downstream channel invert = 351.2	
Channel slope = 0.0082 ft/ft	
Channel side slope = not applicable	
Area of flow = 3.14 ft^2	
Hydraulic radius = 0.5	
Normal depth = 1.54 ft	
Critical depth = 1.58 ft	
Depth downstream = 6.1 ft	
Bend loss = 0 ft	
Depth upstream = 5.15 ft	
Velocity = 6.11 ft/s	
Flow profile = Steep	
FE Split	**363.79**
User defined loss for flow split = 0 ft	
Total flow through flow split = 12.4 mgd	
MH (22+24)	**364.14**
Manhole config. = one pipe in, one pipe out	
Angle between pipes = 90 degrees	
Diameter of pipe into manhole = 42 in	
Diameter of pipe out of manhole = 24 in	
Flow through manhole = 12.4 mgd	
Velocity of pipe out of manhole = 6.11 ft/s	
Manhole configuration K value = 0.6	
Overall head loss = 0.35 ft	
42 FE	**364.27**
Channel shape = Circular	
Manning's 'n' = 0.014	
Channel length = 340 ft	
Channel width/diameter = 3.5 ft	
Flow = 12.4 mgd	
Downstream channel invert = 358.8	

Section Description	Water Surface Elevation
Channel slope = 0.004882 ft/ft Channel side slope = not applicable Area of flow = 9.62 ft^2 Hydraulic radius = 0.875 Normal depth = 1.3 ft Critical depth = 1.34 ft Depth downstream = 5.34 ft Bend loss = 0 ft Depth upstream = 3.81 ft Velocity = 1.99 ft/s Flow profile = Steep	
MH (25+64)	**364.29**
Manhole config. = one pipe in, one pipe out Angle between pipes = 180 degrees Diameter of pipe into manhole = 36 in Diameter of pipe out of manhole = 42 in Flow through manhole = 12.4 mgd Velocity of pipe out of manhole = 1.99 ft/s Manhole configuration K value = 0.3 Overall head loss = 0.02 ft	
Eff FM Weir	**365.06**
Weir invert (top of weir) = 361.77 Weir length = 1.5 ft Weir 'C' coefficient = 3.33 Flow over weir = 12.4 mgd Weir submergence = fully submerged Head over weir = 3.29 ft	
MH (FM Entrance)	**365.1**
Manhole config. = one pipe in, one pipe out Angle between pipes = 180 degrees Diameter of pipe into manhole = 42 in Diameter of pipe out of manhole = 36 in Flow through manhole = 12.4 mgd Velocity of pipe out of manhole = 2.71 ft/s Manhole configuration K value = 0.3 Overall head loss = 0.03 ft	
42 FE-2	**365.11**
Channel shape = Circular Manning's 'n' = 0.013 Channel length = 30 ft Channel width/diameter = 3.5 ft Flow = 12.4 mgd Downstream channel invert = 361.38	

Section Description	Water Surface Elevation

Channel slope = 0.0006667 ft/ft
Channel side slope = not applicable
Area of flow = 9.62 ft^2
Hydraulic radius = 0.875
Normal depth = 2.24 ft
Critical depth = 1.34 ft
Depth downstream = 3.72 ft
Bend loss = 0 ft
Depth upstream = 3.71 ft
Velocity = 1.99 ft/s
Flow profile = Mild

UV Outlet **365.13**

Manhole config. = one pipe in, one pipe out
Angle between pipes = 180 degrees
Diameter of pipe into manhole = 113 in
Diameter of pipe out of manhole = 42 in
Flow through manhole = 12.4 mgd
Velocity of pipe out of manhole = 1.99 ft/s
Manhole configuration K value = 0.3
Overall head loss = 0.02 ft

UV Level Control **365.2**

Constant elevation = 365.2

UV Modules 1 **365.28**

2nd degree polynomial
Flow = 6.2 mgd
Overall head loss = 0.08 ft

UV Modules 2 **365.28**

2nd degree polynomial
Flow = 6.2 mgd
Overall head loss = 0.08 ft

UV Channel 2 **365.28**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 12 ft
Channel width/diameter = 4.08 ft
Flow = 6.2 mgd
Downstream channel invert = 360.4
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 19.92 ft^2
Hydraulic radius = 1.439
Normal depth = infinite

Section Description	Water Surface Elevation

Critical depth = 0.56 ft
Depth downstream = 4.88 ft
Bend loss = 0 ft
Depth upstream = 4.88 ft
Velocity = 0.48 ft/s
Flow profile = Horizontal

UV Channel 1 **365.28**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 12 ft
Channel width/diameter = 4.08 ft
Flow = 6.2 mgd
Downstream channel invert = 360.4
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 19.92 ft^2
Hydraulic radius = 1.439
Normal depth = infinite
Critical depth = 0.56 ft
Depth downstream = 4.88 ft
Bend loss = 0 ft
Depth upstream = 4.88 ft
Velocity = 0.48 ft/s
Flow profile = Horizontal

UV Split **365.28**

User defined loss for flow split = 0 ft
Total flow through flow split = 12.4 mgd

SE 42-2 **365.35**

Pipe shape = Circular
Diameter = 42 in
Length = 20 ft
Flow = 12.4 mgd
Friction method = Hazen Williams
Friction factor = 110
Total fitting K value = 1
Pipe area = 9.62 ft^2
Pipe hydraulic radius = 0.875
Age factor = 1
Solids factor = 1
Velocity = 1.99 ft/s
Friction loss = 0.01 ft
Fitting loss = 0.06 ft
Total loss = 0.07 ft

SE Node

Section Description	**Water Surface Elevation**
SE WYE 2	**365.35**
Main line diameter = 42 in	
Branch diameter = 42 in	
Main line flow = 4.8 mgd	
Branch flow = 4.8 mgd	
Tee head loss = 0 ft	
SE RED 2	**365.35**
Diameter of smaller pipe = 36 in	
Diameter of larger pipe = 42 in	
Flow through pipe = 6.2 mgd	
Transition angle = 10 degrees	
Overall head loss = 0 ft	
Transition K value = 0.02	
Area of smaller pipe = 7.07 ft^2	
Area of larger pipe = 9.62 ft^2	
Velocity in smaller pipe = 2.57 ft/s	
Velocity in larger pipe = 1.89 ft/s	
Overall head loss = 0 ft	
SE 2	**365.39**
Pipe shape = Circular	
Diameter = 36 in	
Length = 120 ft	
Flow = 6.2 mgd	
Friction method = Hazen Williams	
Friction factor = 110	
Total fitting K value = 0.2	
Pipe area = 7.07 ft^2	
Pipe hydraulic radius = 0.75	
Age factor = 1	
Solids factor = 1	
Velocity = 1.36 ft/s	
Friction loss = 0.03 ft	
Fitting loss = 0.01 ft	
Total loss = 0.04 ft	
SC 2 Launder	**365.78**
Launder invert = 364.4	
Launder length = 145.3 ft	
Launder width = 2.5 ft	
Launder slope = 0 ft/ft	
Flow through launder = 6.2 mgd	
Critical depth = 0.77 ft	
Downstream depth = 0.99 ft	
Upstream depth = 1.38 ft	

Section Description	Water Surface Elevation

SC2 Vnotch — **366.78**

Invert of V notch = 366.6
Angle of V notch = 90 degrees
Number of notches = 278
Total flow over weir = 6.2 mgd
Weir submergence = unsubmerged
Head over weir = 0.18 ft

SC2 Ports — **367.19**

Opening type = rectangular orifice
Opening diameter/width = 12 in
Opening height = 18 in
Invert = 365
Number of openings = 4
Flow through opening(s) = 12.4 mgd
Total area of opening(s) = 6 ft^2
Velocity through opening(s) = 3.2 ft/s
Flow behavior = orifice, downstream control
Orifice loss = 0.41 ft
Downstream water level = 366.78
Upstream water level = 367.19

ABE2 — **367.5**

Pipe shape = Circular
Diameter = 36 in
Length = 181.5 ft
Flow = 12.4 mgd
Friction method = Hazen Williams
Friction factor = 110
Total fitting K value = 1.3
Pipe area = 7.07 ft^2
Pipe hydraulic radius = 0.75
Age factor = 1
Solids factor = 1
Velocity = 2.71 ft/s
Friction loss = 0.16 ft
Fitting loss = 0.15 ft
Total loss = 0.31 ft

ABE Split — **368.99**

Weir invert (top of weir) = 368.3
Weir length = 20 ft
Weir 'C' coefficient = 3.33
Total flow through flow split = 24.8 mgd
Weir submergence = unsubmerged
Head over weir = 0.69 ft

Section Description	Water Surface Elevation
ABE Box	**368.99**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 12.5 ft
Channel width/diameter = 5 ft
Flow = 24.8 mgd
Downstream channel invert = 362.55
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 32.21 ft^2
Hydraulic radius = 1.801
Normal depth = infinite
Critical depth = 1.22 ft
Depth downstream = 6.44 ft
Bend loss = 0 ft
Depth upstream = 6.44 ft
Velocity = 1.19 ft/s
Flow profile = Horizontal

AB2 Outlet **369.18**

Opening type = rectangular gate
Opening diameter/width = 36 in
Gate height = 36 in
Invert = 365
Number of gates = 1
Flow through gate(s) = 12.4 mgd
Total area of opening(s) = 9 ft^2
Velocity through gate(s) = 2.13 ft/s
Flow behavior = orifice, downstream control
Gate loss = 0.18 ft
Downstream water level = 368.99
Upstream water level = 369.18

AB1 Outlet **369.18**

Opening type = rectangular gate
Opening diameter/width = 36 in
Gate height = 36 in
Invert = 365
Number of gates = 1
Flow through gate(s) = 12.4 mgd
Total area of opening(s) = 9 ft^2
Velocity through gate(s) = 2.13 ft/s
Flow behavior = orifice, downstream control
Gate loss = 0.18 ft
Downstream water level = 368.99
Upstream water level = 369.18

Section Description	Water Surface Elevation
AB1	**369.18**
Channel shape = Rectangular	
Manning's 'n' = 0.013	
Channel length = 89.83 ft	
Channel width/diameter = 48 ft	
Flow = 12.4 mgd	
Downstream channel invert = 351	
Channel slope = 0 ft/ft	
Channel side slope = not applicable	
Area of flow = 872.55 ft^2	
Hydraulic radius = 10.344	
Normal depth = infinite	
Critical depth = 0.17 ft	
Depth downstream = 18.18 ft	
Bend loss = 0 ft	
Depth upstream = 18.18 ft	
Velocity = 0.02 ft/s	
Flow profile = Horizontal	
SEL1 OUT	**369.24**
Invert of notch = 367.75	
Width of notch = 36 in	
Number of notches = 4	
Total flow over weir = 12.4 mgd	
Weir submergence = fully submerged	
Head over weir = 1.49 ft	
ABI 1	**369.3**
Channel shape = Rectangular	
Manning's 'n' = 0.013	
Channel length = 24 ft	
Channel width/diameter = 2.5 ft	
Flow = 6.2 mgd	
Downstream channel invert = 367.75	
Channel slope = 0 ft/ft	
Channel side slope = not applicable	
Area of flow = 3.75 ft^2	
Hydraulic radius = 0.682	
Normal depth = infinite	
Critical depth = 0.77 ft	
Depth downstream = 1.49 ft	
Bend loss = 0.04 ft	
Depth upstream = 1.55 ft	
Velocity = 2.58 ft/s	
Flow profile = Horizontal	
AB2	**369.18**

Section Description	**Water Surface Elevation**
Channel shape = Rectangular	
Manning's 'n' = 0.013	
Channel length = 89.83 ft	
Channel width/diameter = 48 ft	
Flow = 12.4 mgd	
Downstream channel invert = 351	
Channel slope = 0 ft/ft	
Channel side slope = not applicable	
Area of flow = 872.55 ft^2	
Hydraulic radius = 10.344	
Normal depth = infinite	
Critical depth = 0.17 ft	
Depth downstream = 18.18 ft	
Bend loss = 0 ft	
Depth upstream = 18.18 ft	
Velocity = 0.02 ft/s	
Flow profile = Horizontal	
SEL2 OUT	**369.24**
Invert of notch = 367.75	
Width of notch = 36 in	
Number of notches = 4	
Total flow over weir = 12.4 mgd	
Weir submergence = fully submerged	
Head over weir = 1.49 ft	
ABI 2	**369.3**
Channel shape = Rectangular	
Manning's 'n' = 0.013	
Channel length = 24 ft	
Channel width/diameter = 2.5 ft	
Flow = 6.2 mgd	
Downstream channel invert = 367.75	
Channel slope = 0 ft/ft	
Channel side slope = not applicable	
Area of flow = 3.75 ft^2	
Hydraulic radius = 0.682	
Normal depth = infinite	
Critical depth = 0.77 ft	
Depth downstream = 1.49 ft	
Bend loss = 0.04 ft	
Depth upstream = 1.55 ft	
Velocity = 2.58 ft/s	
Flow profile = Horizontal	
AB Split	**370.24**
Weir invert (top of weir) = 369.25	
Weir length = 6 ft	

Section Description	**Water Surface Elevation**

Weir 'C' coefficient = 3.33
Total flow through flow split = 12.4 mgd
Weir submergence = partially submerged
Head over weir = 0.99 ft

ABI 42 — **370.47**

Pipe shape = Circular
Diameter = 42 in
Length = 260 ft
Flow = 12.4 mgd
Friction method = Hazen Williams
Friction factor = 110
Total fitting K value = 1.9
Pipe area = 9.62 ft^2
Pipe hydraulic radius = 0.875
Age factor = 1
Solids factor = 1
Velocity = 1.99 ft/s
Friction loss = 0.11 ft
Fitting loss = 0.12 ft
Total loss = 0.23 ft

IC Junction Box — **370.52**

Manhole config. = two pipes in, one pipe out
Angle between pipes = not applicable
Diameter of pipe into manhole = 24 in
Diameter of pipe out of manhole = 42 in
Flow through manhole = 12.4 mgd
Velocity of pipe out of manhole = 1.99 ft/s
Manhole configuration K value = 0.8
Overall head loss = 0.05 ft

24 PE — **371.61**

Pipe shape = Circular
Diameter = 24 in
Length = 36 ft
Flow = 9.704 mgd
Friction method = Hazen Williams
Friction factor = 110
Total fitting K value = 2.65
Pipe area = 3.14 ft^2
Pipe hydraulic radius = 0.5
Age factor = 1
Solids factor = 1
Velocity = 4.78 ft/s
Friction loss = 0.15 ft
Fitting loss = 0.94 ft
Total loss = 1.09 ft

Section Description	Water Surface Elevation
TF/AB Split	**371.82**
Manhole config. = one pipe in, one pipe out	
Angle between pipes = 90 degrees	
Diameter of pipe into manhole = 36 in	
Diameter of pipe out of manhole = 24 in	
Flow through manhole = 9.704 mgd	
Velocity of pipe out of manhole = 4.78 ft/s	
Manhole configuration K value = 0.6	
Overall head loss = 0.21 ft	
PC Eff Box	**371.82**
Channel shape = Rectangular	
Manning's 'n' = 0.013	
Channel length = 9 ft	
Channel width/diameter = 3 ft	
Flow = 12.4 mgd	
Downstream channel invert = 364.25	
Channel slope = 0 ft/ft	
Channel side slope = not applicable	
Area of flow = 22.71 ft^2	
Hydraulic radius = 1.252	
Normal depth = infinite	
Critical depth = 1.08 ft	
Depth downstream = 7.57 ft	
Bend loss = 0 ft	
Depth upstream = 7.57 ft	
Velocity = 0.84 ft/s	
Flow profile = Horizontal	
PC 1/2 Drop2	**371.91**
Launder invert = 368	
Launder length = 3 ft	
Launder width = 3 ft	
Launder slope = 0 ft/ft	
Flow through launder = 12.4 mgd	
Critical depth = 1.08 ft	
Downstream depth = 3.82 ft	
Upstream depth = 3.91 ft	
PC 1/2 Drop	**372.8**
Launder invert = 370.92	
Launder length = 3 ft	
Launder width = 3 ft	
Launder slope = 0 ft/ft	
Flow through launder = 12.4 mgd	
Critical depth = 1.08 ft	

Section Description	Water Surface Elevation
Downstream depth = 1.08 ft	
Upstream depth = 1.88 ft	
PC1 E Weir	**374.16**
Invert of V notch = 374	
Angle of V notch = 90 degrees	
Number of notches = 198	
Total flow over weir = 3.1 mgd	
Weir submergence = unsubmerged	
Head over weir = 0.16 ft	
PC1	**374.16**
Channel shape = Rectangular	
Manning's 'n' = 0.013	
Channel length = 140 ft	
Channel width/diameter = 18 ft	
Flow = 3.1 mgd	
Downstream channel invert = 367	
Channel slope = 0 ft/ft	
Channel side slope = not applicable	
Area of flow = 128.83 ft^2	
Hydraulic radius = 3.987	
Normal depth = infinite	
Critical depth = 0.13 ft	
Depth downstream = 7.16 ft	
Bend loss = 0 ft	
Depth upstream = 7.16 ft	
Velocity = 0.04 ft/s	
Flow profile = Horizontal	
PC1 Diffuser	**374.18**
2nd degree polynomial	
Flow = 3.1 mgd	
Overall head loss = 0.02 ft	
24 PI PC1	**374.32**
Pipe shape = Circular	
Diameter = 24 in	
Length = 75 ft	
Flow = 3.1 mgd	
Friction method = Hazen Williams	
Friction factor = 110	
Total fitting K value = 2.95	
Pipe area = 3.14 ft^2	
Pipe hydraulic radius = 0.5	
Age factor = 1	
Solids factor = 1	

Section Description	Water Surface Elevation
Velocity = 1.53 ft/s	
Friction loss = 0.04 ft	
Fitting loss = 0.11 ft	
Total loss = 0.14 ft	
PC1 Trough	**375.73**
Launder invert = 374.75	
Launder length = 5 ft	
Launder width = 2 ft	
Launder slope = 0 ft/ft	
Flow through launder = 3.1 mgd	
Critical depth = 0.56 ft	
Downstream depth = 0.56 ft	
Upstream depth = 0.98 ft	
PC2 E Weir	**374.16**
Invert of V notch = 374	
Angle of V notch = 90 degrees	
Number of notches = 198	
Total flow over weir = 3.1 mgd	
Weir submergence = unsubmerged	
Head over weir = 0.16 ft	
PC2	**374.16**
Channel shape = Rectangular	
Manning's 'n' = 0.013	
Channel length = 140 ft	
Channel width/diameter = 18 ft	
Flow = 3.1 mgd	
Downstream channel invert = 367	
Channel slope = 0 ft/ft	
Channel side slope = not applicable	
Area of flow = 128.83 ft^2	
Hydraulic radius = 3.987	
Normal depth = infinite	
Critical depth = 0.13 ft	
Depth downstream = 7.16 ft	
Bend loss = 0 ft	
Depth upstream = 7.16 ft	
Velocity = 0.04 ft/s	
Flow profile = Horizontal	
PC2 Diffuser	**374.18**
2nd degree polynomial	
Flow = 3.1 mgd	
Overall head loss = 0.02 ft	
24 PI PC2	**374.33**

Section Description	**Water Surface Elevation**
Pipe shape = Circular	
Diameter = 24 in	
Length = 65 ft	
Flow = 3.1 mgd	
Friction method = Hazen Williams	
Friction factor = 110	
Total fitting K value = 3.2	
Pipe area = 3.14 ft²	
Pipe hydraulic radius = 0.5	
Age factor = 1	
Solids factor = 1	
Velocity = 1.53 ft/s	
Friction loss = 0.03 ft	
Fitting loss = 0.12 ft	
Total loss = 0.15 ft	
PC2 Trough	**375.73**
Launder invert = 374.75	
Launder length = 5 ft	
Launder width = 2 ft	
Launder slope = 0 ft/ft	
Flow through launder = 3.1 mgd	
Critical depth = 0.56 ft	
Downstream depth = 0.56 ft	
Upstream depth = 0.98 ft	
PC Weir Split	**377.29**
Weir invert (top of weir) = 377	
Weir length = 18 ft	
Weir 'C' coefficient = 3.33	
Total flow through flow split = 6.2 mgd	
Weir submergence = unsubmerged	
Head over weir = 0.29 ft	
PC Split Orifice	**377.32**
Opening type = rectangular orifice	
Opening diameter/width = 136 in	
Opening height = 24 in	
Invert = 371	
Number of openings = 1	
Flow through opening(s) = 12.4 mgd	
Total area of opening(s) = 22.67 ft^2	
Velocity through opening(s) = 0.85 ft/s	
Flow behavior = orifice, downstream control	
Orifice loss = 0.03 ft	
Downstream water level = 377.29	
Upstream water level = 377.32	

Section Description	Water Surface Elevation

Grit 2 Trough Drop — **378.43**

Launder invert = 377.25
Launder length = 0.01 ft
Launder width = 3 ft
Launder slope = 0 ft/ft
Flow through launder = 6.2 mgd
Critical depth = 0.68 ft
Downstream depth = 0.68 ft
Upstream depth = 1.18 ft

Grit 1 Trough Drop — **378.43**

Launder invert = 377.25
Launder length = 0.01 ft
Launder width = 3 ft
Launder slope = 0 ft/ft
Flow through launder = 6.2 mgd
Critical depth = 0.68 ft
Downstream depth = 0.68 ft
Upstream depth = 1.18 ft

Grit 1 Trough — **378.59**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 20 ft
Channel width/diameter = 3 ft
Flow = 6.2 mgd
Downstream channel invert = 377.25
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 3.58 ft^2
Hydraulic radius = 0.665
Normal depth = infinite
Critical depth = 0.68 ft
Depth downstream = 1.18 ft
Bend loss = 0.14 ft
Depth upstream = 1.34 ft
Velocity = 2.7 ft/s
Flow profile = Horizontal

Grit 1 — **378.61**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 15.71 ft
Channel width/diameter = 5 ft
Flow = 6.2 mgd
Downstream channel invert = 376

Section Description	Water Surface Elevation

Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 12.97 ft^2
Hydraulic radius = 1.273
Normal depth = infinite
Critical depth = 0.49 ft
Depth downstream = 2.59 ft
Bend loss = 0.01 ft
Depth upstream = 2.61 ft
Velocity = 0.74 ft/s
Flow profile = Horizontal

Grit 1 In Trough **378.63**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 20 ft
Channel width/diameter = 2 ft
Flow = 6.2 mgd
Downstream channel invert = 376.75
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 3.73 ft^2
Hydraulic radius = 0.651
Normal depth = infinite
Critical depth = 0.89 ft
Depth downstream = 1.86 ft
Bend loss = 0 ft
Depth upstream = 1.88 ft
Velocity = 2.58 ft/s
Flow profile = Horizontal

Grit 1 Dist Channel **378.66**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 14 ft
Channel width/diameter = 2.5 ft
Flow = 6.2 mgd
Downstream channel invert = 376.75
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 4.7 ft^2
Hydraulic radius = 0.751
Normal depth = infinite
Critical depth = 0.77 ft
Depth downstream = 1.88 ft
Bend loss = 0.03 ft
Depth upstream = 1.91 ft
Velocity = 2.04 ft/s

Section Description	**Water Surface Elevation**

Flow profile = Horizontal

Grit 2 Trough **378.59**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 20 ft
Channel width/diameter = 3 ft
Flow = 6.2 mgd
Downstream channel invert = 377.25
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 3.58 ft^2
Hydraulic radius = 0.665
Normal depth = infinite
Critical depth = 0.68 ft
Depth downstream = 1.18 ft
Bend loss = 0.14 ft
Depth upstream = 1.34 ft
Velocity = 2.7 ft/s
Flow profile = Horizontal

Grit 2 **378.61**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 15.71 ft
Channel width/diameter = 5 ft
Flow = 6.2 mgd
Downstream channel invert = 376
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 12.97 ft^2
Hydraulic radius = 1.273
Normal depth = infinite
Critical depth = 0.49 ft
Depth downstream = 2.59 ft
Bend loss = 0.01 ft
Depth upstream = 2.61 ft
Velocity = 0.74 ft/s
Flow profile = Horizontal

Grit 2 In Trough **378.63**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 20 ft
Channel width/diameter = 2 ft
Flow = 6.2 mgd
Downstream channel invert = 376.75

Section Description	Water Surface Elevation

Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 3.73 ft^2
Hydraulic radius = 0.651
Normal depth = infinite
Critical depth = 0.89 ft
Depth downstream = 1.86 ft
Bend loss = 0 ft
Depth upstream = 1.88 ft
Velocity = 2.58 ft/s
Flow profile = Horizontal

Grit 2 Dist Channel **378.66**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 14 ft
Channel width/diameter = 2.5 ft
Flow = 6.2 mgd
Downstream channel invert = 376.75
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 4.7 ft^2
Hydraulic radius = 0.751
Normal depth = infinite
Critical depth = 0.77 ft
Depth downstream = 1.88 ft
Bend loss = 0.03 ft
Depth upstream = 1.91 ft
Velocity = 2.04 ft/s
Flow profile = Horizontal

Grit Split **378.66**

User defined loss for flow split = 0 ft
Total flow through flow split = 12.4 mgd

Screen Union **378.66**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 0.01 ft
Channel width/diameter = 2.5 ft
Flow = 12.4 mgd
Downstream channel invert = 376.75
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 4.78 ft^2
Hydraulic radius = 0.756
Normal depth = infinite
Critical depth = 1.22 ft

Section Description	**Water Surface Elevation**
Depth downstream = 1.91 ft Bend loss = 0 ft Depth upstream = 1.91 ft Velocity = 4.01 ft/s Flow profile = Horizontal	
S1 E Channel	**378.67**
Channel shape = Rectangular Manning's 'n' = 0.013 Channel length = 12 ft Channel width/diameter = 3 ft Flow = 4.133 mgd Downstream channel invert = 376.75 Channel slope = 0 ft/ft Channel side slope = not applicable Area of flow = 5.74 ft^2 Hydraulic radius = 0.841 Normal depth = infinite Critical depth = 0.52 ft Depth downstream = 1.91 ft Bend loss = 0.01 ft Depth upstream = 1.92 ft Velocity = 1.11 ft/s Flow profile = Horizontal	
Screen 1 (est)	**378.98**
Theory used = Bernoulli Rack/screen invert = 376.75 Rack/screen width = 3 ft Flow through rack = 4.134 mgd Bar width = 0.31 in Bar spacing = 0.31 in Downstream depth = 1.92 ft Approach velocity = 0.96 ft/s Rack/screen head loss = 0.31 ft	
S1 I Channel	**378.98**
Channel shape = Rectangular Manning's 'n' = 0.013 Channel length = 8 ft Channel width/diameter = 3 ft Flow = 4.133 mgd Downstream channel invert = 376.75 Channel slope = 0 ft/ft Channel side slope = not applicable Area of flow = 6.69 ft^2 Hydraulic radius = 0.897	

Section Description	**Water Surface Elevation**

Normal depth = infinite
Critical depth = 0.52 ft
Depth downstream = 2.23 ft
Bend loss = 0 ft
Depth upstream = 2.23 ft
Velocity = 0.96 ft/s
Flow profile = Horizontal

S2 E Channel **378.67**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 12 ft
Channel width/diameter = 3 ft
Flow = 4.133 mgd
Downstream channel invert = 376.75
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 5.74 ft^2
Hydraulic radius = 0.841
Normal depth = infinite
Critical depth = 0.52 ft
Depth downstream = 1.91 ft
Bend loss = 0.01 ft
Depth upstream = 1.92 ft
Velocity = 1.11 ft/s
Flow profile = Horizontal

Screen 1 (est) **378.98**

Theory used = Bernoulli
Rack/screen invert = 376.75
Rack/screen width = 3 ft
Flow through rack = 4.133 mgd
Bar width = 0.31 in
Bar spacing = 0.31 in
Downstream depth = 1.92 ft
Approach velocity = 0.96 ft/s
Rack/screen head loss = 0.31 ft

S2 I Channel **378.98**

Channel shape = Rectangular
Manning's 'n' = 0.013
Channel length = 8 ft
Channel width/diameter = 3 ft
Flow = 4.133 mgd
Downstream channel invert = 376.75
Channel slope = 0 ft/ft
Channel side slope = not applicable
Area of flow = 6.69 ft^2

Section Description	Water Surface Elevation
Hydraulic radius = 0.897 Normal depth = infinite Critical depth = 0.52 ft Depth downstream = 2.23 ft Bend loss = 0 ft Depth upstream = 2.23 ft Velocity = 0.96 ft/s Flow profile = Horizontal	
S3 E Channel	**378.67**
Channel shape = Rectangular Manning's 'n' = 0.013 Channel length = 12 ft Channel width/diameter = 3 ft Flow = 4.133 mgd Downstream channel invert = 376.75 Channel slope = 0 ft/ft Channel side slope = not applicable Area of flow = 5.74 ft^2 Hydraulic radius = 0.841 Normal depth = infinite Critical depth = 0.52 ft Depth downstream = 1.91 ft Bend loss = 0.01 ft Depth upstream = 1.92 ft Velocity = 1.11 ft/s Flow profile = Horizontal	
Screen 1 (est)	**378.98**
Theory used = Bernoulli Rack/screen invert = 376.75 Rack/screen width = 3 ft Flow through rack = 4.133 mgd Bar width = 0.31 in Bar spacing = 0.31 in Downstream depth = 1.92 ft Approach velocity = 0.96 ft/s Rack/screen head loss = 0.31 ft	
S3 I Channel	**378.98**
Channel shape = Rectangular Manning's 'n' = 0.013 Channel length = 8 ft Channel width/diameter = 3 ft Flow = 4.133 mgd Downstream channel invert = 376.75 Channel slope = 0 ft/ft	

Section Description	Water Surface Elevation
Channel side slope = not applicable	
Area of flow = 6.69 ft^2	
Hydraulic radius = 0.897	
Normal depth = infinite	
Critical depth = 0.52 ft	
Depth downstream = 2.23 ft	
Bend loss = 0 ft	
Depth upstream = 2.23 ft	
Velocity = 0.96 ft/s	
Flow profile = Horizontal	
Screen Split	**378.98**
User defined loss for flow split = 0 ft	
Total flow through flow split = 12.4 mgd	
SE WYE 1	**365.36**
Main line diameter = 42 in	
Branch diameter = 42 in	
Main line flow = 4.8 mgd	
Branch flow = 4.8 mgd	
Tee head loss = 0 ft	
SE RED 1	**365.36**
Diameter of smaller pipe = 36 in	
Diameter of larger pipe = 42 in	
Flow through pipe = 6.2 mgd	
Transition angle = 10 degrees	
Overall head loss = 0 ft	
Transition K value = 0.02	
Area of smaller pipe = 7.07 ft^2	
Area of larger pipe = 9.62 ft^2	
Velocity in smaller pipe = 2.57 ft/s	
Velocity in larger pipe = 1.89 ft/s	
Overall head loss = 0 ft	
SE 1	**365.38**
Pipe shape = Circular	
Diameter = 36 in	
Length = 40 ft	
Flow = 6.2 mgd	
Friction method = Hazen Williams	
Friction factor = 110	
Total fitting K value = 0.4	
Pipe area = 7.07 ft^2	
Pipe hydraulic radius = 0.75	
Age factor = 1	
Solids factor = 1	
Velocity = 1.36 ft/s	

Section Description	Water Surface Elevation
Friction loss = 0.01 ft Fitting loss = 0.01 ft Total loss = 0.02 ft	
SC 1 Launder	**365.78**
Launder invert = 364.4 Launder length = 145.3 ft Launder width = 2.5 ft Launder slope = 0 ft/ft Flow through launder = 6.2 mgd Critical depth = 0.77 ft Downstream depth = 0.98 ft Upstream depth = 1.38 ft	
SC1 Vnotch	**366.78**
Invert of V notch = 366.6 Angle of V notch = 90 degrees Number of notches = 278 Total flow over weir = 6.2 mgd Weir submergence = unsubmerged Head over weir = 0.18 ft	
SC1 Ports	**367.19**
Opening type = rectangular orifice Opening diameter/width = 12 in Opening height = 18 in Invert = 365 Number of openings = 4 Flow through opening(s) = 12.4 mgd Total area of opening(s) = 6 ft^2 Velocity through opening(s) = 3.2 ft/s Flow behavior = orifice, downstream control Orifice loss = 0.41 ft Downstream water level = 366.78 Upstream water level = 367.19	
ABE1	**367.5**
Pipe shape = Circular Diameter = 36 in Length = 181.5 ft Flow = 12.4 mgd Friction method = Hazen Williams Friction factor = 110 Total fitting K value = 1.3 Pipe area = 7.07 ft^2 Pipe hydraulic radius = 0.75 Age factor = 1 Solids factor = 1	

Section Description	**Water Surface Elevation**
Velocity = 2.71 ft/s Friction loss = 0.16 ft Fitting loss = 0.15 ft Total loss = 0.31 ft	

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APPENDIX 4-3

Appendix 4-3

Outfall Hydraulic Analysis

This memorandum presents the methodology and results of the existing Wastewater Treatment Plant (WWTP) outfall hydraulic analysis.

4-3.1 Existing Outfall

The City of Pasco's (City) existing outfall system leaves the WWTP's Ultraviolet (UV) Disinfection Building and proceeds west to a manhole in Grey Avenue. It then follows a southerly line, defined by Grey Avenue, continuing approximately 900 feet offshore from the north bank of the Columbia River, and terminates at a diffuser approximately 20 feet below the water surface. The outfall has three 8-inch diameter diffuser ports and is 50 feet long. The orientation of the outfall system is shown in **Figure 4-3.1**. Design drawings for the diffuser are included in **Attachment 4-3.1**.

4-3.2 Capacity Analysis

Hydraulic modeling of the outfall system's diffuser, open channel pipes, and pressure pipes utilized InfoSWMM to simulate flow scenarios and identify areas of hydraulic concern. InfoSWMM utilizes a traditional method for analyzing water surface profiles. Specifically, a downstream control point is established, enabling calculation of the hydraulic profile upstream of that control point. Hand calculations and field observations were then used to further refine and verify the likely hydraulic conditions.

Previous studies of the outfall by Murraysmith did not have access to the outfall design drawings or survey verification of outfall piping inverts and manhole rims. For this study, the model was updated using outfall design drawings and field surveyed manhole rims and invert measurements provided by the City. City staff also supported an outfall calibration attempt by collecting water surface elevations on the Columbia River and within the "Missing Manhole" (see **Figure 4-3.1)** at approximately 8 mgd of outfall flow. The water surface in the manhole at this flow was determined to be in a free-flowing open channel condition. Based on this, it could only be determined that the downstream pipe and diffuser losses where not larger than modeled.

The analysis was completed using both "normal" and "highwater" conditions of the Columbia River McNary Pool. The normal pool elevation of the McNary Pool is 340 feet and was used for the "normal" condition in the modelling. The recorded maximum water surface elevation (343.71 feet) at the nearest United States Geological Survey monitoring location (12514500) was used for "highwater" model condition.

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CITY OF PASCO

Wastewater Treatment Plant Facility Plan

DRAFT

Figure 4-3.1
Outfall

April 2018 16-1916

To complete the analysis, the hydraulic grade line profiles were generated for multiple flow rates. Observed deficiencies included submergence of the effluent flowmeter weir, loss of containment (e.g. manhole overflow), and UV Disinfection System lamp ballast submergence. When manholes or channels were determined to overflow, they were sealed in the model to contain the flow and the hydraulic analysis continued. The next deficient location was determined and documented until each component of the outfall was deficient. This analysis was completed for the existing outfall system and a set of potential improvements.

4-3.3 Hydraulic Analysis Results

The hydraulic analysis results are summarized in the Table 4-3.1 and Table 4-3.2. These tables provide the flow at which point a deficiency occurs, the deficiency location, and what is occurring. Hydraulic grade profiles for each analysis shown in Table 4-3.1 and Table 4-3.2 are included in Attachment 4-3.2.

4-3.4 Outfall Improvements

The outfall needs improvement within the planning horizon of the WWTP Facility Plan. To be able to pass the flows shown in Table 4-4 of Section 4 Future Conditions and Future Wastewater Flow Projection, a major outfall system upgrade project is needed. This will include replacement of the diffuser and outfall piping to increase the capacity to more than double the current capacity.

Since design, permitting and construction of a complete outfall system upgrade may not be feasible before near-term deficiencies occur, breaking the improvements into smaller steps was explored. One possible sequence of steps is summarized in Table 4-3.1 and Table 4-3.2.

The first step includes replacing the effluent weir and flume with a submerged magmeter. This project will decrease headloss in the upper portion of the outfall and provide reliable flow metering, particularly at higher flows. The next incremental step has been separated into two sub-steps since what proceeds first will depend on permitting, project budgeting, and concept feasibility. Step 2a is to construct two additional risers and ports on the diffuser in the Columbia River to reduce headloss and gain capacity. Step 2b is to construct a new larger pipeline from manhole JCT-30 (in Grey Avenue) to near the Columbia River's edge to also reduce headloss and gain capacity. The last outfall project component is to replace the remainder of the pipeline in the Columbia River with a larger pipe.

In the modelling of these steps, the upsized pipeline was assumed the same diameter (42-inch) as the pipeline from the UV Disinfection Building to the manhole in Grey Avenue. Due to the increased slope possible on the upsized line, a reduction down to a 36-inch diameter is likely. The final step upsizes the remainder of the pipeline in the river and assumes the existing step 2a modified outfall is maintained. Based on constructability and river mixing constraints, the installation of a new outfall diffuser should be assumed necessary. The installation of two additional ports on the existing diffuser was only modelled to show a means of providing short-term hydraulic capacity gains, but was not modeled for mixing adequacy.

Table 4-3.1
Outfall Hydraulic Summary at "Normal" Columbia River Water Surface Elevation

Deficiency Location	Deficiency Description	Existing Outfall Normal Operation Flow (mgd)	Improved Outfall Step 1: Improve Flow Metering	Step 2a: Add two ports on diffuser (mgd)	Step 2b: New pipe onland (mgd)	Complete Step 2: Combo Step 2a and 2b (mgd)	Step 3: New pipe in river (mgd)
JCT-32 "Effluent Flow Meter Manhole"	Effluent weir submerged	11.0	>23.0	>23.0	>23.0	>23.0	>23.0
JCT-28 "Missing manhole"	Water overflowing from manhole	12.0	12.0	16.0	13.0	16.0	>23.0
UV Building	UV modules submerged	13.0	13.0	15.0	16.0	19.0	>23.0
UV Building	Water overflowing from channels	14.0	14.0	16.0	17.0	21.0	>23.0
JCT-30 "Manhole in Grays"	Water overflowing from manhole	14.5	14.5	17.0	18.0	22.0	>23.0

Table 4-3.2
Outfall Hydraulic Summary at "High Water" Columbia River Water Surface Elevation

Deficiency Location	Deficiency Description	Existing Outfall Highwater Operation Flow (mgd)	Improved Outfall				
			Step 1: Improve Flow Metering	Step 2a: Add two ports on diffuser (mgd)	Step 2b: New pipe onland (mgd)	Complete Step 2: Combo Step 2a and 2b (mgd)	Step 3: New pipe in river (mgd)
JCT-32 "Effluent Flow Meter Manhole"	Effluent weir submerged	11.0	>23.0	>23.0	>23.0	>23.0	>23.0
JCT-28 "Missing manhole"	Water overflowing from manhole	10.5	10.5	13.0	12.0	14.0	>23.0
UV Building	UV modules submerged	11.5	11.5	14.0	14.0	18.0	>23.0
UV Building	Water overflowing from channels	13.0	13.0	16.0	16.0	20.0	>23.0
JCT-30 "Manhole in Grays"	Water overflowing from manhole	13.5	13.5	17.0	17.0	21.0	>23.0

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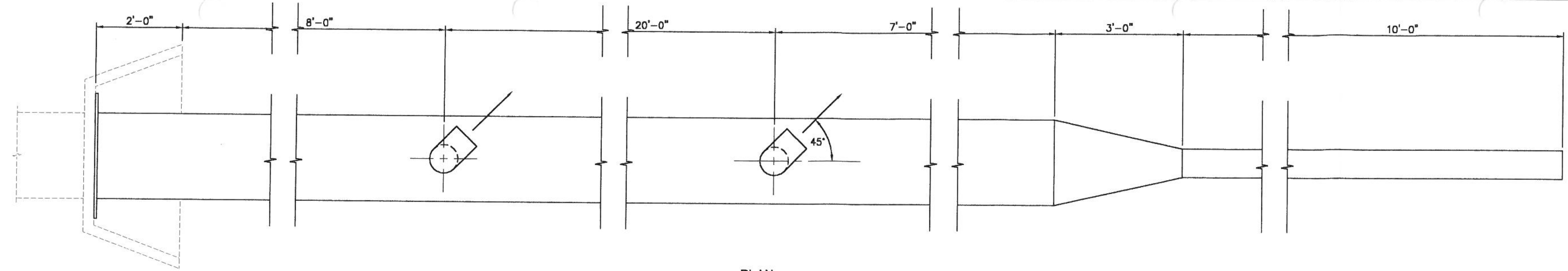
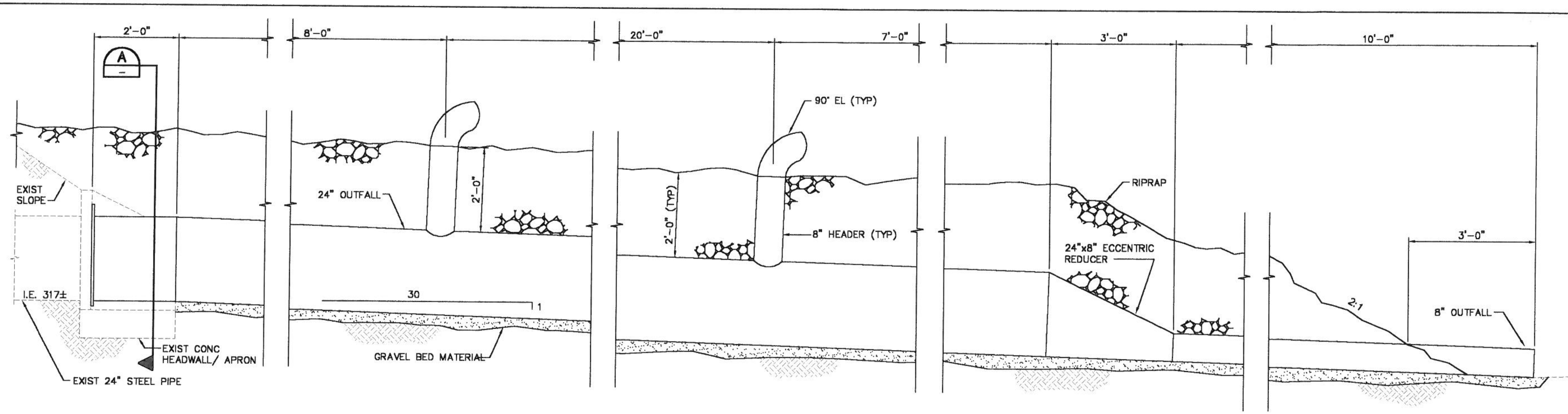
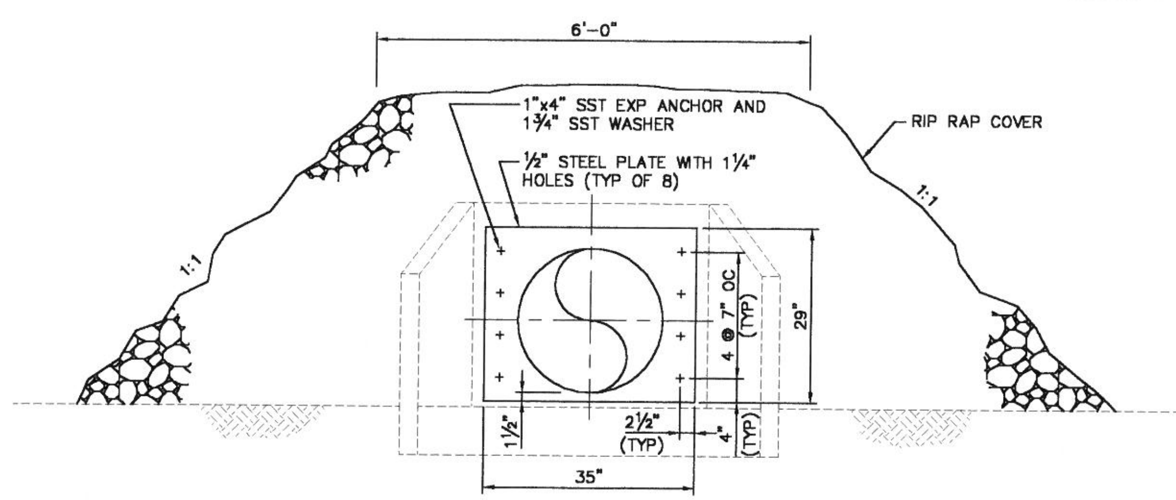
ATTACHMENT 4-3.1



PLAN
24" OUTFALL
SCALE: 3/4" = 1'-0"



PROFILE
24" OUTFALL
SCALE: 3/4" = 1'-0"



SECTION A
SCALE: 3/4" = 1'-0"

PIPE FABRICATION NOTES

1. PIPE AND FITTING MATERIAL SHALL BE STEEL CONFORMING TO AWWA STEEL PIPE MANUAL.
2. PIPE SHALL BE 1/4" THICK WALL. WALL ATTACHMENT PLATE SHALL BE 1/2" THICK.
3. PROVIDE 30-MIL COATING OF COAL TAR EPOXY AFTER FABRICATION, INSIDE & OUTSIDE OF PIPE.
4. ALL PIPE AND FITTING CONNECTIONS SHALL BE WELDED. PIPE SHALL BE WELDED TO STEEL PLATE.
5. WELDS TO CONFORM WITH AWS CODE.
6. PIPE SHALL BE FABRICATED AND DELIVERED TO THE SITE IN ONE PIECE.

PIPE INSTALLATION NOTES

1. REMOVE ALL ROCKS AND DEBRIS, PROVIDE UNIFORM GRADE BENEATH PIPE.
2. PIPE BED MATERIAL SHALL BE CLEAN 3/4" MINUS CHIPPED GRAVEL WITH NO MORE THAN 5% BY WEIGHT RETAINED ON A 1/4" SIEVE. GRAVEL SHALL BE PLACED UNDER AND AROUND PIPE TO FILL VOIDS AND PROVIDE ADEQUATE SUPPORT.
3. PLACEMENT OF RIPRAP SHALL AVOID DAMAGE TO THE PIPE, FITTINGS, AND HEADWALL, AND SHALL BE PLACED SO BE PLACED SO AS TO PREVENT TURBIDITY FROM THE RIVER BED.
4. RIP RAP D_{50}=12" ANGULAR
5. DURING CONSTRUCTION DISTURBANCE TO SURROUNDING AREAS SHALL BE KEPT TO A MINIMUM.
6. PIPE SHALL BE INSPECTED BY ENGINEER PRIOR TO BEING PLACED IN THE RIVER.
7. PROVIDE PHOTO DOCUMENTATION DURING INSTALLATION MILESTONES:
   A. SUBGRADE PREPARATION
   B. PIPELINE INSTALLATION
   C. PIPELINE BEDDING
   D. RIP RAP PLACEMENT
   E. FINAL COMPLETION

HDR
HDR Engineering, Inc.

PROJECT MANAGER	AHK
DESIGNED	YM
DRAWN	RC
CHECKED	AHK
PROJECT NUMBER	07568-026-002-05
DATE	JUNE 1997

THIS LINE IS ONE INCH WHEN DRAWING IS FULL SIZE. IF NOT ONE INCH, SCALE ACCORDINGLY.

NO	BY	DESCRIPTION

ANTHONY H. KRUSCHKE
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
EXPIRES 05/31/98

CITY OF PASCO

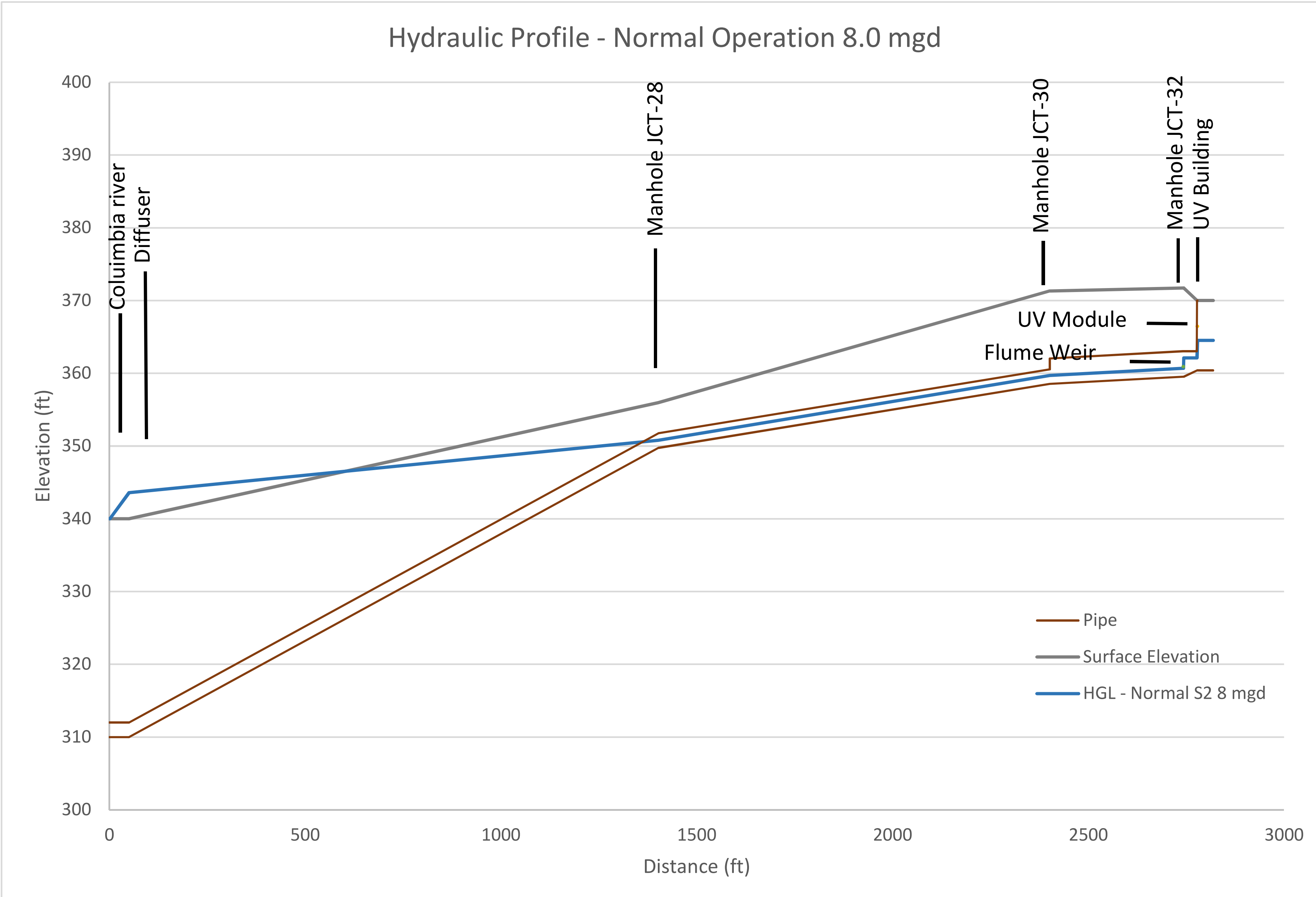
WASTE WATER TREATMENT PLANT OUTFALL REHABILITATION

OUTFALL PLAN, PROFILE AND SECTION

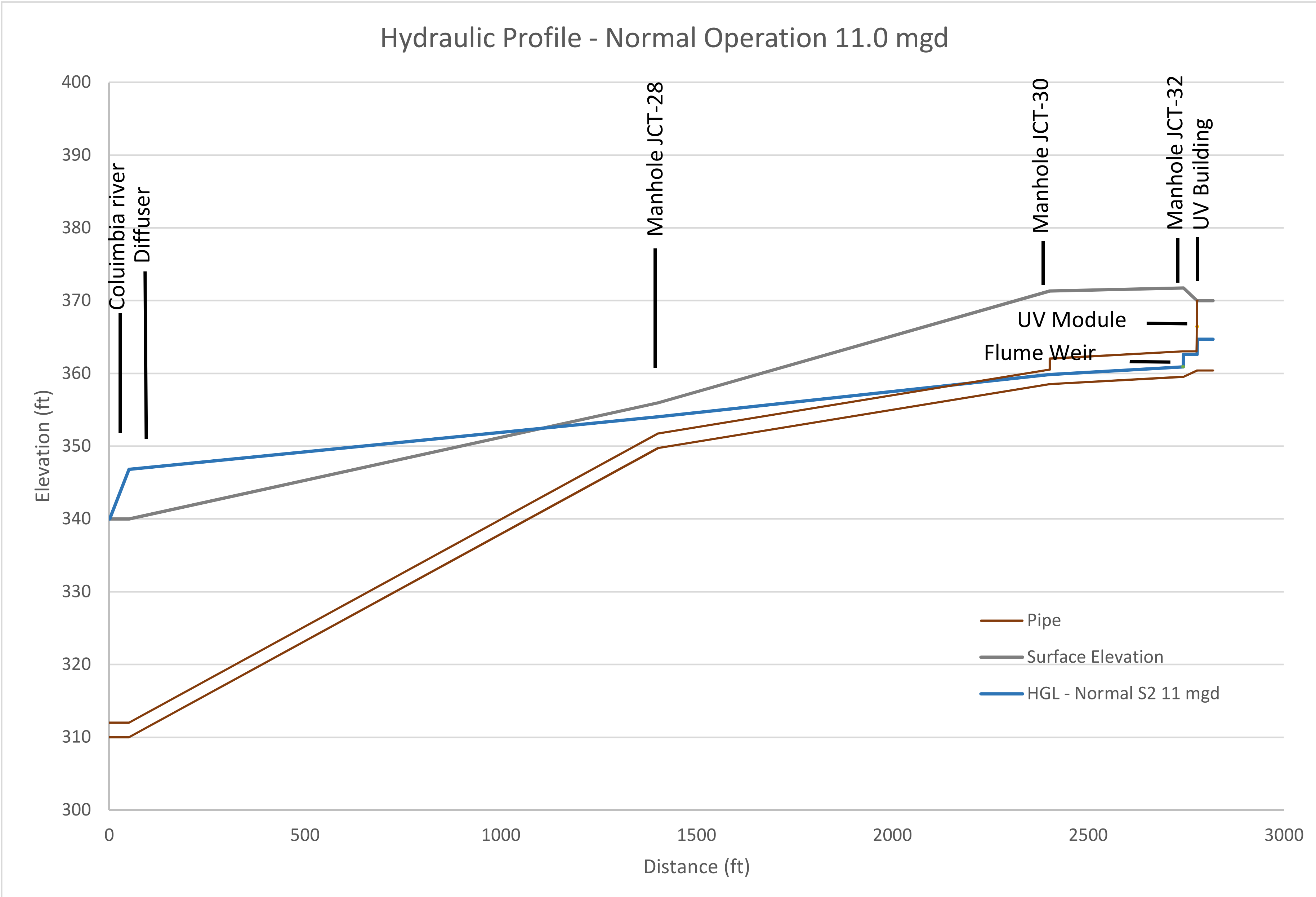
DRAWING NUMBER
1

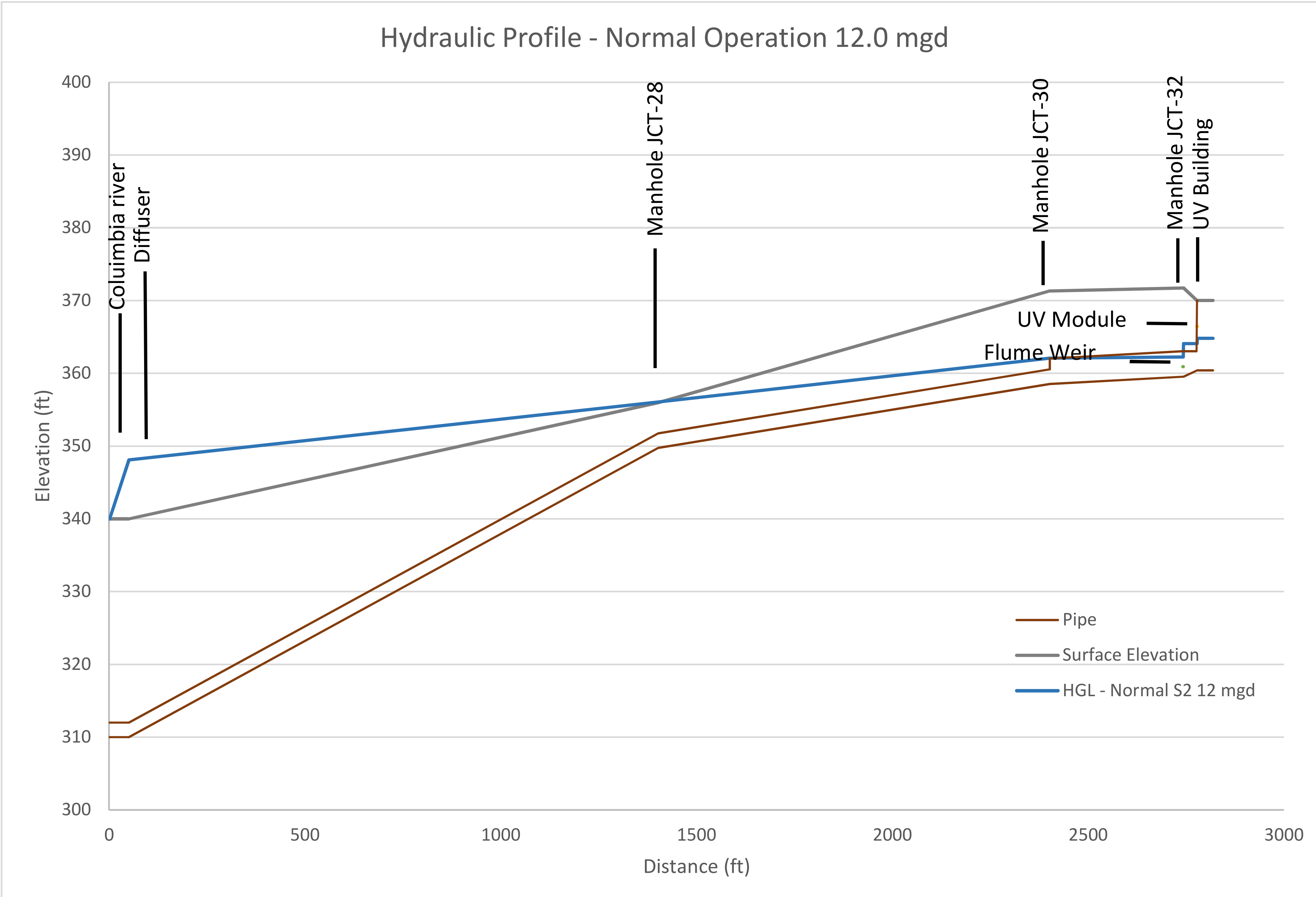
06/20/97
OUTFALL.DWG

ATTACHMENT 4-3.2

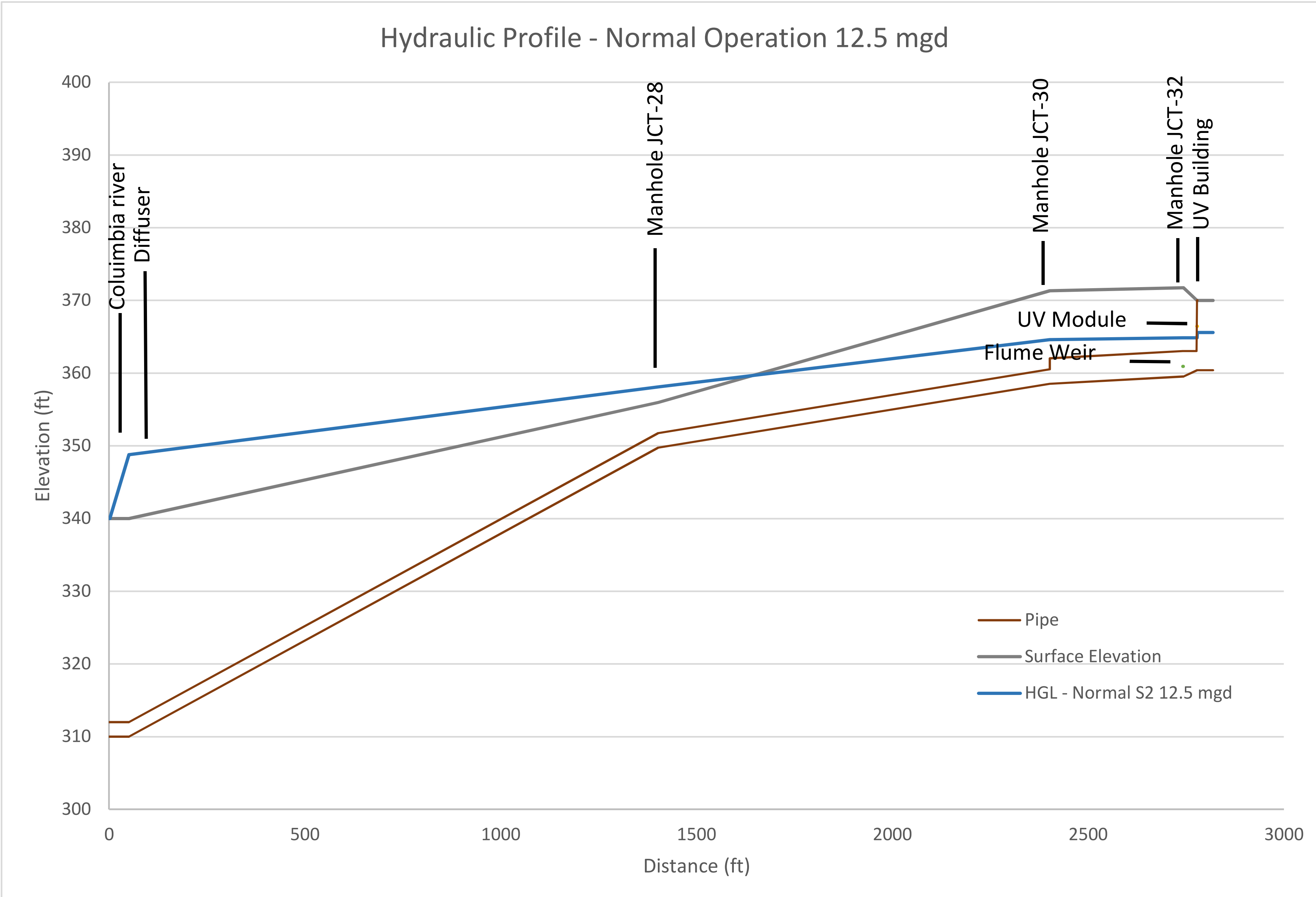


Hydraulic Profile - Normal Operation 8.0 mgd
Columbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Pipe
Surface Elevation
HGL - Normal S2 8 mgd

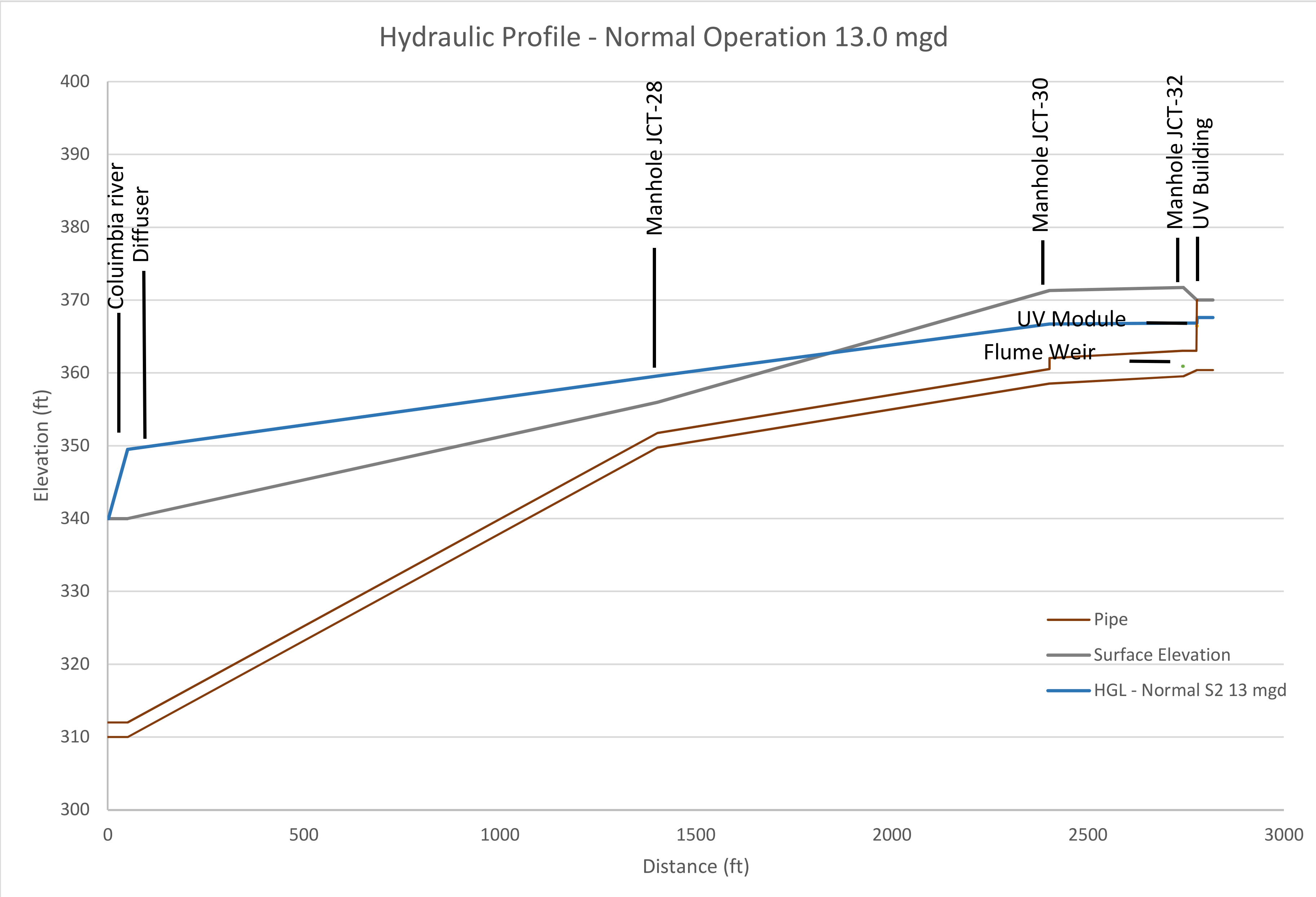

Hydraulic Profile - Normal Operation 11.0 mgd
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - Normal S2 11 mgd



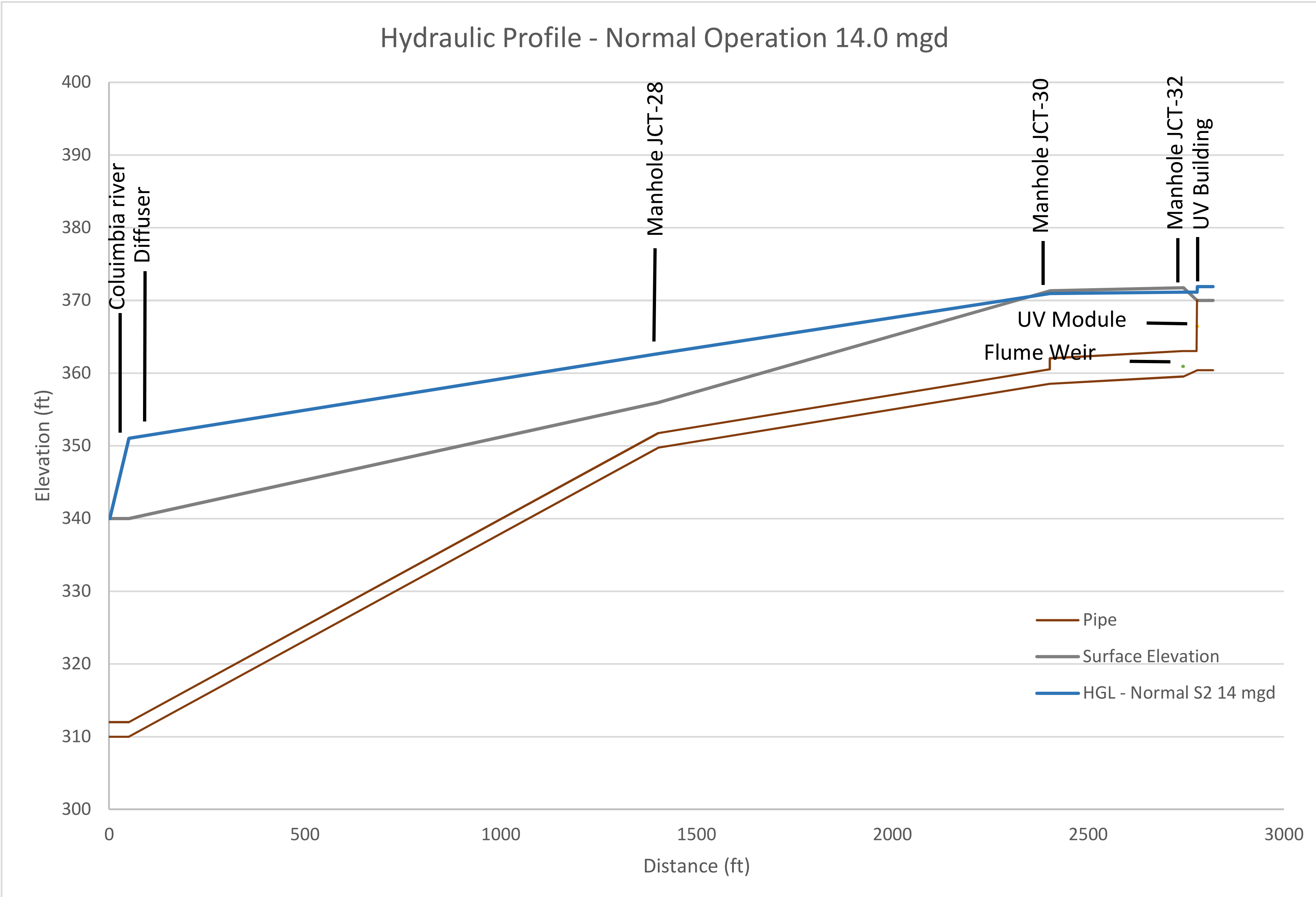
Hydraulic Profile - Normal Operation 12.0 mgd
Elevation (ft)
Distance (ft)
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - Normal S2 12 mgd
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000

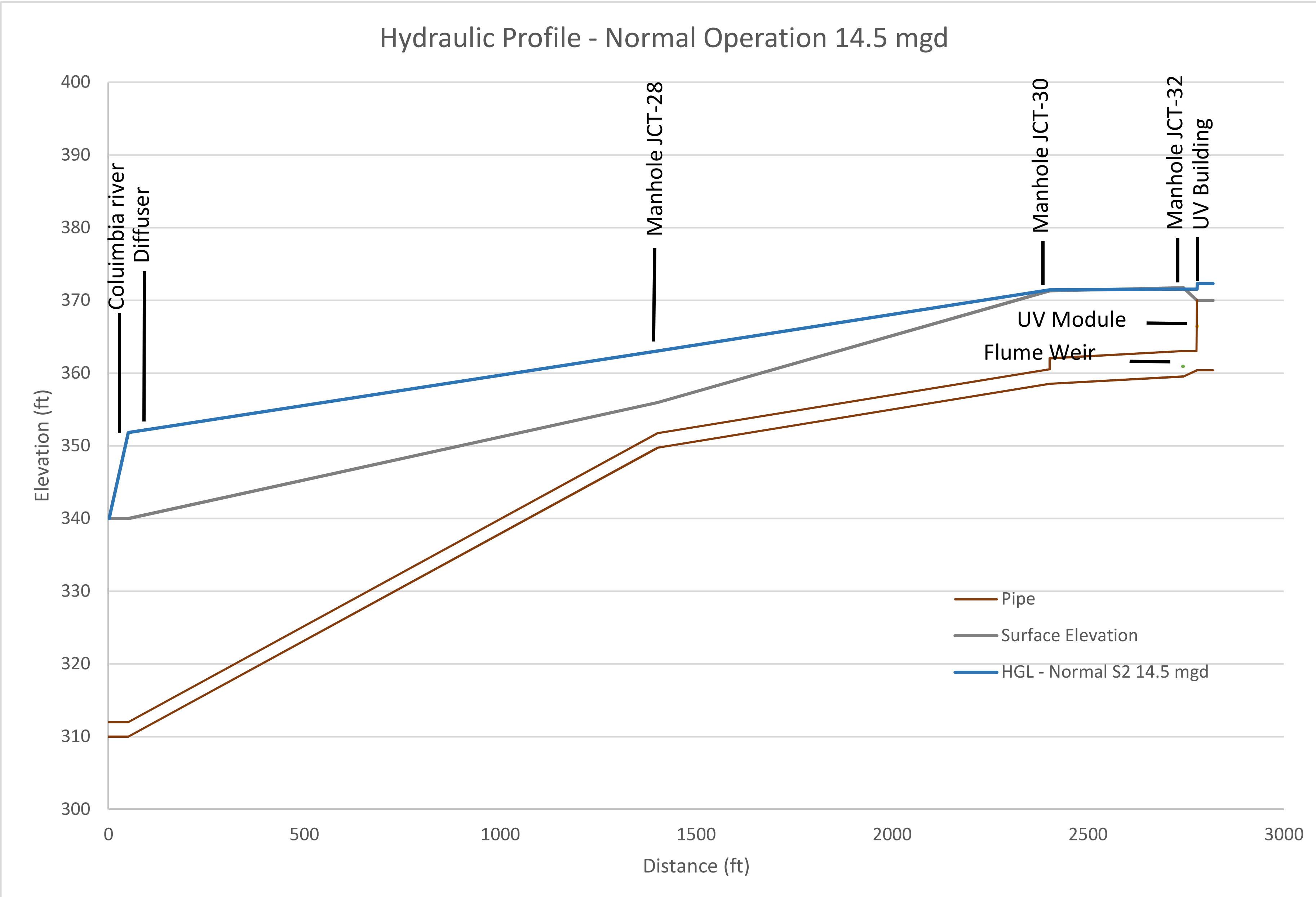


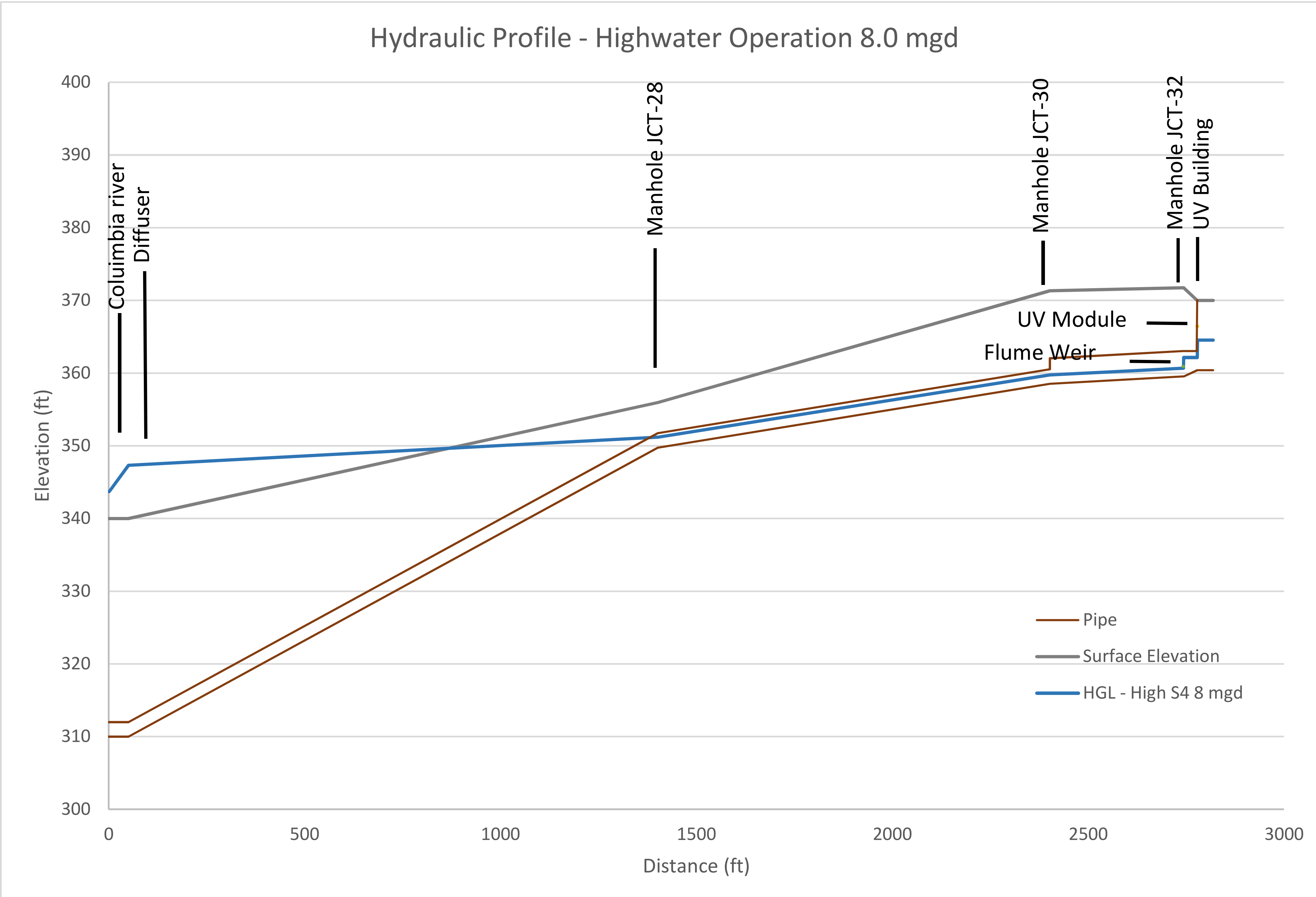
Hydraulic Profile - Normal Operation 12.5 mgd
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - Normal S2 12.5 mgd



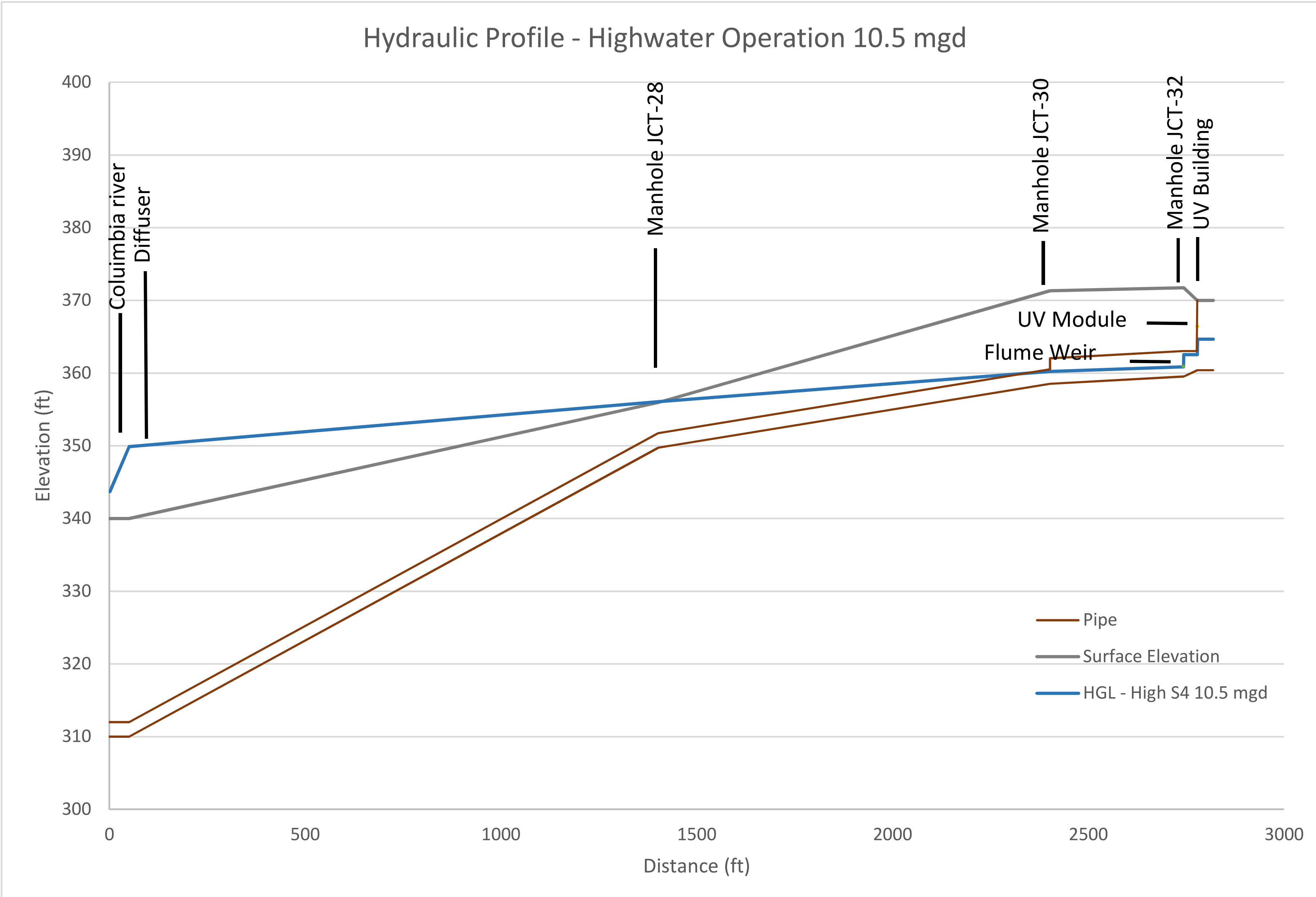
Hydraulic Profile - Normal Operation 13.0 mgd
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - Normal S2 13 mgd


Hydraulic Profile - Normal Operation 14.0 mgd
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - Normal S2 14 mgd


Hydraulic Profile - Normal Operation 14.5 mgd
400
390
380
370
360
350
340
330
320
310
300
Elevation (ft)
0
500
1000
1500
2000
2500
3000
Distance (ft)
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - Normal S2 14.5 mgd



Hydraulic Profile - Highwater Operation 8.0 mgd
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Elevation (ft)
Distance (ft)
Pipe
Surface Elevation
HGL - High S4 8 mgd
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000



Hydraulic Profile - Highwater Operation 10.5 mgd
Columbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - High S4 10.5 mgd
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
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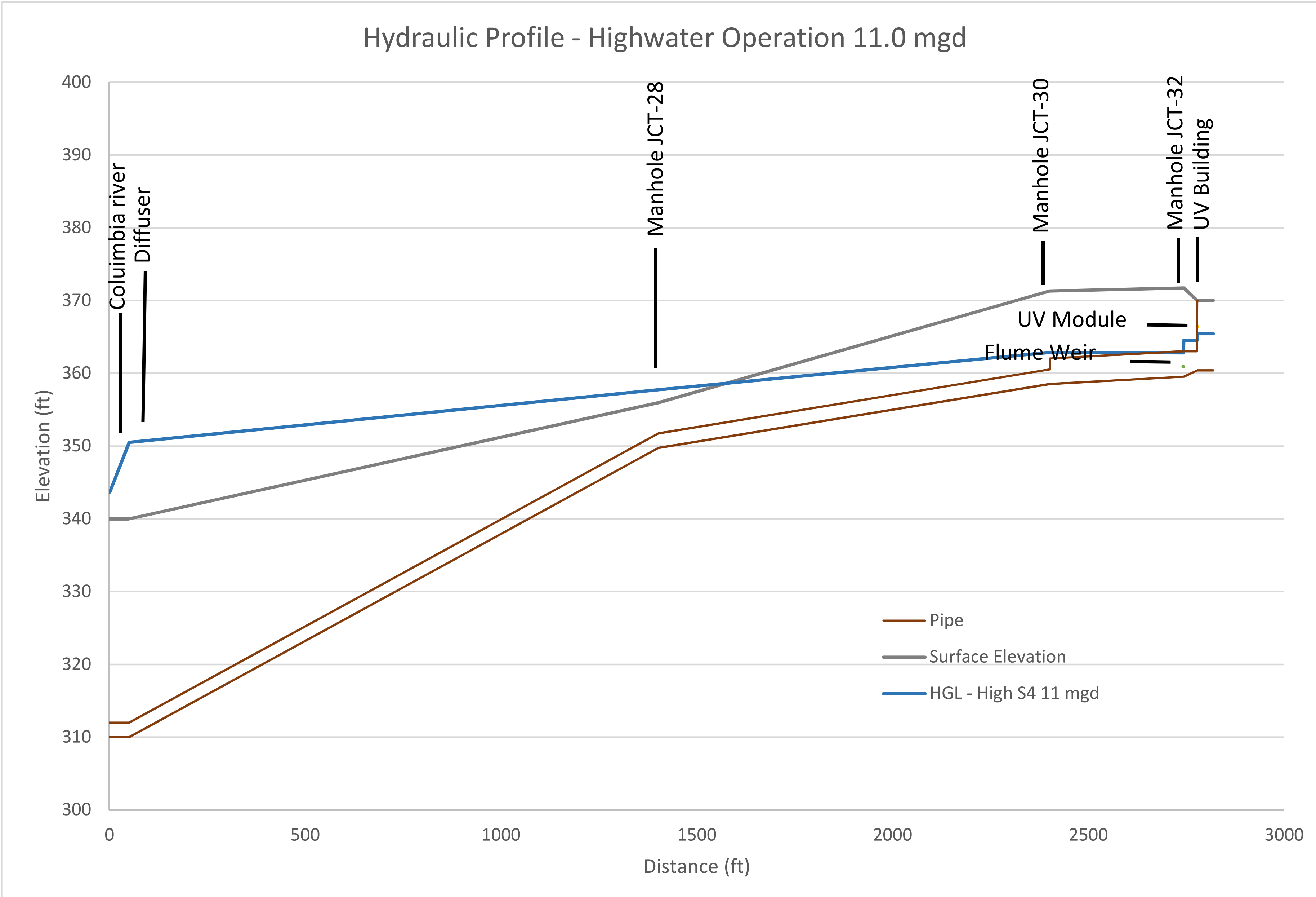
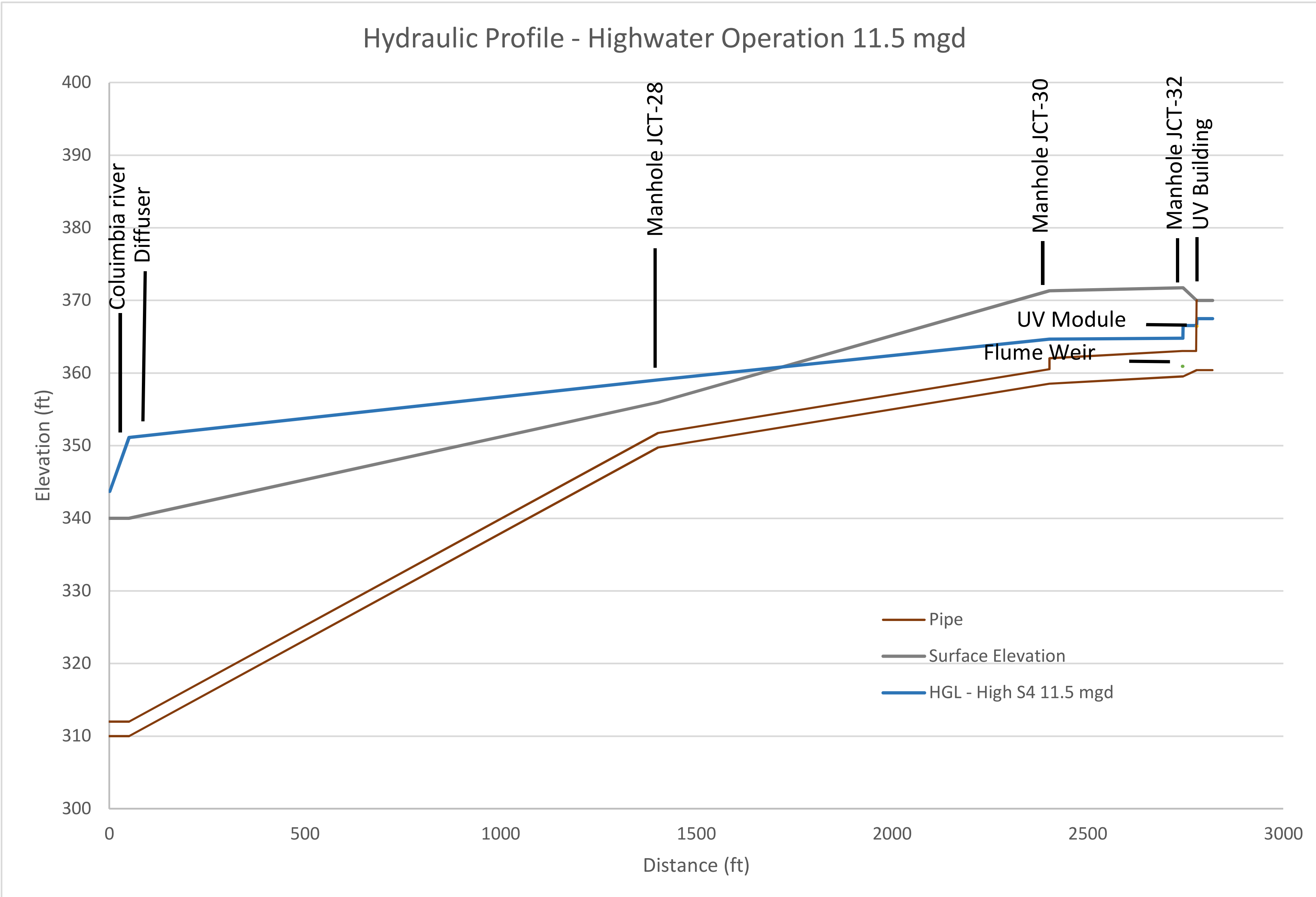
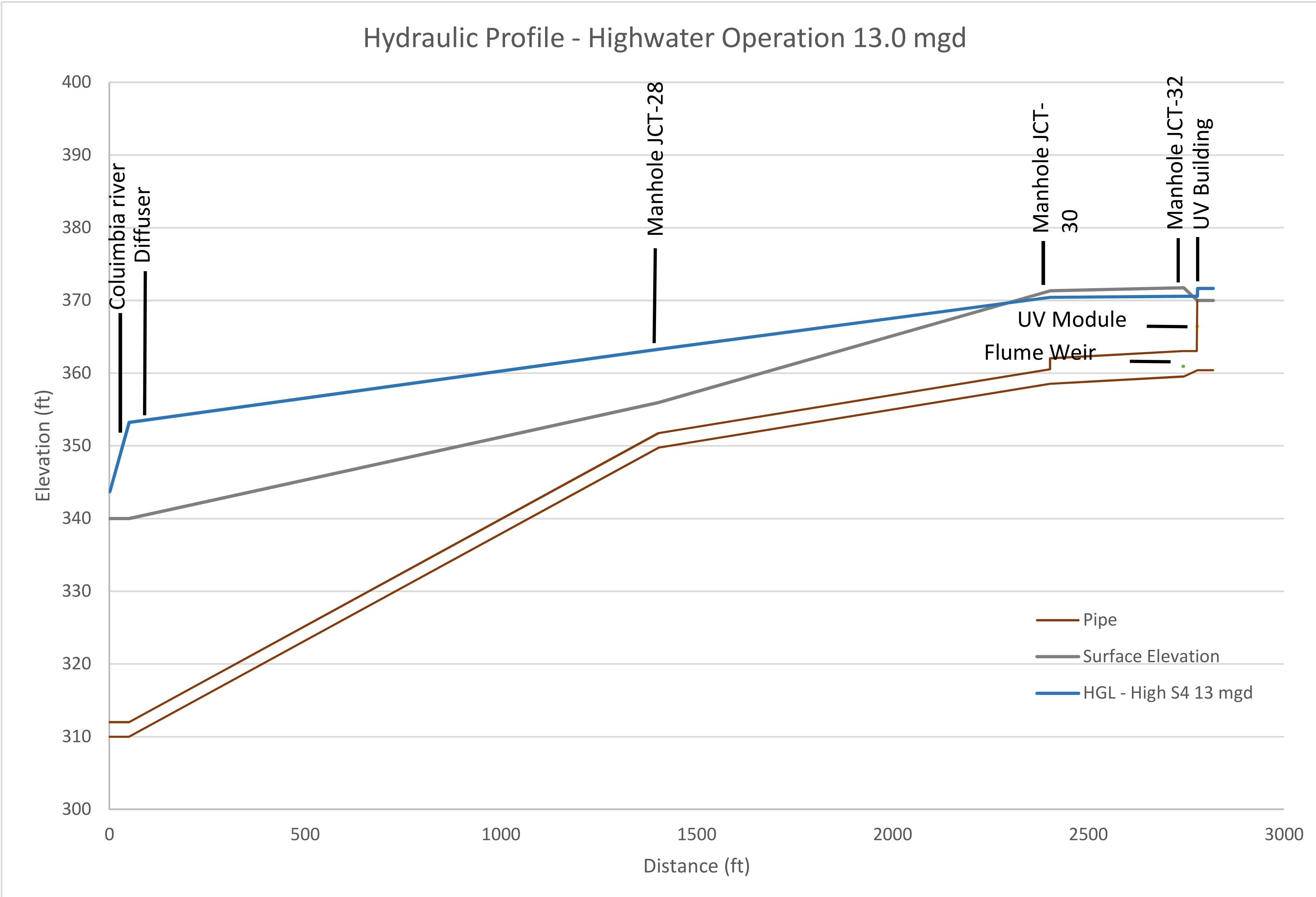
2500
3000

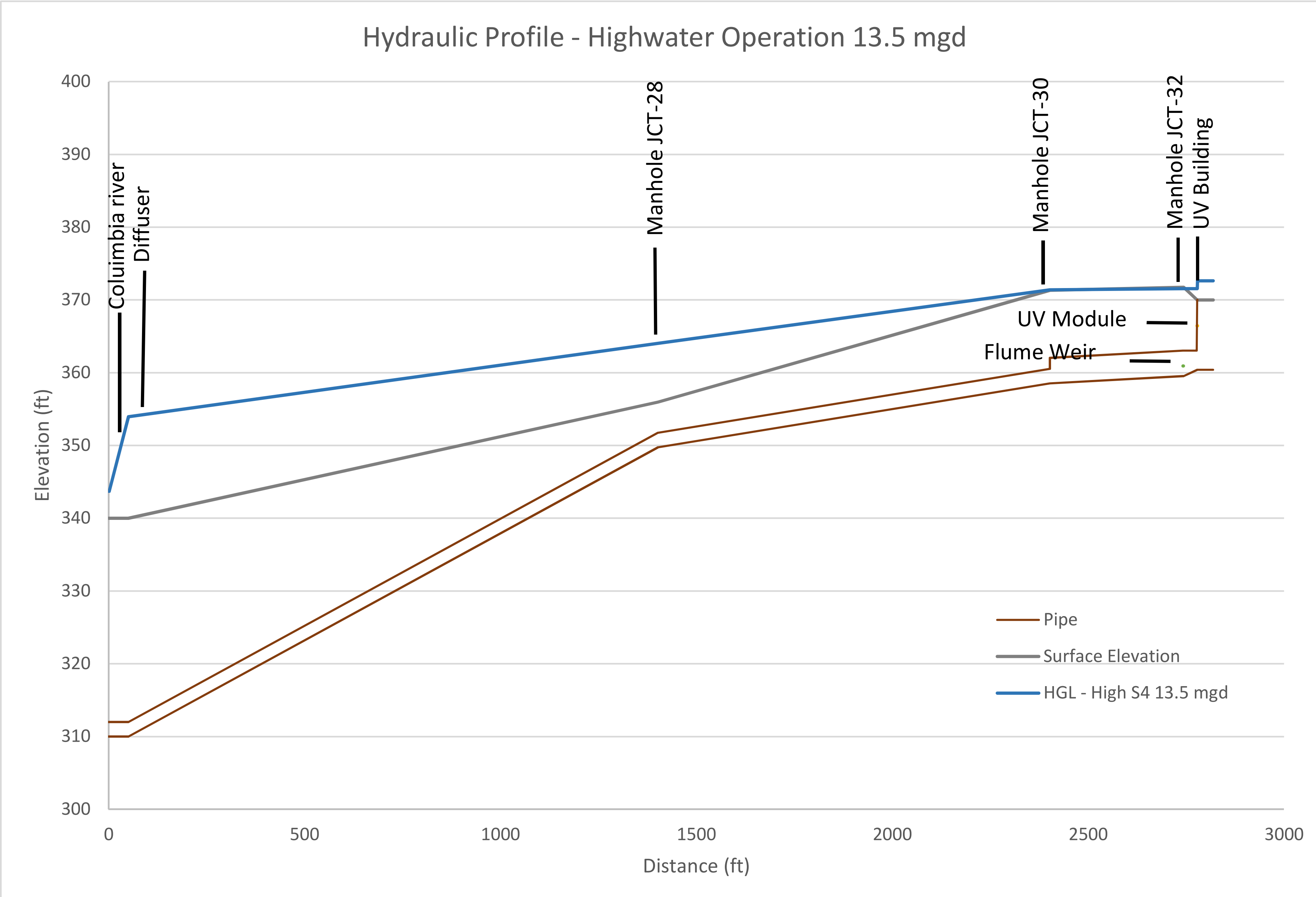

Hydraulic Profile - Highwater Operation 11.0 mgd
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Pipe
Surface Elevation
HGL - High S4 11 mgd



Hydraulic Profile - Highwater Operation 11.5 mgd
400
390
380
370
360
350
340
330
320
310
300
Elevation (ft)
0
500
1000
1500
2000
2500
3000
Distance (ft)
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Pipe
Surface Elevation
HGL - High S4 11.5 mgd



Hydraulic Profile - Highwater Operation 13.0 mgd
Coluimbia river
Diffuser
Manhole JCT-28
Manhole JCT-
30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Pipe
Surface Elevation
HGL - High S4 13 mgd



Hydraulic Profile - Highwater Operation 13.5 mgd
Columbia river
Diffuser
Manhole JCT-28
Manhole JCT-30
Manhole JCT-32
UV Building
UV Module
Flume Weir
Elevation (ft)
Distance (ft)
400
390
380
370
360
350
340
330
320
310
300
0
500
1000
1500
2000
2500
3000
Pipe
Surface Elevation
HGL - High S4 13.5 mgd

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2019 Wastewater Treatment Plant Facility Plan

City of Pasco Washington

Appendices Volume 2 of 2

JULY 2019

Table of Contents

3. Existing Conditions – Treatment Facilities

4. Existing Capacity Analysis

5. Future Conditions

6. Liquid Stream Alternatives

7. Biosolids Handling Alternatives

8. Project Implementation

Figures

Tables

Appendices

References

AACE International Recommended Practice No. 56R-08 Cost Estimate Classification System - As Applied for the Building and General Construction Industries - TCM Framework: 7.3 - Cost Estimating and Budgeting Rev. December 31, 2011

City of Pasco, City of Pasco Comprehensive Sewer Plan, May 2014

Daigger, G.T. Development of Refined Clarifier Operating Diagrams Using an Updated Settling Characteristics Database; 1995

Daigger G.T., Roper R.E.; The Relationship Between SVI and Activated Sludge Settling Characteristics, 1985

HDR, Primary Clarifier Performance Testing, February 2018

Metcalf & Eddy, *Wastewater Engineering: Treatment and Resource Recovery*. McGraw-Hill, 2017

NPDES Waste discharge permit No. WA-004496

State of Washington Department of Ecology; Criteria for Sewage Works Design (Orange Book); August 2008

State of Washington Department of Ecology; Water Quality Permitting and Reporting Information System (Paris); Pasco WWTP Facility Summary: https://apps.ecology.wa.gov/paris/FacilitySummary.aspx?FacilityId=23413, August 2018

Water Environment Federation, Design of Water Resource Recovery Facilities, WEF Manual of Practice No. 8, 5th Ed., 2010

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APPENDIX 5-1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
WATER AND
WATERSHEDS

NOV 1 5 2016

Ms. Maia Bellon, Director
Department of Ecology
Post Office Box 47600
Olympia, Washington 98504-7600

Re: EPA's Partial Approval/Partial Disapproval of Washington's Human Health Water Quality Criteria and Implementation Tools

Dear Ms. Bellon:

The Environmental Protection Agency has completed its Clean Water Act review of the new and revised water quality standards (WQS) that the Department of Ecology (Ecology) submitted to the EPA on August 1, 2016. The EPA values the leadership that Washington has shown in completing its development and adoption of human health criteria for toxics. The EPA recognizes that Ecology developed this rule after engaging in an extensive public process spanning several years, and worked collaboratively with EPA, tribes, and key stakeholders throughout the process. The EPA also acknowledges the importance of strategies for reasonably implementing these water quality criteria in Clean Water Act programs and is committed to continue working with Ecology and others on implementation over the long-term.

Under CWA section 303(c), 33 U.S.C. 1313(c), and the EPA's implementing regulations at 40 CFR 131.4, states have the primary responsibility for reviewing, establishing, and revising WQS, which include the designated uses of a waterbody or waterbody segment and the water quality criteria necessary to protect those designated uses. CWA section 303(c) also requires states to submit new or revised WQS to EPA for review, as the EPA must ensure that those WQS are consistent with the CWA and EPA's implementing regulations.

The new and revised WQS are located in the Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC):

- Human Health Criteria and Other Narrative Revisions (WAC 173-201A-240)
- Variances (WAC 173-201A-420)
- Intake Credits (WAC 173-201A-460)
- Compliance Schedules (WAC 173-201A-510(4))
- Implementation Clarification for Combined Sewer Overflows (CSO) Treatment Plants (WAC 173-201A-510(6))

A summary of EPA's actions is provided below and further described in the enclosed *Technical Support Document for EPA's Partial Approval/Partial Disapproval of Washington's Human Health Water Quality Criteria and Implementation Tools* (hereafter referred to as the TSD).

Summary of the EPA's Actions
The EPA initially established Washington's human health water quality criteria for toxic pollutants in the 1992 National Toxics Rule (NTR).[1] Ecology's August 1, 2016 submittal contains 192 new human health criteria for 97 priority pollutants that are applicable to all surface waters of the state. The EPA is taking action under CWA section 303(c) to approve in part, and disapprove in part, the human health criteria submitted by Washington. Specifically:

I. Pursuant to the EPA's authority under CWA section 303(c) and implementing regulations at 40 CFR Part 131, the EPA is approving the following:

- 45 human health criteria contained in Table 240
- Narrative revisions at WAC 173-201A-240, in part
- Revisions to the variance provision at WAC 173-201A-420, in part
- Revisions to the compliance schedule provision at WAC 173-201A-510(4), in part

II. Pursuant to the EPA's authority under CWA section 303(c) and implementing regulations at 40 CFR Part 131, the EPA is disapproving the following:

- 143 human health criteria contained in Table 240 and associated footnotes
- Narrative language at WAC 173-201A-240(3)
- Part of the variance provision at WAC 173-201A-420(5)(a)

The EPA is not taking action on the following because they are not WQS reviewable under CWA section 303(c):

- Certain footnotes to Table 240
- Narrative language at WAC 173-201A-240(4)
- New intake credit rule at WAC 173-201A-460
- New provision regarding implementation for CSO Treatment Plants at WAC 173-201A-510(6)

In addition, the EPA is taking no action under CWA section 303(c) at this time on four new human health criteria submitted by Ecology for two pollutants (thallium and 2,3,7,8-TCDD (dioxin)) and part of the compliance schedule provision at WAC 173-201A-510(4)(a)(i). Additional information and a detailed discussion of the rationale supporting all of the EPA's decisions is included in the enclosed TSD.

The EPA's Evaluation of Washington's New Human Health Criteria
In reviewing Washington's submittal, the EPA began by evaluating whether Washington's human health criteria are protective of Washington's applicable designated uses and based on sound scientific rationale, consistent with 40 CFR 131.11. It is important to note that while the EPA carefully considers

[1] The EPA. 1992. *Toxics Criteria for Those States Not Complying with Clean Water Act*, section 303(c)(2)(B). 40 CFR Part 131.36. http://water.epa.gov/lawsregs/rulesregs/ntr/. Amended in 1999 for PCBs. http://water.epa.gov/lawsregs/rulesregs/ntrfact.cfm.

the scientific defensibility and protectiveness of both the inputs used to derive criteria and the resulting criteria values, it is ultimately on the criteria values that EPA takes approval or disapproval action under CWA section 303(c). EPA evaluated Washington's criteria values against criteria that the EPA determined would be protective of the state's designated uses and scientifically defensible (e.g., based on appropriate bioaccumulation factors (BAFs) and protective relative source contribution (RSC) values of less than 1). In so doing, the EPA determined that there are instances where Washington's criteria are as stringent as or more stringent than criteria the EPA determined would be protective of the state's designated uses and scientifically defensible, using appropriate inputs. CWA section 510, 33 U.S.C. § 1370, preserves the authority of states to adopt more stringent standards than otherwise required by the CWA. Therefore, the EPA is approving Washington's criteria where they are as stringent as or more stringent than scientifically defensible criteria that the EPA determined would be protective of Washington's designated uses, consistent with CWA requirements and the EPA's implementing regulations, specifically 40 CFR 131.11.

Additionally, the EPA is approving most revisions to the narrative language at WAC 173-201A-240 (such as the new downstream waters provision), but is taking no action on one provision and disapproving one provision, which is further described in the enclosed TSD.

Under CWA section 303(c)(3) and the EPA's regulations at 40 CFR 131.21 and 131.22, if EPA disapproves a state or tribe's new or revised water quality standards, it must "specify the changes" necessary to meet the applicable requirements of the CWA and the EPA's regulations. A comprehensive summary of the EPA's actions and the specific changes necessary to address each disapproval are included in the TSD.

For the criteria that the EPA disapproved, concurrent with this action on Washington's submittal, the EPA is finalizing a federal rule for Washington containing 144 human health criteria in accordance with CWA section 303(c)(3) and (c)(4) requirements.[2] After the effective date of the final rule, those federal criteria will be in effect for CWA purposes along with the human health criteria that Washington adopted and the EPA is approving in this action. For reference, the EPA is also enclosing a table of the CWA-effective human health criteria applicable to Washington, which shows the Ecology criteria approved by the EPA and the EPA federally promulgated criteria. Washington continues to have the option to adopt and submit to the EPA human health criteria for the pollutants in the EPA's final federal rule, consistent with CWA section 303(c) and the EPA's implementing regulations at 40 CFR part 131.

The EPA's Evaluation of Washington's New and Revised Implementation Tools

Regarding the state's implementation tools, the EPA is approving Ecology's revisions to its variance provision and compliance schedule provision, in part. The EPA is disapproving WAC 173-201A-420(5)(a) of the variance provision since it conflicts with 40 CFR 131.14. EPA is not acting on WAC 173-201A-510(4)(a)(i) of the compliance schedule provision pertaining to aquatic life criteria at this time, since the EPA has yet to complete Endangered Species Act (ESA) consultation. The EPA is taking

[2] The EPA is promulgating a different number of human health criteria (144) than it is disapproving (143) in Ecology's 2016 submittal. Ecology did not adopt org only criteria for methylmercury or water + org and org only criteria for bis(2-chloro-1-methylethyl) ether. These are priority pollutants for which the EPA has 304(a) recommended criteria, and CWA section 303(c)(2)(B) requires that states adopt numeric criteria for these pollutants, as necessary to support the states' designated uses. Therefore, the EPA is including these three criteria in its final federal rule for Washington. The EPA's final federal rule, however, does not include revised water + org and org only criteria for arsenic, even though the EPA is disapproving the arsenic criteria in Ecology's submittal. Therefore, the existing water + org and org only arsenic criteria from the NTR (0.018 μg/L and 0.14 μg/L) will remain in effect.

no action on the remaining implementation tools (intake credit rule and CSO implementation clarification) since these provisions pertain to National Pollutant Discharge Elimination System (NPDES) implementation and are not new or revised WQS reviewable under CWA section 303(c). The state may use its approved implementation tools in concert with the approved new state criteria as well as the federal human health criteria applicable to Washington. The EPA recognizes the importance of implementation tools in making progress toward improved water quality while allowing a reasonable time for industry to comply with more stringent requirements, and remains committed to providing assistance to Ecology during implementation of the criteria.

Conclusion

As noted above, the EPA appreciates Ecology's significant efforts to update human health criteria for Washington waters over the last several years. The EPA's actions support key advances Ecology made to update the criteria based on regional and local data, such as the use of available tribal fish consumption surveys. At the same time, the EPA felt it was necessary to also adopt criteria based on the latest national criteria recommendations in the absence of a sufficient rationale for departing from those recommendations. The combination of the EPA-approved criteria from the state's rule and the criteria in the EPA's final federal rule set an appropriate level of protection for all Washington citizens, including tribal members with treaty-protected fishing rights. As stated previously, the EPA remains available to work closely with Ecology and others during implementation of the criteria.

We look forward to continuing our work together to protect Washington's water quality. If you have any questions or comments, please contact me at (206) 553-1855 or you may contact Angela Chung, the Water Quality Standards Unit Manager, at (206) 553-6511.

Sincerely,

Daniel D. Opalski, Director
Office of Water and Watersheds

Enclosures

cc: Mr. Kelly Susewind, Ecology
Ms. Heather Bartlett, Ecology
Ms. Melissa Gildersleeve, Ecology
Ms. Cheryl Niemi, Ecology

CWA-Effective Human Health Criteria Applicable to Washington

(shaded)	Ecology criteria approved by EPA
(unshaded)	EPA federally promulgated criteria

			CWA-Effective Criteria	
	Chemical	CAS Number	Water & Organisms (µg/L)	Organisms Only (µg/L)
1	1,1,1-Trichloroethane	71556	20000	50000
2	1,1,2,2-Tetrachloroethane	79345	0.1	0.3
3	1,1,2-Trichloroethane	79005	0.35	0.90
4	1,1-Dichloroethylene	75354	700	4000
5	1,2,4-Trichlorobenzene	120821	0.036	0.037
6	1,2-Dichlorobenzene	95501	700	800
7	1,2-Dichloroethane	107062	8.9	73
8	1,2-Dichloropropane	78875	0.71	3.1
9	1,2-Diphenylhydrazine	122667	0.01	0.02
10	1,2-Trans-Dichloroethylene	156605	200	1000
11	1,3-Dichlorobenzene	541731	2	2
12	1,3-Dichloropropene	542756	0.22	1.2
13	1,4-Dichlorobenzene	106467	200	200
14	2,3,7,8-TCDD (Dioxin)**	1746016	0.000000013	0.000000014
15	2,4,6-Trichlorophenol	88062	0.25	0.28
16	2,4-Dichlorophenol	120832	10	10
17	2,4-Dimethylphenol	105679	85	97
18	2,4-Dinitrophenol	51285	30	100
19	2,4-Dinitrotoluene	121142	0.039	0.18
20	2-Chloronaphthalene	91587	100	100
21	2-Chlorophenol	95578	15	17
22	2-Methyl-4,6-Dinitrophenol	534521	3	7
23	3,3'-Dichlorobenzidine	91941	0.0031	0.0033
24	3-Methyl-4-Chlorophenol	59507	36	36
25	4,4'-DDD	72548	0.0000079	0.0000079
26	4,4'-DDE	72559	0.00000088	0.00000088
27	4,4'-DDT	50293	0.0000012	0.0000012
28	Acenaphthene	83329	30	30
29	Acrolein	107028	1.0	1.1
30	Acrylonitrile	107131	0.019	0.028
31	Aldrin	309002	0.000000041	0.000000041
32	alpha-BHC	319846	0.000048	0.000048
33	alpha-Endosulfan	959988	6	7
34	Anthracene	120127	100	100
35	Antimony	7440360	6	90
36	Arsenic**	7440382	0.018	0.14
37	Asbestos[a]	1332214	7,000,000 (fibers/L)	

CWA-Effective Human Health Criteria Applicable to Washington

(shaded)	Ecology criteria approved by EPA
(unshaded)	EPA federally promulgated criteria

	Chemical	CAS Number	CWA-Effective Criteria: Water & Organisms (µg/L)	CWA-Effective Criteria: Organisms Only (µg/L)
38	Benzene- Upper CSF	71432	0.44	1.6
39	Benzidine	92875	0.00002	0.000023
40	Benzo(a) Anthracene	56553	0.00016	0.00016
41	Benzo(a) Pyrene	50328	0.000016	0.000016
42	Benzo(b) Fluoranthene	205992	0.00016	0.00016
43	Benzo(k) Fluoranthene	207089	0.0016	0.0016
44	beta-BHC	319857	0.0013	0.0014
45	beta-Endosulfan	33213659	9.7	10
46	Bis(2-Chloroethyl) Ether	111444	0.02	0.06
47	Bis(2-Chloro-1-Methylethyl) Ether*	108601	400	900
48	Bis(2-Ethylhexyl) Phthalate	117817	0.045	0.046
49	Bromoform	75252	4.6	12
50	Butylbenzyl Phthalate	85687	0.013	0.013
51	Carbon Tetrachloride	56235	0.2	0.35
52	Chlordane	57749	0.000022	0.000022
53	Chlorobenzene	108907	100	200
54	Chlorodibromomethane	124481	0.60	2.2
55	Chloroform	67663	100	600
56	Chrysene	218019	0.016	0.016
57	Copper[a]	7440508	1300	
58	Cyanide	57125	9	100
59	Dibenzo(a,h) Anthracene	53703	0.000016	0.000016
60	Dichlorobromomethane	75274	0.73	2.8
61	Dieldrin	60571	0.000000070	0.000000070
62	Diethyl Phthalate	84662	200	200
63	Dimethyl Phthalate	131113	600	600
64	Di-n-Butyl Phthalate	84742	8	8
65	Endosulfan Sulfate	1031078	9	10
66	Endrin	72208	0.002	0.002
67	Endrin Aldehyde	7421934	0.034	0.035
68	Ethylbenzene	100414	29	31
69	Fluoranthene	206440	6	6
70	Fluorene	86737	10	10
71	gamma-BHC; Lindane	58899	0.43	0.43
72	Heptachlor	76448	0.00000034	0.00000034
73	Heptachlor Epoxide	1024573	0.0000024	0.0000024
74	Hexachlorobenzene	118741	0.0000050	0.0000050

CWA-Effective Human Health Criteria Applicable to Washington

(shaded)	Ecology criteria approved by EPA
(unshaded)	EPA federally promulgated criteria

			CWA-Effective Criteria	
	Chemical	CAS Number	Water & Organisms (µg/L)	Organisms Only (µg/L)
75	Hexachlorobutadiene	87683	0.01	0.01
76	Hexachlorocyclopentadiene	77474	1	1
77	Hexachloroethane	67721	0.02	0.02
78	Indeno(1,2,3-cd) Pyrene	193395	0.00016	0.00016
79	Isophorone	78591	27	110
80	Methyl Bromide	74839	300	2400
81	Methylene Chloride	75092	10	100
82	Methylmercury[b]	22967926		0.03
83	Nickel	7440020	80	100
84	Nitrobenzene	98953	30	100
85	N-Nitrosodimethylamine	62759	0.00065	0.34
86	N-Nitrosodi-n-Propylamine	621647	0.0044	0.058
87	N-Nitrosodiphenylamine	86306	0.62	0.69
88	Pentachlorophenol (PCP)	87865	0.002	0.002
89	Phenol	108952	9000	70000
90	Polychlorinated Biphenyls (PCBs)[c]		0.000007	0.000007
91	Pyrene	129000	8	8
92	Selenium	7782492	60	200
93	Tetrachloroethylene	127184	2.4	2.9
94	Thallium**	7440280	1.7	6.3
95	Toluene	108883	72	130
96	Toxaphene	8001352	0.000032	0.000032
97	Trichloroethylene	79016	0.3	0.7
98	Vinyl Chloride	75014	0.02	0.18
99	Zinc	7440666	1000	1000

[a] This criterion is based on a regulatory level developed under the Safe Drinking Water Act.

[b] This criterion is expressed as the fish tissue concentration of methylmercury (mg methylmercury/kg fish). See *Water Quality Criterion for the Protection of Human Health: Methylmercury* (EPA-823-R-01-001, January 3, 2001) for how this value is calculated using the criterion equation in EPA's 2000 Human Health Methodology rearranged to solve for a protective concentration in fish tissue rather than in water.

[c] This criterion applies to total PCBs (e.g., the sum of all congener or isomer or homolog or Aroclor analyses).

* Bis(2-Chloro-1-Methylethyl) Ether was previously listed as Bis(2-Chloroisopropyl) Ether.

** EPA withdrew its proposal for these criteria, so the CWA-effective criteria are those that EPA originally promulgated for Washington in the National Toxics Rule.

APPENDIX 5-2

Appendix 5-2

Water Quality and Tier II Antidegradation Study

5-2.1 Executive Summary

The State of Washington Department of Ecology (Ecology) requested that the City of Pasco, WA (City) submit a Tier II Antidegradation Study (Study) to support its application for a permit modification of National Pollutant Discharge Elimination System Waste Discharge Permit No. WA-004496-2. Currently, the Permit limits treated process wastewater discharge to the Columbia River.

The expanded discharge requires authorization through National Pollutant Discharge Elimination System (NPDES) and must comply with the antidegradation standards. This report has been prepared to address the Tier II Antidegradation requirements. The upgrades to the process wastewater treatment train for the facility expansion are being developed in the Wastewater Treatment Plant (WWTP) Facility Plan presently being developed by Murraysmith, Inc. (Murraysmith). The Facility Plan will include details of the expanded discharge and WWTP and be written in accordance with Washington Administrative Code (WAC) 173-240-60.

The modeling and calculations discussed in this Study show that the proposed discharge will not cause a "measurable change" in water quality at the chronic mixing zone boundary, as defined by WAC 173-201A-320(3). In addition, the proposed treated effluent discharge will not violate the water quality standards for acute or chronic conditions. This Study demonstrates that the proposed expanded discharge along with the improved wastewater treatment train, as described, complies with the intent of the antidegradation standards regulations and will not cause measurable degradation and will improve water quality of the Columbia River.

5-2.2 Introduction and Purpose

This technical memorandum provides an evaluation of the City's WWTP capacity expansion with regard to water quality in the Columbia River and Washington water quality standards. This Water Quality and Tier II Antidegradation Study (Study) supports the City's application for a permit modification of NPDES Waste Discharge Permit No. WA-004496-2 (Permit). To accommodate an expansion of the WWTP, the City seeks to modify the Permit to allow flow and loads to the Columbia River as detailed in the WWTP Facility Plan.

Federal regulations (40 CFR 131.12) and the WAC Chapter 173-201A establish surface water quality antidegradation standards. The proposed expanded discharge as described above requires authorization through NPDES and must comply with the antidegradation standards. This report has been prepared to address the Tier II Antidegradation requirements.

Washington's antidegradation rule is defined in WAC 173-201A-300, and the rule specifies the following purpose of the antidegradation policy:

> "(a) Restore and maintain the highest possible quality of the surface waters of Washington;
>
> (b) Describe situations under which water quality may be lowered from its current condition;
>
> (c) Apply to human activities that are likely to have an impact on the water quality of a surface water;
>
> (d) Ensure that all human activities that are likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART); and
>
> (e) Apply three levels of protection for surface waters of the state, as generally described below:
>
>> (i) Tier I is used to ensure existing and designated uses are maintained and protected and applies to all waters and all sources of pollution.
>>
>> (ii) Tier II is used to ensure that waters of a higher quality than the criteria assigned in this chapter are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities.
>>
>> (iii) Tier III is used to prevent the degradation of waters formally listed in this chapter as "outstanding resource waters," and applies to all sources of pollution."

Washington's antidegradation rule also provides that waterbodies "may not be further degraded" except as authorized by the rule (refer to WAC 173-201A-310(1)).

Tier II antidegradation protections address "new or expanded actions … that are expected to cause a measurable change in the quality of the water," and such actions "may not be allowed unless the department determines that the lowering of water quality is necessary and in the overriding public interest" (refer to WAC 173-201A-320(1)). Ecology has specified in the rule that a Tier II review "will only be conducted for new or expanded actions conducted under the following authorizations. Public involvement with the Tier II review are conducted in accordance with the processes associated with NPDES discharge permits, as well as other permitting.

Ecology has interpreted "degradation" as a "measurable change in water quality" away from conditions unaffected by the source area (after allowing for mixing consistent with WAC 173-201A-400(7)). In the context of this rule, a measurable change is defined by Ecology as a:

(a) Temperature increase of 0.3 degrees Celsius or greater
(b) Dissolved oxygen decrease of 0.2 mg/L (milligram per liter) or greater
(c) Bacteria level increase of 2 colony forming units/100 mL or greater
(d) Hydrogen potential (pH) change of 0.1 units or greater
(e) Turbidity increase of 0.5 NTU (nephelometric turbidity unit) or greater, or
(f) Any detectable increase in the concentration of a toxic or radioactive substance

Ecology rules specifies that "to determine that a lowering of water quality is necessary and in the overriding public interest, an analysis must be conducted for new or expanded actions when the resulting action has the potential to cause a measurable change in the physical, chemical, or biological quality of a water body."

A Tier II Antidegradation Study is required when the following three conditions are met, as stated in the Water Quality Program Guidance Manual Tier II Antidegradation (Ecology, 2011):

1. "It must be an action associated with specified authorizations by Ecology.

2. It must be a new or expanded action.

3. The action must have the potential to cause measurable degradation to existing water quality at the edge of a chronic mixing zone."

The proposed discharge is regulated by Ecology (Condition #1) and is slightly more than a 100 percent increase from the current discharge (Condition #2). Because of the proposed discharge is larger than previous flow conditions, it has been assumed that the new discharge has the potential to cause measurable degradation (Condition #3) and therefore requires a Tier II Antidegradation Study.

5-2.2.1 Project Background

The City operates a WWTP that discharges under the current NPDES Permit. The treated wastewater is discharged to the Columbia River following preliminary treatment, primary treatment, secondary treatment and disinfection.

The upgrades to the process wastewater treatment train for the facility expansion will be detailed in the WWTP Facility Plan being developed by Murraysmith. This Study was written to accompany the WWTP Facility Plan and modified Permit application in accordance with WAC 173-240-130.

5-2.2.2 Discharge to the Columbia River

The discharge location of the outfall is the Columbia River (WRIA 36) at river mile 327.6, approximately 3 miles upstream of the confluence of the Columbia River and the Snake River (**Figure 5-2.1**). The existing outfall in the Columbia River, terminates with a 24-inch steel multiport diffuser with three 8-inch diameter diffuser ports at 20-foot spacing: two ports are 2-foot risers and the third port is located at the diffuser invert. A 20-inch pipe delivers treated effluent to the diffuser. Outfall record drawings are included in **Attachment 5-2.1**.

The effluent flows will be discharged into the Columbia River through the existing outfall and diffuser until a replacement outfall and diffuser are completed in the future. The existing outfall and diffuser are planned to be replaced due to hydraulic deficiencies and to provide greater capacity. In addition to this study, a mixing zone study will need to be completed during planning and design of the new outfall and diffuser.

The current permit (2010) authorizes a mixing zone of 330 feet downstream from the point of discharge (from the diffuser), and an acute zone boundary of 33 feet downstream from the point of discharge.

The Columbia River in the outfall area is approximately 3,070 feet wide and normal depth of 30 feet in the McNary Pool. River channel geometry was confirmed in National Oceanic and Atmospheric Administration (NOAA) Columbia River soundings chart 18542 Juniper to Pasco 10th Edition (January 2000), which is included in **Attachment 5-2.2**.

5-2.2.3 Applicable Regulations and Guidance

This evaluation has been prepared to be consistent with WAC 173-201A, and to align with the Washington State Department of Ecology (Ecology) ***Water Quality Program Permit Writer's Manual*** (Permit Writer's Manual) (2015) and ***Water Quality Program Guidance Manual: Supplemental Guidance on Implementing the Tier II Antidegradation*** (Ecology, 2011).

The elements of this evaluation include the following:

- Assessment of State Water Quality Standards and Antidegradation Rules
- Summary of biological resources and uses of the Columbia River discharge site.
- Analysis of discharge compliance with state water quality standards and antidegradation rules

5-2.2.4 Applicable Water Quality Standards

The Water Quality Standards for Surface Waters of the State of Washington (WAC Chapter 173-201A) include narrative and numerical receiving water quality standards, as well as antidegradation rules in Chapter 173-201A-300 that are consistent with the Federal Clean Water Act. These standards address many water quality parameters: dissolved oxygen, temperature, toxicity, turbidity, pH, coliform bacteria, dissolved gases, aesthetic water conditions, radioisotope concentrations, and toxic substances. Effects on each of these water quality parameters have been evaluated in the sections below using projected effluent flows, existing wastewater data, updated dilution factors for the existing WWTP outfall diffuser, and background Columbia River receiving water data.

The Columbia River, at various locations near the WWTP, is included on the 303(d) list of impaired waters in Category 1, 2, 4a and 5.

- **Category 1** - Meets tested standards for clean waters: placement in this category does not necessarily mean that a water body is free of all pollutants. Most water quality monitoring is designed to detect a specific array of pollutants, so placement in this category means that the water body met standards for all the pollutants for which it was tested. Specific information about the monitoring results may be found in the individual listings.

- **Category 2** - Waters of concern: waters where there is some evidence of a water quality problem, but not enough to require production of a water quality improvement project (also known as a Total Maximum Daily Load) at this time. There are several reasons why a water body would be placed in this category. A water body might have pollution levels that are not quite high enough to violate the water quality standards, or there may not have been enough violations to categorize it as impaired according to Ecology's listing policy. There might be data showing water quality violations, but the data were not collected using proper scientific methods. In all of these situations, these are waters that Ecology will want to continue to test.

- **Category 3** - Insufficient data: water where there is insufficient data to meet minimum requirements per Ecology Policy 1-11.

- **Category 4** - Polluted waters that do not require a Total Maximum Daily Load (TMDL): waters that have pollution problems that are being solved in one of three ways, which are:

  - **Category 4a** - has a TMDL: water bodies that have an approved TMDL in place and are actively being implemented

  - **Category 4b** - has a pollution control program, similar to a TMDL plan, that is expected to solve the pollution problems

  - **Category 4c** - is impaired by causes that cannot be addressed through a TMDL plan. Impairments in these water bodies include low water flow, stream channelization, and dams. These problems, while not pollutants, require complex solutions to help restore water bodies to more natural conditions.

- **Category 5** - Polluted waters that require a TMDL: the traditional list of impaired water bodies traditionally known as the 303(d) list. Placement in this category means that Ecology has data showing that the water quality standards have been violated for one or more pollutants, and there is no TMDL or pollution control plan. TMDLs are required for the water bodies in this category.

A review of the current Water Quality Assessment (2016 EPA approval) identified 52 assessment listings for the Columbia River from northwest of the City to the McNary Dam. Due to their proximity to the City's current wastewater outfalls, these areas of impaired water have the potential to impact the discharge limits in the City's NPDES permit. Figure 5-2.-2 and Table 5-2.1 show the location, type and category of impairment type for each of these 52 assessment listings. Category 1 assessment (meets standards) are shown in italics.

The Mid-Columbia River in the area of the WWTP has two TMDLs for Dioxin (1991) and Total Dissolved Gas (2004). In addition, the Category 5 listed by Ecology on the Water Quality Assessment 2016 webpage are Temperature, 4,4'-DDE, and Polychlorinated Biphenyls (PCBs).

Table 5-2.1
Relevant Water Quality Assessment Listings

Assessment Unit ID	Listing ID	Medium	Parameter	Category
170200160604_01_01	6309	Temperature	Water	5
170200160604_01_01	8289	Total Dissolved Gas	Water	4A
170200160604_01_01	8800	Dioxin	Tissue	4A
170200160604_01_01	8288	pH	Water	2
170701010103_01_01	21541	Temperature	Water	5
170701010201_01_02	21542	Temperature	Water	5
170701010201_01_02	72218	4,4'-DDE	Tissue	5
170701010201_01_02	78816	Polychlorinated Biphenyls (PCBs)	Tissue	5
170701010201_01_02	8803	Dioxin	Water	4A
170701010201_01_02	78611	2,3,7,8-TCDD TEQ	Tissue	2
170701010201_01_02	*70808*	*1,2-Dichlorobenzene*	*Tissue*	*1*
170701010201_01_02	*70811*	*1,3-Dichlorobenzene*	*Tissue*	*1*
170701010201_01_02	*70816*	*1,4-Dichlorobenzene*	*Tissue*	*1*
170701010201_01_02	*70820*	*2,4-Dichlorophenol*	*Tissue*	*1*
170701010201_01_02	*70827*	*Bis(2-chloroisopropyl)ether*	*Tissue*	*1*
170701010201_01_02	*70838*	*Di-n-butyl phthalate*	*Tissue*	*1*
170701010201_01_02	*70842*	*Diethyl phthalate*	*Tissue*	*1*
170701010201_01_02	*70846*	*Dimethyl phthalate*	*Tissue*	*1*
170701010201_01_02	*70898*	*N-Nitrosodiphenylamine*	*Tissue*	*1*
170701010201_01_02	*70899*	*Phenol*	*Tissue*	*1*
170701010201_01_02	*75000*	*4,4'-DDD*	*Tissue*	*1*
170701010201_01_02	*75082*	*4,4'-DDT*	*Tissue*	*1*
170701010201_01_02	*75274*	*Endrin*	*Tissue*	*1*
170701010201_01_02	*75453*	*Heptachlor*	*Tissue*	*1*
170701010201_01_02	*75649*	*Hexachlorocyclopentadiene*	*Tissue*	*1*
170701010201_01_02	*75725*	*Hexachlorocyclohexane (Lindane)*	*Tissue*	*1*
170701010201_01_02	*78547*	*2,3,7,8-TCDD (Dioxin)*	*Tissue*	*1*
170701010201_01_02	*78688*	*Endosulfan*	*Tissue*	*1*
170701010201_01_02	*79442*	*Pyrene*	*Tissue*	*1*
170701010201_01_02	*79444*	*Anthracene*	*Tissue*	*1*
170701010201_01_02	*79450*	*Fluorene*	*Tissue*	*1*
170701010201_01_02	*79452*	*Fluoranthene*	*Tissue*	*1*
170701010201_01_02	*79522*	*Mercury*	*Tissue*	*1*
170701010201_01_01	16881	Temperature	Water	2
170701010201_01_01	*16880*	*pH*	*Water*	*1*
17020004000376	37874	Dioxin	Tissue	4A
17020004000376	18520	4,4'-DDE	Tissue	2
17020004000376	18553	Aldrin	Tissue	2
17020004000376	18628	Chlordane	Tissue	2
17020004000376	18740	Hexachlorobenzene	Tissue	2
17020004000376	18819	Polychlorinated Biphenyls (PCBs)	Tissue	2
170701010206_01_01	8799	Dioxin	Tissue	4A
170701010206_01_01	16878	Temperature	Water	2
170701010206_01_01	18517	4,4'-DDE	Tissue	2
170701010206_01_01	18550	Aldrin	Tissue	2
170701010206_01_01	18625	Chlordane	Tissue	2
170701010206_01_01	18737	Hexachlorobenzene	Tissue	2
170701010206_01_01	18816	Polychlorinated Biphenyls (PCBs)	Tissue	2
170701010206_01_01	*16877*	*pH*	*Water*	*1*
17110011000242	9299	Temperature	Water	5
17110011000242	7963	Total Dissolved Gas	Water	4A
17110011000242	71934	pH	Water	2

1. Data from: http://www.ecy.wa.gov/programs/wq/303d/ Accessed on: August 28, 2017

5-2.2.5 Designated Uses

Use designations for the Columbia River (from Washington-Oregon border, river mile 309.3, to Grand Coulee Dam, river mile 596.6), which includes the City's outfall, are defined in WAC 173-201A Table 602 as follows:

- Aquatic Life Uses: Spawning/Rearing
- Recreational Uses: Primary Contact
- Water Supply Uses: Domestic Water, Industrial Water, Agricultural Water, and Stock Water
- Miscellaneous Uses: Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, and Aesthetics

These uses are further defined in WAC 173-201A-600 Use Designations—Fresh Waters Table 600 (key to Table 602) and are summarized in **Table 5-2.2**.

Table 5-2.2
Beneficial Use Designations for the Columbia River

Use	Use Designation	Description
Aquatic Life Uses: WAC 173-201A-200(1)	Salmonid spawning, rearing, and migration.	The key identifying characteristic of this use is salmon or trout spawning and emergence that only occurs outside of the summer season (September 16 - June 14). Other common characteristic aquatic life uses for waters in this category include rearing and migration by salmonids.
Recreation Uses: WAC 173-201A-200(2)	Primary contact recreation	Primary contact recreation
Water Supply Uses: WAC 173-201A-200(3)	Domestic Water	Domestic water supply
	Industrial Water	Industrial water supply
	Agricultural Water	Agricultural water supply
	Stock Water	Stock watering
Miscellaneous Uses: WAC 173-201A-200(4)	Wildlife Habitat	Wildlife habitat
	Harvesting	Fish harvesting
	Commerce/ Navigation	Commerce and navigation
	Boating	Boating
	Aesthetics	Aesthetic values

Fresh water designated uses and criteria are found in WAC 173-201A-200 Fresh Water Designated Uses, Protection and Criteria and summarized for the Columbia River in **Table 5-2.3**.

Table 5-2.3
Fresh Water Designated Uses, Protection and Criteria for the Columbia River

Use Designation	Protection	Criteria
Salmonid Spawning, Rearing, and Migration	WAC 173-201A-200: Table 200 (1)(c) Aquatic Life Temperature Criteria in Fresh Water	Highest 7-DADMax: 17.5 degrees Celsius (63.5 degrees Fahrenheit)
	WAC 173-201A-200: Table 200 (1)(d) - Aquatic Life Dissolved Oxygen Criteria in Fresh Water	Lowest 1 day minimum: 8.0 mg/L
	WAC 173-201A-200: Table 200 (1)(e) - Aquatic Life Turbidity Criteria in Fresh Water	NTU: 5 NTU over background when the background is 50 NTU or less; or, A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
	WAC 173-201A-200: Table 200 (1)(f) - Aquatic Life Total Dissolved Gas Criteria in Fresh Water	Percent Saturation: Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.
	WAC 173-201A-200: Table 200 (1)(g) - Aquatic Life pH Criteria in Fresh Water	pH Units: pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.
Primary Contact Recreation	WAC 173-201A-200: Table 200 (2)(b) - Water Contact Recreation Bacteria Criteria in Fresh Water	Bacteria Indicator: Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL.

WAC 173-201A-260 Natural Conditions and Other Water Quality Criteria and Applications provides general criteria that apply to the water supply uses for toxic, radioactive, deleterious materials, and aesthetic values. Toxic, radioactive, or deleterious material concentrations must be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health. Aesthetic values must not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.

5-2.3 Water Quality – Columba River and WWTP Effluent

Columbia River receiving water conditions used in this study were collected from various sources and are described further below.

The United States Geological Survey (USGS) maintains several gauging stations in the Columbia River, both upstream and downstream of the WWTP. Each station records different data, and these are summarized in **Table 5-2.4**. Complete Water Quality data was not available for the Columbia River through USGS gauges in the immediate area of the WWTP discharge.

Flow and temperature from the USGS gauges stations (USGS, 2016 and Ecology, 2016a) were used to determine the river characteristics necessary to conduct this Study including the seven-day consecutive low flow with a ten-year return frequency (7Q10), the 30-day consecutive low flow with a 5 year return frequency (30Q5), river depth, the seven day average of daily maximum temperature (7-DADMax), and the one day maximum temperature (1-DMax).

The City's existing Permit Fact Sheet provided information for other water quality data as well.

- Columbia River DO (mg/)
- Columbia River pH
- Columbia River Ammonia (mg/L)

The following parameters were monitored by the City Water Department at their water treatment plant (approximately 5,000 feet upstream of the WWTP Discharge):

- Columbia River Hardness (mg/L as $CaCO_3$)
- Columbia River Alkalinity (mg/L as $CaCO_3$)
- Columbia River Turbidity (NTU)

Table 5-2.4
Fresh Water Designated Uses, Protection and Criteria for the Columbia River

USGS Gauge	Name	Location Description	Data Available	Calculations Completed
14019240	Columbia River Below McNary Dam Near Umatilla, OR	Below McNary Dam	▪ Temperature, Water ▪ Air Pressure ▪ Pressure, Dissolved Gases ▪ Pressure, Dissolved Gases ▪ Depth, Sensor	-
14019220	Columbia River at McNary Dam Lock NR Umatilla, OR	Above McNary Dam	▪ Temperature, Water ▪ Pressure, Dissolved Gases	-
12514500	Columbia River on Clover Island at Kennewick, WA	Upstream of WWTP on Clover Island	▪ Elevation, Lake/Reservoir	Depth
12514400	Columbia River Below HWY 395 Bridge at Pasco, WA	Upstream of WWTP at Hwy 395 Bridge	▪ Temperature, Water ▪ Pressure, Dissolved Gases	7-DADMax 1-DMax
12472800	Columbia River Below Priest Rapids Dam, WA	Below Priest Rapids Dam	▪ Discharge, Cubic Feet per Second (cfs) ▪ Gage Height	7Q10 30Q5

5-2.4 Antidegradation Analysis - Discharge Compliance with Water Quality Standards

This section provides evaluations of the WWTP discharge compliance with water quality standards for total dissolved gas, dioxin, dichlorodiphenyldichloroethylene, polychlorinated biphenyls, temperature, dissolved oxygen, turbidity, pH, coliform bacteria, dissolved gases, radioisotopes, and toxic substances.

The antidegradation assessment conducted in this Study utilized Ecology's Water Qualtiy-Based NPDES Permit Calculations (PermitCalc) Workbook (Ecology, 2016b). The PermitCalc Workbook is used by Ecology during the discharge permitting process to evaluate the impact of proposed discharges. Ecology was consulted during the preparation of these calculations to understand the use and intent of the Workbook. Inputs used in the analysis are summarized in **Table 5-2.5**.

Table 5-2.5
Fresh Water Designated Uses, Protection and Criteria for the Columbia River

Input Parameter		Quantity
Columbia River	7Q10	48,590 cfs
	30Q5	59,426 cfs
	7DADMax Core Summer	21.6 °C
	7DADMax Supplemental	20.7 °C
	Alkalinity	58.26 mg/L as CaCO3
	Hardness	66.21 mg/L as CaCO3
	pH	8.03 to 8.45
	Dissolved Oxygen	9.38 to 14.08 mg/L
	Fecal Coliform	11 CFU/100mL
WWTP Effluent	2040 Average Annual Flow	10.8 mgd
	2040 Max Month Flow	11.23 mgd
	2040 Daily Max Flow	13.93 mgd
	7DADMax Core Summer	25.5 °C
	7DADMax Supplemental	27.1 °C
	Alkalinity	58.26 mg/L as CaCO3
	Hardness	66.21 mg/L as CaCO3
	pH	6.08 to 8.19
	Dissolved Oxygen	0.87 mg/L
	Fecal Coliform	172 CFU/100mL
Aquatic Life - Acute	Allowable Percent of River Flow	2.5%
Aquatic Life – Chronic	Allowable Percent of River Flow	25%
HH-Non-Carcinogen	Allowable Percent of River Flow	25%
HH-Carcinogen	Allowable Percent of River Flow	25%

5-2.4.1 Total Dissolved Gas

EPA approved Washington Department of Ecology's submittal of the Total Dissolved Gas TMDL for the Mid-Columbia River in 2004. The area covered by this TMDL includes the Columbia River Mainstem from the Canadian border to the Oregon/Washington border. The primary source of Total Dissolved Gas pollution is hydroelectric dams and this TMDL has no impact on municipal wastewater discharges such as the City of Pasco's.

The numeric and narrative standards for total dissolved gas are set forth in WAC 173-201A-200(1)(f), which limits dissolved gases in freshwater to less than 110 percent of saturation. The WWTP discharge will not release dissolved gases such as hydrogen sulfide, carbon dioxide, or other gases that would cause or contribute to a violation of this criterion in the Columbia River. The treated wastewater discharged to the Columbia River will contain dissolved oxygen as the only significant dissolved gas and will not exceed 110 percent saturation for dissolved gases. Therefore, the WWTP discharge would not cause or contribute to a violation of this criterion.

5-2.4.2 Dioxin

The Dioxin TMDL for the Columbia River Basin was approved in 1991. The area covered by this TMDL includes the Columbia River from the Pacific Ocean to the Canadian border. The primary source of dioxin is from manufacture of chlorinated herbicide, the combustion of domestic and industrial wastes, and the production of chlorine-bleach wood pulp. The TMDL did not assign waste load allocations to the municipal discharges. It is now yet known how this will be applied to the City's future NPDES permit and when Ecology begins writing the new permit, the writers will review the TMDL and will incorporate any TMDL requirements into the permit. The WWTP is not required to test for dioxin and there is no data for analysis. Dioxin is not typically present in municipal wastewater and therefore not likely to be present in the City's municipal wastewater effluent.

5-2.4.2 4,4'-DDE

Dichlorodiphenyldichloroethylene, 4,4'-DDE also known simply as DDE, is a metabolite of Dichlorodiphenyltrichloroethane (DDT). DDT is an insecticide that was widely used to control mosquitoes but was banned in the United States (US) and abroad. 4,4'-DDE is formed by the loss of a hydrogen and chloride. DDE persistent in the environment and bioaccumulates. DDE is listed as Category 5 by Ecology on the Water Quality Assessment 2016 (Ecology, 2017) and could one day have a TMDL. The City's WWTP effluent was tested 22 times for DDE from 2013 to 2017 with each returning non-detect. 4,4'-DDE is not likely to be present in the City's municipal wastewater and cause or contribute to a violation.

5-2.4.3 Polychlorinated biphenyls

Polychlorinated biphenyls (PCBs) are a group of manmade chemicals that are organic chlorine compounds based on two benzene rings. PCBs were widely used dialectic and coolant fluids. PCBs are persistent in the environment. PCB production in the United States was banned in 1979. PCBs are included in the Category 5 Ecology Water Quality Assessment 2016 (Ecology, 2017) and could one day have a TMDL. The City's WWTP effluent was tested 22 times for PCBs from 2013 to 2017 with each returning non-detect for the family of PCBs tested. PCBs are not likely to be present in the City's municipal wastewater and cause or contribute to a violation.

5-2.4.4 Temperature

Temperature is included in the Category 5 Ecology Water Quality Assessment 2016 (Ecology, 2017) and could one day have a TMDL. The temperature standards (WAC 173-201A-200(1)(c)) include temperature narrative and numeric criteria. The Columbia River has specific temperature criteria that are defined in WAC 173-201A-602, Table 602. The numeric criteria for the Columbia River, from Washington-Oregon border (river mile 309.3) to Priest Rapids Dam (river mile 397.1), are:

> "Temperature shall not exceed a 1-day maximum (1-DMax) of 20.0 degrees Celsius due to human activities. When natural conditions exceed a 1-DMax of 20.0 degrees Celsius, no

temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3 degrees Celsius; nor shall such temperature increases, at any time, exceed 0.3 degrees Celsius; nor shall such temperature increase, at any time, exceed t = 34/(T+9)."

In addition, WAC 173-201A-200(1)(c) stipulates that the maximum incremental temperature increase allowed and resulting from an individual point source cannot exceed 28/(T+7) (in degrees Celsius) at the mixing zone, where T is background temperature. This maximum incremental temperature is only relevant when background river temperatures are equal to or less than 17.5 degrees Celsius (at 17.5, equates to an allowable rise of 1.14 degrees Celsius).

From April 2009 to September 2017, the average annual daily temperature for the Columbia River was 13.9 degrees Celsius, the average annual maximum daily temperature for the Columbia River was 21.2 degrees Celsius and the maximum day temperature was 21.8 degrees Celsius.

The calculated worst-case temperature increase was predicted using Ecology's spreadsheet calculation "Freshwater Temperature Reasonable Potential and Limit Calculation". Assuming a worst case 7DADMax of the River (21.6 degrees Celsius Core Summer and 20.74 degrees Celsius Supplemental Criteria) and WWTP Effluent (25.5 degrees Celsius Core Summer and 27.1 degrees Celsius Supplemental Criteria), there is a temperature increase of 0.006 degrees Celsius and 0.009 degrees Celsius for Core Summer and Supplemental Criteria, respectively. Thus, no "measurable" temperature increase" (0.3 degrees Celsius or greater) in the Columbia River temperature will occur at the end of the chronic mixing zone. These spreadsheet calculations are provided in **Attachment 5-2.3**.

5-2.4.5 Dissolved Oxygen

The applicable water quality standard for dissolved oxygen (WAC 173-201A-200(1)(d)) specifies a lowest 1-day minimum dissolved oxygen of 8.0 milligrams per liter (mg/L) during the summer period when salmon rearing and migration may occur. The Columbia River has a dissolved oxygen maximum and minimum of 14.08 and 9.38 mg/L, respectively, per the City's NPDES Fact Sheet **Table 3**.

The wastewater influence on the receiving waters can be identified as immediate dissolved oxygen demand that occurs during the dilution process in the river. Receiving water dissolved oxygen concentrations at the completion of wastewater dilution (at the mixing zone boundary) were predicted using Ecology's spreadsheet calculation "Dissolved Oxygen at Chronic Mixing Zone" assuming the lowest predicted dilution factor at the mixing zone boundary under 7Q10 low river flow conditions. This calculation assumes the conservative effluent dissolved oxygen concentration of 0.87 mg/L (minimum average month WWTP effluent dissolved oxygen 2012 through 2017), and an immediate effluent dissolved oxygen demand (iDOD) of 2 mg/L. These spreadsheet calculations are provided in **Attachment 5-2.3**. The dissolved oxygen concentration change is less than 0.2 mg/L under these worst-case scenarios. Therefore, the WWTP discharge proposed in the Engineering Report would not cause or contribute to a violation of this criterion.

5-2.4.6 Turbidity

The water quality turbidity criterion allows a maximum turbidity change at the mixing zone boundary of 5 nephelometric turbidity units (NTU) when background river turbidity is 50 NTU or less, and up to a 10 percent increase in stream turbidity when background river turbidity is greater than 50 NTU (WAC 173-201A-200(1)(e)). From 2011 to 2017, as sampled by the City of Pasco Water Department at the water treatment plant approximately 5,000 feet upstream of the WWTP discharge, the Columbia River had an average and maximum turbidity of 1.2 NTU and 6.2 NTU, respectively. The WWTP is not required to monitor effluent turbidity or receiving water turbidity, and there is no basis to estimate values.

For comparison, at 4.8 mgd (7.5 cfs) and Columbia River flow at the 7Q10 of 48,605 cfs with 25 percent mixing corresponding to 12,151 cfs, the effluent NTU of the WWTP effluent would need to be 8,105 to cause over 5 NTU in the River. At the future average annual flow of 10.8 mgd (16.7 cfs), the effluent NTU would need to be 3,643 to cause over 5 NTU in the River. The rough conversion from NTU to TSS for settled secondary effluent is 2.3 to 2.4 mg/L TSS per NTU (Metcalf and Eddy, 2017). At that conversion, the WWTP effluent would have to be in the range of 8,379 to 19,452 mg/L TSS to cause a violation which is well above the WWTP's historical influent and effluent TSS concentration.

A measurable change is defined as an increase of 0.5 NTU or greater per WAC 173-201A-320(3). The City's effluent maximum month TSS was 29.3 mg/L 2012 to 2017 and utilizing the same conversion from NTU and TSS as shown above, which corresponds to approximately 70 NTU. Using the PermitCalc Workbooks "Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries", the NTU at the chronic mixing zone boundary would rise only 0.09 NTU. Therefore, the WWTP discharge proposed in the Engineering Report would not cause or contribute to a violation of this criterion.

5-2.4.7 pH

The effluent pH limit in the City's NPDES Permit is a daily minimum and maximum of 6.0 to 9.0 standard units, respectively. The applicable pH standard for the Columbia River (WAC 173-201A-200(1)(g)) is between 6.5 and 8.5. According to effluent data from January 2012 through December 2017, average day effluent pH has remained between 6.32 and 8.65. According to the NPDES Fact Sheet Table 3, the Columbia River has had an ambient pH minimum and maximum of 8.45 and 9.03, respectively.

Utilizing the pH ranges of the WWTP effluent, ambient Columbia River and the regulated Columbia River, the pH at the mixing zone boundary can be calculated using the Ecology Reasonable Potential Analysis (RPA) spreadsheet calculation titled "Calculation of pH of a Mixture of Two Flows". These spreadsheet calculations are provided in **Attachment 5-2.2.** Per DOE direction, the difference between the pH at the chronic mixing zone boundary at today's flow were compared to the pH at the chronic mixing zone boundary with the future flow to identify the change in pH.

The calculation results are summarized in **Table 5-2.6**. The definition for a "measurable change" in pH according to WAC 173-201A-320(3) is 0.1 units.

Table 5-2.6
pH Summary

Columbia River pH	Effluent pH	pH at Chronic Mixing Zone Boundary – Current Flow	pH at Chronic Mixing Zone Boundary – Future Flow	pH delta at mixing zone boundary	Comment
8.45	6.32	8.38	8.41	0.03	Not measurable change
8.45	8.65	8.45	8.45	0.00	Not measurable change
9.03	6.32	8.80	8.88	0.08	Not measurable change
9.03	8.65	9.03	9.03	0.00	Not measurable change
6.5	6.32	6.50	6.50	0.00	Not measurable change
6.5	8.65	6.50	6.50	0.00	Not measurable change
8.5	6.32	8.42	8.45	0.03	Not measurable change
8.5	8.65	8.50	8.50	0.00	Not measurable change

5-2.4.8 Bacteria

The numeric and narrative bacterial standards are set in WAC 173-201A, Table 200(2)(b) which states the freshwater bacteria criterion for primary contact recreation applicable in the Columbia River specify that "fecal coliform organism levels must not exceed a geometric mean value of 100 CFU/100 mL (colony forming units per 100 milliliter), with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 CFU/100 mL."

The WWTP uses ultraviolet light disinfection to treat the wastewater before discharge. Between January 2012 and December 2017, the WWTP effluent had an average fecal coliform level of 38 colonies/100 mL and a geometric mean of 24 colonies/100 mL and the maximum month concentration of 172 CFU/100mL. During this time period, 602 fecal coliform tests were taken and 8 returned with fecal coliform level higher than 200 CFU/100 mL, or 1.3 % of tests.

Using the PermitCalc Workbook, the calculated rise in fecal coliform values at the end of the mixing zone due to the WWTP plant are less than the defined "measurable change" (2 CFU/100mL). The spreadsheet calculations are provided in **Attachment 5-2.3**.

5-2.4.9 Radioisotopes

WAC 173-201A-250 prohibits radioisotope concentrations in excess of maximum permissible concentrations defined in federal statutes. The influent flow and loads are not known to contain radioisotopes, and WWTP treatment unit processes are not known to create or concentrate such isotopes. Therefore, the discharge is not expected to contain any radioisotopes. The WWTP is not required to monitor effluent radionuclides and there is no basis to estimate values.

5-2.4.10Toxic Substances

Treated effluent samples have been collected and analyzed at the WWTP for the past several years for the Priority Pollutant (PP) list (**Attachment 5-2.4**). Several toxics were detected in these samples and each will be discussed here. The antidegradation guidance states that a measurable change is considered "any detectable increase in the concentration of a toxic or radioactive substance" at the end of the chronic mixing zone. Detectable increases are defined in Appendix A of the current Permit by the detection limit (DL) or quantitation limit (QL) of the specified analytical methods.

WAC 173-201A-240 prohibits discharge of toxic pollutants in amounts that may be harmful to beneficial uses (**Attachment 5-2.5**). WAC 173-201A-240, Table 240(3) establishes numeric criteria for the protection of aquatic organisms in freshwater and marine water, and the EPA-approved numeric criteria for the protection of human health were established in November 2016. An evaluation of the dilution factors required for the WWTP effluent maximum discharge concentrations to comply with the aquatic life and human health-based water quality criteria is presented in paragraphs below.

5-2.4.10.1 Acid Compounds

Phenol is an aromatic organic compound primarily used to synthesize plastics. It is not used or added to the process water inside the facility. Phenol was detected in the treated effluent testes for Phenol in 2011 to 2018 on a quarterly basis with concentrations ranging from 0.01 micrograms per liter (µg/L) to 0.63 µg/L with an average of 0.04 µg/L in 30 samples. The QL listed in Appendix A of the Permit is 50 µg/L. There is not DL listed in Appendix A of the Permit. The concentration of Phenol in the treated effluent is below the QL and therefore the treated effluent would not create a detectable increase in Phenol concentrations at the end of the mixing zone. The human health (water and organism) water quality criterion for Phenol is 9,000 µg/L and there is no aquatic life criterion. The concentration detected is well below the human health criterion (**Attachment 5-2.5**). Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

5-2.4.10.2 Base-neutral compounds

Bis(2-ethylhexyl)phthalate was detected in the treated effluent sample collected on February 16, 2016 and February 7, 2017 at concentrations of 0.51 µg/L and 0.51 µg/L, respectively. This chemical is a common laboratory contaminant and is used in the production of plastics. It can seep out of plastics into the environment and is not used or added to the process water inside the facility. Bis(2-ethylhexyl) was detected only in two of the treated effluent samples. The human health water quality (water and organism) criterion for bis(2-ethylhexyl)phthalate is 0.045 µg/L and 0.046 µg/L for organisms only. The Bis(2-ethylhexyl)phthalate concentration at the end of the chronic mixing zone (**Appendix 5-2.3**) is below the water quality criteria. Therefore, the discharge complies with the water quality criteria

Di-n-octyl phthalate was detected in the treated effluent sample collected on August 9, 2016 and August 1, 2017 at concentrations of 1.23 µg/L and 0.73 µg/L, respectively. Di-n-octyl phthalate is used in plastic production. The DL and QL listed for di-n-octyl phthalate are 0.3 µg/L and 0.6 µg/L, respectively. There are no human health or aquatic life criteria (**Attachment 5-2.5-3**) and it is not included in the PermitCalc Workbook. The concentration calculated at the end of the chronic mixing zone is 0.0017 µg/L (**Attachment 5-2.3**) which is below the DL and QL and therefore, will not cause a measurable change.

5-2.4.10.3 Volatile Compounds

Chloroform was detected in the treated effluent samples collected in 2013, 2014, 2015 and 2017 with concentration range from 0.61 µg/L to 1.78 µg/L. Chloroform is used an organic compound and is produced naturally in nature and is also used in manufacturing. It is not used inside the facility or added to the WWTP process. The DL and QL list in Appendix A of the Permit are 1.0 µg/L and 2.0 µg/L, respectively. The calculated concentration of Chloroform at the end of the chronic mixing zone is 0.0004 µg/L and below the DL and QL. The human health water (water and organism) quality criterion for Chloroform is 100 µg/L and 600 µg/L for organism only. The concentration calculated is below the DL and human health criterion (**Attachment 5-2.5**). Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

Chloromethane, also known as methyl chloride, was detected in the treated effluent sample collected on 2/13/2011 at a concentration of 1.02 µg/L. Chloromethane is a haloalkane that was once used as refrigerant but is no longer present in consumer production due to concerns about its toxicity. It is not used inside the facility or added to the WWTP process.The DL and QL listed in Appendix A of the Permit are 1.0 µg/L and 2.0 µg/L, respectively. There is not water quality criteria (**Attachment 5-2.5**). The detected concentration of Chloromethane in the treated effluent is below the QL. The concentration calculated at the end of the chronic mixing zone is below the DL (**Attachment 5-2.3**). Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

5-2.4.10.4 Other Chemicals Present

3+4-methylphenol was detected in the treated effluent sample collected on August 1, 2017 at a concentration of 1.44 µg/L. It is not used inside the facility or added to the WWTP process. There are no human health or aquatic life criteria (**Attachment 5-2.5**), it is not included in the PermitCalc

Workbook and there is no DL or QL listed in Appendix A of the Permit. The concentration calculated at the end of the chronic mixing zone is 0.002 µg/L (**Attachment 5-2.3**).

4-Chloroanaline was detected in the treated effluent sample collected in 2013 and 2016 at concentrations from 3.52 µg/L to 12.1 µg/L. 4-Chloroanaline is used in the chemical induction for the production of pesticides, drugs and dyes. It is not used inside the facility or added to the WWTP process. There is no human health or aquatic life criterion. There are no human health or aquatic life criteria (**Attachment 5-2.5**), it is not included in the PermitCalc Workbook and there is no DL or QL listed in Appendix A of the Permit. The concentration calculated at the end of the chronic mixing zone is 0.017 µg/L (**Attachment 5-2.3**).

Acetone was detected in the treated effluent sample collected in 2013, 2016 and 2017 concentrations from 3.55 µg/L to 21.5 µg/L. Acetone is used as a solvent for domestic and industrial uses. There is no human health or aquatic life criterion. There are no human health or aquatic life criteria (**Attachment 5-2.5**), it is not included in the PermitCalc Workbook and there is no DL or QL listed in Appendix A of the Permit. The concentration calculated at the end of the chronic mixing zone is 0.03 µg/L (**Attachment 5-2.3**).

Diethylphthalate was detected in the treated effluent sample collected on February 16, 2016 at a concentration of 0.78 µg/L. Diethylphthalate is used as a plasticizer, detergent base and in aerosol sprays. It is not used inside the facility or added to the WWTP process. The human health water (water and organism) quality criterion for Diethylphthalate is 200 µg/L and 200 µg/L for organism only. The concentration detected is below the human health criterion (**Attachment 5-2.5**). The DL and QL listed in Appendix A of the Permit are 1.9 µg/L and 7.6 µg/L, respectively. The Diethylphthalate concentration in the WWTP discharge is below the DL, QL and the water quality criteria. Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

Pyridine was detected in the treated effluent sample collected on February 10, 2015 at a concentration of 0.55 µg/L. Pyridine is used in pesticide production and as a solvent. It is not used inside the facility or added to the WWTP process. There are no human health or aquatic life criteria (**Attachment 5-2.5**), it is not included in the PermitCalc Workbook and there is no DL or QL listed in Appendix A of the Permit. The concentration calculated at the end of the chronic mixing zone is 0.0008 µg/L (**Attachment 5-2.3**).

Toluene was detected in the treated effluent sample collected on February 10, 2015 and August 1, 2017 at concentrations of 0.76 µg/L and 1.62 µg/L, respectively. Toluene is used as a solvent for many compounds. It is not used inside the facility or added to the WWTP process. The human health water and organism water quality criterion for Toluene is 72 µg/L and 130 µg/L for organism only (**Attachment 5-2.5**). Toluene is not included in the PermitCalc Workbook and there is no DL or QL listed in Appendix A of the Permit. The concentration calculated at the end of the chronic mixing zone is 0.0022 µg/L (**Attachment 5-2.3**).

5-2.4.11 Ammonia

Ammonia is present in the City's WWTP effluent. The concentration in the treated effluent is sampled twice per week as part of the current Permit. From 2012 to 2017, the annual average ammonia concentration is 16.7 mg/L, the maximum month concentration is 45.3 mg/L and the maximum day effluent ammonia concentration was 53.3 mg/L. The QL listed in Appendix A of the Permit is 0.3 mg/L (no DL listed). Ammonia in the Columbia River is 0.01 mg/L as shown in NPDES Fact Sheet Table 3. Using the conservative number maximum day ammonia concentration and the ambient river concentration, the PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of ammonia at the end of the acute and chronic mixing zone to be 952.87 µg/L and 86.82 µg/L, respectively. The PermitCalc workbook calculated aquatic life criterion for ammonia is 2,385 µg/L and 313µg/L for acute and chronic mixing, respectively. The ammonia concentration at the end of the chronic mixing zone is below the QL and the water quality criteria. Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

5-2.4.12 Arsenic

Arsenic is a naturally occurring metal found in certain geologic units and is not used or added to the process water inside the facility. Arsenic was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 1.0 µg/L to 2.5 µg/L in 8 samples. The DL and QL listed in Appendix A of the Permit are 0.1 µg/L and 0.5 µg/L, respectively. The aquatic life criterion for arsenic is 360 µg/L and 190 µg/L for acute and chronic mixing, respectively (**Attachment 5-2.5**). The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of arsenic at the end of the chronic mixing zone to be 0.09 µg/L. The arsenic concentration at the end of the chronix mixing zone is below the DL, QL and water quality criteria . Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

5-2.4.13 Cadmium

Cadmium is a naturally occurring metal found in certain geologic units and is not used or added to the process water inside the facility. Cadmium was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 0.74 µg/L to 2.0 µg/L with an average of 1.48 µg/L in 8 samples. The DL and QL listed in Appendix A of the Permit are 0.05 µg/L and 0.25 µg/L, respectively. The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of cadmium at the end of the acute and chronic mixing zone to be 0.002 µg/L and 0.000 µg/L, respectively. The PermitCalc workbook calculated aquatic life criterion for cadmium is 2.3679 µg/L and 0.76 µg/L for acute and chronic mixing, respectively. The cadmium concentrations at the end of the mixing zones are below the DL, QL and criteria. Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

5-2.4.14 Chlorine

The potential for residual chlorine in the treated effluent from the current process wastewater treatment system is extremely low due to the use of Ultra Violet light for disinfection and the long retention time and organic content of the existing wastewater treatment system. Chlorine is used within the WWTP process occasionally in the return activated sludge to control filamentous bacterial growth. The QL listed in Appendix A of the Permit is 50.0 µg/L and there is not a DL listed. Chlorine is not required to be monitored and recorded at the WWTP. Staff have occasionally tested for chlorine as part of other testing and recollection of results is that it is typically is near 0.02 mg/L and the maximum recalled ever seeing is 0.15 mg/L.

5-2.4.15 Copper

Copper is a naturally occurring metal found in certain geologic units and in some water system piping. It is not used or added to the process water inside the facility. Copper was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 12.3 µg/L to 75.9 µg/L with an average of 40.2 µg/L in 29 samples. The DL and QL listed in Appendix A of the Permit are 0.4 µg/L and 2.0 µg/L, respectively. The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of copper at the end of the acute and chronic mixing zone to be 1.996 µg/L and 0.778 µg/L, respectively. The PermitCalc workbook calculated aquatic life criterion for copper is 11.538 µg/L and 7.9803 µg/L for acute and chronic mixing, respectively. The human health criteria water & organism is 1,300 µg/L. The copper concentrations at the end of the mixing zones are below these criteria. Therefore, the discharge complies with the water quality criteria.

5-2.4.16 Cyanide

Cyanide is a naturally occurring Chloroform and has been manufactured for varying purposes. In nature, cyanide is found naturally in some foods. Cyanide is used to make paper, textile and plastics. Cyanide was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 0.01 µg/L to 0.1 µg/L with an average of 0.013 µg/L in 29 samples. The DL and QL listed in Appendix A of the Permit are 2 µg/L and 10 µg/L, respectively. The aquatic life criterion for Cyanide is 22 µg/L and 5.2 µg/L for acute and chronic mixing, respectively. The human health criteria water & organism is 9 µg/L and the organism only is 100 µg/L. The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of cyanide at the end of the acute and chronic mixing zone to be 0.002 µg/L and 0.000 µg/L, respectively. The Cyanide concentrations at the end of the mixing zone is below the DL, QL and the criteria. Therefore, the discharge will not cause a measurable change and complies with the water quality criteria.

5-2.4.17 Lead

Lead is a naturally occurring metal found in certain geologic units and is not used or added to the process water inside the facility. Lead was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 1 µg/L to 2.5 µg/L with an average of 1.8 µg/L in 8 samples. The DL and QL listed in Appendix A of the Permit are 0.1 µg/L and 0.5 µg/L, respectively.

The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of lead at the end of the acute and chronic mixing zone to be 0.039 µg/L and 0.003 µg/L, respectively. The PermitCalc workbook calculated aquatic life criterion for lead is 41.11 µg/L and 1.602 µg/L for acute and chronic mixing, respectively (**Attachment 5-2.5**). The lead concentration at the end of the chronic mixing zone is below the detection limit. Therefore, the discharge will not cause a measurable change.

5-2.4.18 Mercury

Mercury can be a component of air pollution and in dental fillings. It is not used or added to the process water inside the facility. Mercury was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 0.0001 µg/L to 0.0261 µg/L with an average of 0.0092 µg/L in 8 samples. The DL and QL listed in Appendix A of the Permit are 0.0002 µg/L and 0.0005 µg/L, respectively. The aquatic life criterion for mercury is 2.1 µg/L and 0.012 µg/L for acute and chronic mixing, respectively (**Attachment 5-2.5**). The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of mercury at the end of the acute and chronic mixing zone to be 0.00073 µg/L and 0.00007 µg/L, respectively. The mercury concentrations at the end of the mixing zones are well below the criteria. Therefore, the discharge will not cause a measurable change.

5-2.4.19 Molybdenum

Molybdenum is a naturally occurring metal found in certain geologic units and is not used or added to the process water inside the facility. Molybdenum was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 2.1 µg/L to 5.1 µg/L with an average of 3.25 µg/L in 8 samples. The DL and QL listed in Appendix A of the Permit are 0.1 µg/L and 0.5 µg/L, respectively. Molybdenum is not included in the Reasonable Potential Calculation tab of the PermitCalc Workbook and does not have human or aquatic life water quality criteria. The calculated concentration at the end of the chronic mixing zone is 0.007 µg/L. The molybdenum concentration at the end of the chronic mixing zone is below the DL. Therefore, the discharge will not cause a measurable change.

5-2.4.20 Selenium

Selenium is a naturally occurring metal found in certain geologic units and is not used or added to the process water inside the facility. Selenium was detected in the treated effluent samples collected from 2011 to 2018 with concentrations ranging from 2.0 µg/L to 14.3 µg/L with an average of 4.92 µg/L in 8 samples. The DL and QL listed in Appendix A of the Permit are 1.0 µg/L and 1.0 µg/L, respectively. The aquatic life criterion for selenium is 20 µg/L and 5 µg/L for acute and chronic mixing, respectively. The water quality criteria for protection of human health water & organism is 60 µg/L and organism only is 200 µg/L (**Attachment 5-2.5**). The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of selenium at the end of the acute and chronic mixing zone to be 0.48 µg/L and 0.039 µg/L, respectively. The selenium concentration at the end of the chronic mixing zone is below the DL and the criteria. Therefore, the discharge will not cause a measurable change.

5-2.4.21 Zinc

Zinc is a naturally occurring metal found in certain geologic units and in galvanized piping. It is not used or added to the process water inside the facility. Zinc was detected in the treated effluent samples collected in 2011 to 2018 with concentrations ranging from 25.1 µg/L to 82.9 µg/L with an average of 57.7 µg/L in 8 samples. The DL and QL listed in Appendix A of the Permit are 0.5 µg/L and 2.5 µg/L, respectively. The human health criteria, water & organism and organism only, is 1,000 µg/L. The PermitCalc Workbook (**Attachment 5-2.3**) calculated the concentration of zinc at the end of the acute and chronic mixing zone to be 2.773 µg/L and 0.226 µg/L, respectively. The PermitCalc Workbook calculated aquatic life criterion for zinc is 80.70 µg/L and 73.69 µg/L for acute and chronic mixing, respectively. The zinc concentration at the end of the chronic mixing zone is below the DL and the criteria. Therefore, the discharge will not cause a measurable change.

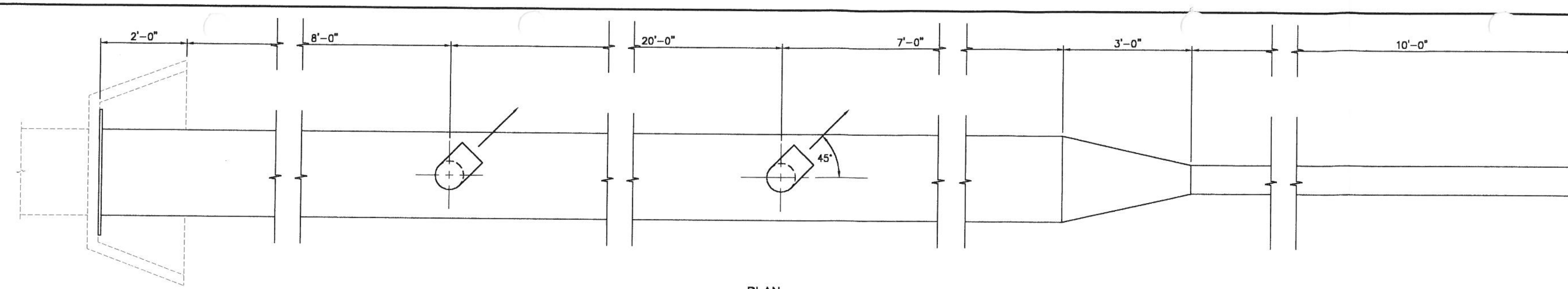
5-2.4.22 Acute and Chronic Toxicity

The projected discharge and improvements to the WWTP are not expected to result in an increase in pollutant concentrations and it is not expected to cause or contribute to a violation of acute and chronic toxicity criteria. There is no anticipated WWTP facility process or material change which will increase the potential for effluent toxicity. Therefore, there is no anticipated change in or need for whole effluent toxicity (WET) testing.

5-2.5 Conclusions

The modeling and calculations discussed in this Study show that the proposed discharge of treated WWTP effluent will not cause a "measurable change" in water quality at the chronic mixing zone boundary, as defined by WAC 173-201A-320(3). In addition, the proposed treated effluent discharge will not violate the water quality standards for acute or chronic conditions. This Study demonstrates that the proposed expanded discharge along with the improved wastewater treatment train, as described, complies with the intent of the antidegradation standards regulations and will not cause measurable degradation and will improve water quality of the Columbia River.

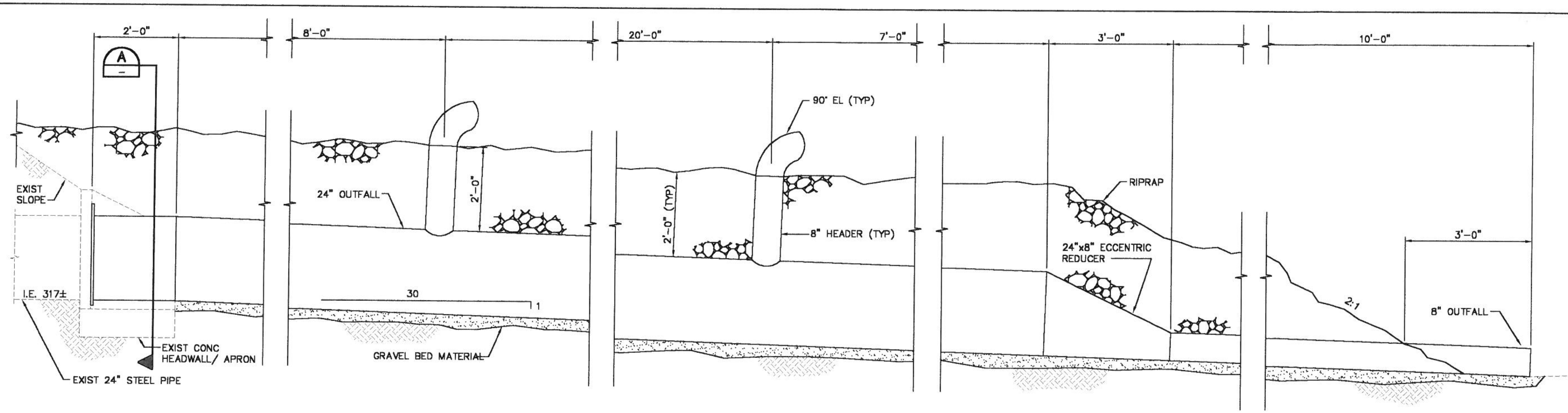
ATTACHMENT 5-2.1



PLAN

24" OUTFALL

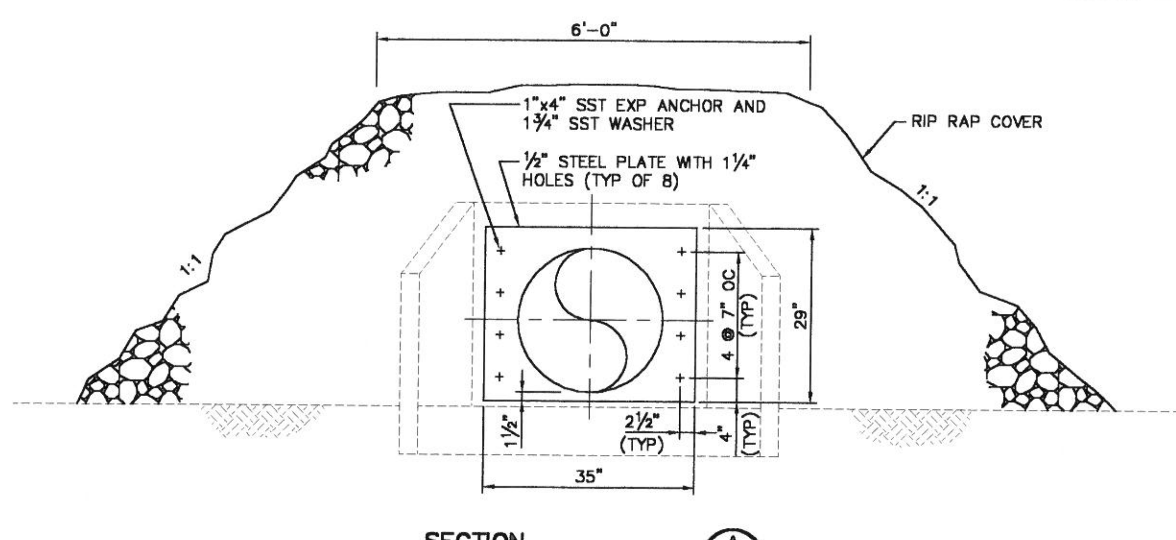
SCALE: ¾" = 1'-0"



PROFILE

24" OUTFALL

SCALE: ¾" = 1'-0"



SECTION A

SCALE: ¾" = 1'-0"

PIPE FABRICATION NOTES

1. PIPE AND FITTING MATERIAL SHALL BE STEEL CONFORMING TO AWWA STEEL PIPE MANUAL.
2. PIPE SHALL BE ¼" THICK WALL. WALL ATTACHMENT PLATE SHALL BE 1/2" THICK.
3. PROVIDE 30-MIL COATING OF COAL TAR EPOXY AFTER FABRICATION, INSIDE & OUTSIDE OF PIPE.
4. ALL PIPE AND FITTING CONNECTIONS SHALL BE WELDED. PIPE SHALL BE WELDED TO STEEL PLATE.
5. WELDS TO CONFORM WITH AWS CODE.
6. PIPE SHALL BE FABRICATED AND DELIVERED TO THE SITE IN ONE PIECE.

PIPE INSTALLATION NOTES

1. REMOVE ALL ROCKS AND DEBRIS, PROVIDE UNIFORM GRADE BENEATH PIPE.
2. PIPE BED MATERIAL SHALL BE CLEAN 3/4" MINUS CHIPPED GRAVEL WITH NO MORE THAN 5% BY WEIGHT RETAINED ON A 1/4" SIEVE. GRAVEL SHALL BE PLACED UNDER AND AROUND PIPE TO FILL VOIDS AND PROVIDE ADEQUATE SUPPORT.
3. PLACEMENT OF RIPRAP SHALL AVOID DAMAGE TO THE PIPE, FITTINGS, AND HEADWALL, AND SHALL BE PLACED SO BE PLACED SO AS TO PREVENT TURBIDITY FROM THE RIVER BED.
4. RIP RAP D_{50}=12" ANGULAR
5. DURING CONSTRUCTION DISTURBANCE TO SURROUNDING AREAS SHALL BE KEPT TO A MINIMUM.
6. PIPE SHALL BE INSPECTED BY ENGINEER PRIOR TO BEING PLACED IN THE RIVER.
7. PROVIDE PHOTO DOCUMENTATION DURING INSTALLATION MILESTONES:
   - A. SUBGRADE PREPARATION
   - B. PIPELINE INSTALLATION
   - C. PIPELINE BEDDING
   - D. RIP RAP PLACEMENT
   - E. FINAL COMPLETION

HDR

HDR Engineering, Inc.

PROJECT MANAGER AHK

DESIGNED YM

DRAWN RC

CHECKED AHK

PROJECT NUMBER 07568-026-002-05

DATE JUNE 1997

THIS LINE IS ONE INCH WHEN DRAWING IS FULL SIZE. IF NOT ONE INCH, SCALE ACCORDINGLY.

NO	BY	DESCRIPTION

EXPIRES 05/31/98

CITY OF PASCO

WASTE WATER TREATMENT PLANT OUTFALL REHABILITATION

OUTFALL PLAN, PROFILE AND SECTION

DRAWING NUMBER 1

06/20/97

OUTFALL.DWG

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ATTACHMENT 5-2.2

NOAA encourages users to submit inquiries, discrepancies or comments about this chart at http://www.nauticalcharts.noaa.gov/staff/contact.htm.

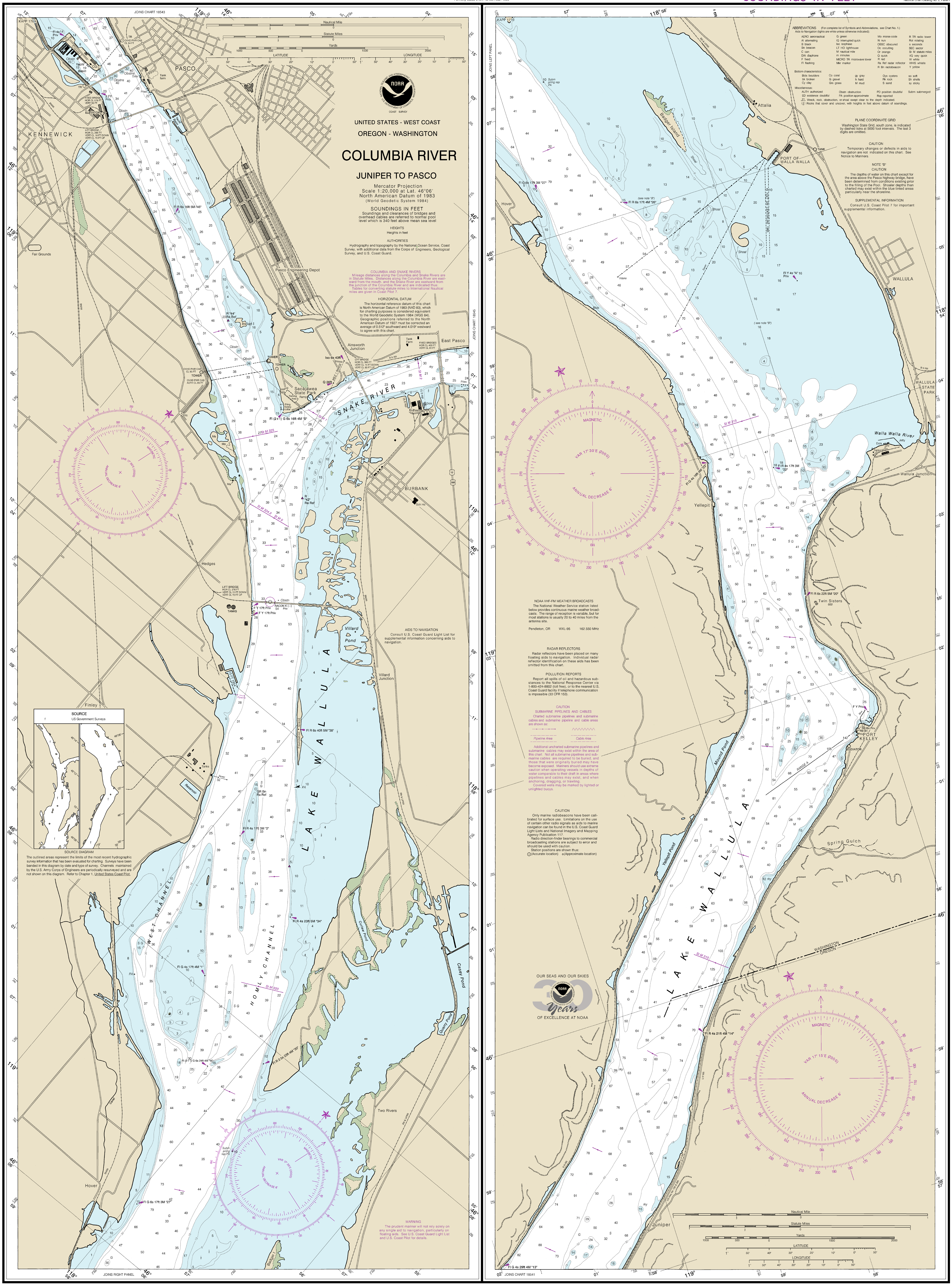
18542

Formerly C&GS 6164, 1st Ed., Mar. 1960

SOUNDINGS IN FEET

Nautical Chart Catalog No. 2, Panel I

18542



18542

CAUTION
This chart has been corrected from the Notice to Mariners published weekly by the National Imagery and Mapping Agency and the Local Notice to Mariners issued periodically by each U.S. Coast Guard district to the date shown in the lower left hand corner.

SOUNDINGS IN FEET

Published at Washington, D.C.
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
COAST SURVEY

Columbia River, Juniper to Pasco
SOUNDINGS IN FEET - SCALE 1:20,000

18542

10th Ed., Jan. 2000. Last Correction: 9/16/2016. Cleared through:
LNM: 3817 (9/19/2017), NM: 3917 (9/30/2017), CHS: 0817 (8/25/2017)

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To ensure that this chart was printed at the proper scale, the line below should measure six inches (152 millimeters).
If the line does not measure six inches (152 millimeters), this copy is not certified safe for navigation.

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ATTACHMENT 5-2.3

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	City of Pasco, WA WWTP
Receiving Water	Columbia River - Mid

Step 2: Enter Dilution Factors -OR- Calculate DFs by entering Facility/Receiving Water Flow Data

Do you want to enter dilution factors -or- flow data?	Flow Data

	Annual Average	Max Monthly Average	Daily Max
Facility Flow, MGD	10.800	11.232	13.932
Facility Flow, cfs (calculated)	16.71	17.38	21.55

	Condition	Receiving Water Flow, cfs	Allowable % of river flow	Max Dilution Factor Allowed
Aquatic Life - Acute	7Q10	48590.55762	0.025	**57.4**
Aquatic Life - Chronic	7Q10	48590.55762	0.25	**700.1**
HH-Non-Carcinogen	30Q5	59426.29451	0.25	**856.0**
HH-Carcinogen	Harmonic Mean	145771.6728	0.25	**2182.2**
Whole river at 7Q10	7Q10	48590.55762	1	**2797.4**

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25.47	21.59
pH, s.u.	6.5	8.03
Alkalinity, mg/L as CaCO3	58.26144068	58.26144068
Hardness, mg/L CaCO3	66.21144068	66.21144068
Salinity, psu		
Receiving water TSS, mg/L (leave blank if unknown)		
If TSS is annual data, enter 'A'; if from critical period, enter 'S'; If no TSS, leave blank		

Step 4: Specifiy if using 'Mixed' values for hardness, temperature, and pH

	Use 'Mixed Hardness' (Y/N)	Use 'Mixed Max Temp' (Y/N)	Use 'Mixed pH (Y/N)
	N	N	N
Acute Zone Boundary	66.2	21.7	7.8
Chronic Zone Boundary	66.2	21.6	8.0
Whole river at 7Q10	66.2	21.6	8.0

Reasonable Potential Calculation

Facility	City of Pasco, WA WWTP
Water Body Type	Freshwater
Rec. Water Hardness	66.2114406779661 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	57.4	700.1
Human Health Carcinogenic		2182.2
Human Health Non-Carcinogenic		856.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	pH	Polychlorinated Biphenyls (PCB's) 53469219, 11097691, 1104282, 11141165, 12672296, 11096825, 12674112 18P-24P	DIOXIN (2,3,7,8-TCDD) 1746016	DDT METABOLITE (DDE) 72559 8P	ALKALINITY	BACTERIA	OXYGEN DISSOLVED 7782447	GASSES, TOTAL DISSOLVED	SOLIDS,SUSPENDED AND TURBIDITY	
Effluent Data	# of Samples (n)		605	2093	23				2094	2066			
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		53,300		0								
	Calculated 50th percentile Effluent Conc. (when n>10)				0								
Receiving Water Data	90th Percentile Conc., ug/L		10.00		0			58.2614					
	Geo Mean, ug/L				0								
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	7,526	-	2	-	1.1	-	document	-	Gold Book	-	
		Chronic	798	6.5 - 8.5	0.014	-	0.001	20000	-	173-201A	-	173-201A	
	WQ Criteria for Protection of Human Health, ug/L		-	-	0.000007	1.3E-08	8.8E-07	-	-	-	-	-	
	Metal Criteria Translator, decimal	Acute	-	-	-	-	-	-	-	-	-	-	
		Chronic	-	-	-	-	-	-	-	-	-	-	
	Carcinogen?		N	N	Y	Y	Y	N	N	N	N	N	

Aquatic Life Reasonable Potential

Effluent percentile value			0.950	0.950	0.950		0.950	0.950	0.950	0.950	0.950	0.950
s	$s^2=\ln(CV^2+1)$		0.555	0.555	0.555		0.555	0.555	0.555	0.555	0.555	0.555
Pn	$Pn=(1\text{-confidence level})^{1/n}$		0.995	0.999	0.878		#DIV/0!	#DIV/0!	0.999	0.999	#DIV/0!	#DIV/0!
Multiplier			1.00	1.00	1.00		#DIV/0!	#DIV/0!	1.00	1.00	#DIV/0!	#DIV/0!
Max concentration (ug/L) at edge of…		Acute	939.01	0.000	0.000		#DIV/0!	#DIV/0!	0.000	0.000	#DIV/0!	#DIV/0!
		Chronic	86.12	0.000	0.000		#DIV/0!	#DIV/0!	0.000	0.000	#DIV/0!	#DIV/0!
Reasonable Potential? Limit Required?			**NO**	**#VALUE!**	**NO**		**#DIV/0!**	**#DIV/0!**	**#VALUE!**	**#VALUE!**	**#VALUE!**	**#VALUE!**

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		
LTA Coeff. Var. (CV), decimal		
Permit Limit Coeff. Var. (CV), decimal		
Waste Load Allocations, ug/L	Acute	
	Chronic	
Long Term Averages, ug/L	Acute	
	Chronic	
Limiting LTA, ug/L		
Metal Translator or 1?		
Average Monthly Limit (AML), ug/L		
Maximum Daily Limit (MDL), ug/L		

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.554513029	0.55451	0.55451
Pn	Pn=(1-confidence level)1/n	0.878	#DIV/0!	#DIV/0!
Multiplier		0.524297641	#DIV/0!	#DIV/0!
Dilution Factor		2182.226087	2182.23	2182.23
Max Conc. at edge of Chronic Zone, ug/L		0	#DIV/0!	#DIV/0!
Reasonable Potential? Limit Required?		**NO**	**#DIV/0!**	**#DIV/0!**

Human Health Limit Calculation

# of Compliance Samples Expected per month	
Average Monthly Effluent Limit, ug/L	
Maximum Daily Effluent Limit, ug/L	

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Page 2

Facility	City of Pasco, WA WWTP
Water Body Type	Freshwater
Rec. Water Hardness	66.2114406779661 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	57.4	700.1
Human Health Carcinogenic		2182.2
Human Health Non-Carcinogenic		856.0

Pollutant, CAS No. & NPDES Application Ref. No.			ARSENIC (inorganic)	CADMIUM - 7440439 4M Hardness dependent	CHLORINE (Total Residual) 7782505	COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M	LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	SELENIUM 7782492 10M	ZINC- 7440666 13M hardness dependent		
Effluent Data	# of Samples (n)		8	8		29	29	8	8	8	8		
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		2.5	2		75.9	0.1	2.5	0.0261	14.3	82.9		
	Calculated 50th percentile Effluent Conc. (when n>10)					40.231	0.0131						
Receiving Water Data	90th Percentile Conc., ug/L			0		0.67	0	0	0	0	0		
	Geo Mean, ug/L		0			0.67	0		0	0	0		
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	-	2.36794	19	11.538	22	41.1101	2.1	20	80.702		
		Chronic	-	0.76004	11	7.9803	5.2	1.602	0.012	5	73.693		
	WQ Criteria for Protection of Human Health, ug/L		0.018	-	-	1300	9	-	0.14	60	1000		
	Metal Criteria Translator, decimal	Acute	-	0.943	-	0.996	-	0.466	0.85	-	0.996		
		Chronic	-	0.943	-	0.996	-	0.466	-	-	0.996		
	Carcinogen?		Y	N	N	N	N	N	N	N	N		

Aquatic Life Reasonable Potential

			Arsenic	Cadmium	Chlorine	Copper	Cyanide	Lead	Mercury	Selenium	Zinc		
Effluent percentile value				0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950		
s	$s^2=\ln(CV^2+1)$			0.555	0.555	0.555	0.555	0.555	0.555	0.555	0.555		
Pn	$Pn=(1\text{-confidence level})^{1/n}$			0.688	#DIV/0!	0.902	0.902	0.688	0.688	0.688	0.688		
Multiplier				1.90	#DIV/0!	1.00	1.00	1.90	1.90	1.90	1.90		
Max concentration (ug/L) at edge of…		Acute		0.062	#DIV/0!	1.976	0.002	0.039	0.001	0.473	2.732		
		Chronic		0.005	#DIV/0!	0.777	0.000	0.003	0.000	0.039	0.224		
Reasonable Potential? Limit Required?				**NO**	**#DIV/0!**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**		

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		
LTA Coeff. Var. (CV), decimal		
Permit Limit Coeff. Var. (CV), decimal		
Waste Load Allocations, ug/L	Acute	
	Chronic	
Long Term Averages, ug/L	Acute	
	Chronic	
Limiting LTA, ug/L		
Metal Translator or 1?		
Average Monthly Limit (AML), ug/L		
Maximum Daily Limit (MDL), ug/L		

Human Health Reasonable Potential

		Arsenic	Cadmium	Chlorine	Copper	Cyanide	Lead	Mercury	Selenium	Zinc		
s	$s^2=\ln(CV^2+1)$	0.5545			0.5545	0.55451		0.55451	0.5545	0.5545		
Pn	Pn=(1-confidence level)1/n	0.688			0.902	0.902		0.688	0.688	0.688		
Multiplier		0.7624			0.4884	0.48844		0.76241	0.7624	0.7624		
Dilution Factor		2182.2			856.01	856.013		856.013	856.01	856.01		
Max Conc. at edge of Chronic Zone, ug/L		0.0009			0.7162	1.5E-05		2.3E-05	0.0127	0.0738		
Reasonable Potential? Limit Required?		**NO**			**NO**	**NO**		**NO**	**NO**	**NO**		

Human Health Limit Calculation

# of Compliance Samples Expected per month	
Average Monthly Effluent Limit, ug/L	
Maximum Daily Effluent Limit, ug/L	

Comments/Notes:

References: WAC 173-201A,

Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Reasonable Potential Calculation - Page 3

Facility	City of Pasco, WA WWTP
Water Body Type	Freshwater
Rec. Water Hardness	66.2114406779661 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	57.4	700.1
Human Health Carcinogenic		2182.2
Human Health Non-Carcinogenic		856.0

			PHENOL 108952 10A	BIS(2-ETHYLHEXYL) PHTHALATE 117817 13B	CHLOROFORM 67663 11V	METHYL CHLORIDE 74873 21V	DIETHYLPHTHALATE 84662 24B	TOLUENE 108883 25V					
Pollutant, CAS No. & NPDES Application Ref. No.													
Effluent Data	# of Samples (n)		30	2	9	1	1	3					
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)			0.51	1.94		0.78	1.62					
	Calculated 50th percentile Effluent Conc. (when n>10)		0.04										
Receiving Water Data	90th Percentile Conc., ug/L												
	Geo Mean, ug/L		0	0	0		0	0				0	
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	-	-	-	-	-	-					
		Chronic	-	-	-	-	-	-					
	WQ Criteria for Protection of Human Health, ug/L		9000	0.045	100	-	200	72					
	Metal Criteria Translator, decimal	Acute	-	-	-	-	-	-					
		Chronic	-	-	-	-	-	-					
	Carcinogen?		N	Y	Y	-	N	N					

Aquatic Life Reasonable Potential

Effluent percentile value		
s	$s^2=\ln(CV^2+1)$	
Pn	$Pn=(1\text{-confidence level})^{1/n}$	
Multiplier		
Max concentration (ug/L) at edge of…	Acute	
	Chronic	
Reasonable Potential? Limit Required?		

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		
LTA Coeff. Var. (CV), decimal		
Permit Limit Coeff. Var. (CV), decimal		
Waste Load Allocations, ug/L	Acute	
	Chronic	
Long Term Averages, ug/L	Acute	
	Chronic	
Limiting LTA, ug/L		
Metal Translator or 1?		
Average Monthly Limit (AML), ug/L		
Maximum Daily Limit (MDL), ug/L		

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.5545	0.5545	0.5545		0.55451	0.55451
Pn	Pn=(1-confidence level)1/n	0.905	0.224	0.717		0.050	0.368
Multiplier		0.4835	1.5242	0.7276		2.48953	1.20486
Dilution Factor		856.01	2182.2	2182.2		856.013	856.013
Max Conc. at edge of Chronic Zone, ug/L		5E-05	0.0004	0.0006		0.00227	2.3E-03
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**		**NO**	**NO**

Human Health Limit Calculation

# of Compliance Samples Expected per month	
Average Monthly Effluent Limit, ug/L	
Maximum Daily Effluent Limit, ug/L	

Comments/Notes:

References: WAC 173-201A,
Technical Support Document for Water Quality-based Toxics Control, US EPA, March 1991, EPA/505/2-90-001, pages 56/99

Instructions: Enter data on 'Input 1' tab and below with yellow fields.
- Click here for more details -

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	700.1
Receiving Water Fecal Coliform, #/100 ml	11
Effluent Fecal Coliform - worst case, #/100 ml	172
Surface Water Criteria, #/100 ml	*100*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**11**
Difference between mixed and ambient, #/100 ml	0.23

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for fecal coliform.

Calculation of Dissolved Oxygen at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	700.1
Receiving Water DO Concentration, mg/L	9.4
Effluent DO Concentration, mg/L	0.91
Effluent Immediate DO Demand (IDOD), mg/L	2.0
Surface Water Criteria, mg/L	*8.0*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**9.37**
DO decrease caused by effluent at chronic boundary, mg/L	**0.01**

Conclusion: At design flow, the discharge has no reasonable potential to violate water quality standards for dissolved oxygen.

References: EPA/600/6-85/002b and EPA/430/9-82-011

Instructions: Enter data on 'Input 1' tab and below with yellow fields. Spreadsheet uses pH and temperature at mixing zone boundaries, you can override this by entering your own data in these cells.
- Click here for more details -

Freshwater Un-ionized Ammonia Criteria Calculation

Based on Chapter 173-201A WAC, amended November 20, 2006

	Background	mixed @ Acute Boundary	mixed @ Chronic Boundary	mixed @ Whole River
INPUT				
1. Receiving Water Temperature (deg C):	21.6	21.7	21.6	21.6
2. Receiving Water pH:	8.0	7.8	8.0	8.0
3. Is salmonid habitat an existing or designated use?	Yes	Yes	Yes	Yes
4. Are non-salmonid early life stages present or absent?	Present	Present	Present	Present
OUTPUT				
Using mixed temp and pH at mixing zone boundaries?	yes			
Ratio	13.500	13.500	13.500	13.500
FT	1.400	1.400	1.400	1.400
FPH	1.000	1.089	1.000	1.000
pKa	9.352	9.350	9.352	9.352
Unionized Fraction	0.045	0.030	0.044	0.045
Unionized ammonia NH3 criteria (mg/L as NH_3)				
Acute:	0.293	0.275	0.000	0.293
Chronic:	0.042	0.039	0.042	0.042
RESULTS				
Total ammonia nitrogen criteria (mg/L as N):				
Acute:	5.305	**7.526**		5.354
Chronic:	0.766		**0.798**	0.774

Freshwater Temperature Reasonable Potential and Limit Calculation

Based on WAC 173-201A-200(1)(c)(i)--(ii) and the Water Quality Program Guidance. All data inputs must meet WQ guidelines. The Water Quality temperature guidance document may be found at: https://fortress.wa.gov/ecy/publications/summarypages/0610100.html

	Core Summer Critera	Supplemental Criteria
INPUT	July 1-Sept 14	Sept 15-July 1
1. Chronic Dilution Factor at Mixing Zone Boundary	700.1	700.1
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	21.6 °C	20.7 °C
3. 7DADMax Effluent Temperature (95th percentile)	25.5 °C	27.1 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	17.5 °C	17.5 °C
OUTPUT		
5. Temperature at Chronic Mixing Zone Boundary:	21.6 °C	20.8 °C
6. Incremental Temperature Increase or decrease:	0.006 °C	0.009 °C
7. Maximum Allowable Incremental Temperature Increase:	0.3 °C	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	21.9 °C	21.0 °C
A. If ambient temp is warmer than WQ criterion		
9. Does temp fall within this warmer temp range?	YES	YES
10. Temperature Limit if Required:	NO LIMIT	NO LIMIT
B. If ambient temp is cooler than WQ criterion but within 28/(T_{amb}+7) and within 0.3 °C of the criterion		
11. Does temp fall within this incremental temp. range?	---	---
12. Temp increase allowed at mixing zone boundary, if required:	---	---
C. If ambient temp is cooler than (WQ criterion-0.3) but within 28/(T_{amb}+7) of the criterion		
13. Does temp fall within this Incremental temp. range?	---	---
14. Temp increase allowed at mixing zone boundary, if required:	---	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))		
15. Does temp fall within this Incremental temp. range?	---	---
16. Temp increase allowed at mixing zone boundary, if required:	---	---
RESULTS		
17. Do any of the above cells show a temp increase?	**NO**	**NO**
18. Temperature Limit if Required?	**NO LIMIT**	**NO LIMIT**

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.)

INPUT			
	@ Acute Boundary	**@ Chronic Boundary**	**@ Whole River**
1. Dilution Factor at Mixing Zone Boundary	57.4	700.1	2797.4
2. Ambient/Upstream/Background Conditions			
Temperature (deg C):	21.59	21.59	21.59
pH:	8.45	8.45	8.45
Alkalinity (mg CaCO3/L):	58.26	58.26	58.26
3. Effluent Characteristics			
Temperature (deg C):	25.47	25.47	25.47
pH:	8.19	8.19	8.19
Alkalinity (mg CaCO3/L):	58.26	58.26	58.26
OUTPUT			
1. Ionization Constants			
Upstream/Background pKa:	6.37	6.37	6.37
Effluent pKa:	6.35	6.35	6.35
2. Ionization Fractions			
Upstream/Background Ionization Fraction:	0.99	0.99	0.99
Effluent Ionization Fraction:	0.99	0.99	0.99
3. Total Inorganic Carbon			
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	59	59	59
Effluent Total Inorganic Carbon (mg CaCO3/L):	59	59	59
4. Condtions at Mixing Zone Boundary			
Temperature (deg C):	21.65	21.59	21.59
Alkalinity (mg CaCO3/L):	58.26	58.26	58.26
Total Inorganic Carbon (mg CaCO3/L):	58.75	58.75	58.75
pKa:	6.37	6.37	6.37
RESULTS			
pH at Mixing Zone Boundary:	**8.44**	**8.45**	**8.45**

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

INPUT			
1. EFFLUENT CHARACTERISTICS			
Discharge (cfs):			16.707538
$CBOD_5$ (mg/L):			30
NBOD (mg/L):			76.228994
Dissolved Oxygen (mg/L):			0.9095985
Temperature (deg C):			25.471429
2. RECEIVING WATER CHARACTERISTICS			
Upstream Discharge (cfs):			48590.558
Upstream $CBOD_5$ (mg/L):			2
Upstream NBOD (mg/L):			1
Upstream Dissolved Oxygen (mg/L):			9.38
Upstream Temperature (deg C):			20.742857
Elevation (ft NGVD):			343
Downstream Average Channel Slope (ft/ft):			0.001
Downstream Average Channel Depth (ft):			30
Downstream Average Channel Velocity (fps):			0.5576
3. REAERATION RATE (Base e) at 20 deg C (day^{-1}):			3.57
	Applic.	Applic.	Suggested
Reference	Vel (fps)	Dep (ft)	Values
Churchill	1.5 - 6	2 - 50	0.02
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.06
Owens	0.1 - 6	1 - 2	0.03
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.28
4. BOD DECAY RATE (Base e) AT 20 deg C (day^{-1}):			0.23
(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value -->*			0.05

OUTPUT	
1. INITIAL MIXED RIVER CONDITION	
$CBOD_5$ (mg/L):	2.0
NBOD (mg/L):	1.0
Dissolved Oxygen (mg/L):	9.4
Temperature (deg C):	20.7
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)	
Reaeration (day^-1):	3.63
BOD Decay (day^-1):	0.24
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU	
Initial Mixed CBODU (mg/L):	3.0
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	4.0
4. INITIAL DISSOLVED OXYGEN DEFICIT	
Saturation Dissolved Oxygen (mg/L):	8.851
Initial Deficit (mg/L):	-0.53
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	1.11
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	10.17
7. CRITICAL DO DEFICIT (mg/L):	0.20
8. CRITICAL DO CONCENTRATION (mg/L):	**8.65**

Molybdenum

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	5.1
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.002**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	5.1
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0070**

Chloromethane

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	1.02
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.000**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	1.02
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0014**

3,4-DimethylPhenol

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	1.44
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.000**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	1.44
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0020**

Di-n,Octyl Phthalate

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	1.23
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.000**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	1.23
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0017**

Chloroanaline

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	12.1
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.004**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	12.1
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0166**

Acetone

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	21.5
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.007**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	21.5
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0295**

Pyridine

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	0.55
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.000**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	0.55
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0008**

Chlorine

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	0.2
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.000**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	0.2
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0003**

Toluene

Calculation of Dilution Factors and Concentrations at Mixing Zone Boundaries

Use to calculate volume-restricted dilution factors

INPUT	
1. Effluent Flow	16.708
2. Effluent Concentration	1.62
3. Receiving Water Flow (same units as #1)	48590.56
4. Receiving Water Concentration (same units as #2)	0.00
OUTPUT	
Concentration - complete mix (same units as #1 above)	**0.001**
Dilution Factor - complete mix	**2909.3**
Dilution Factor - Acute, 2.5% Dilution	**73.7**
Dilution Factor - Chronic, 25% Dilution	**728.1**

Use to calculate concentration at mixing zone boundary

INPUT	
1. Dilution Factor	728.1
2. Effluent Concentration	1.62
4. Receiving Water Concentration	0.00
OUTPUT	
Concentration - at mixing zone boundary	**0.0022**

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ATTACHMENT 5-2.4

United States Environmental Protection Agency

Priority Pollutant List

Priority Pollutants are a set of chemical pollutants we regulate, and for which we have developed analytical test methods. The current list of 126 Priority Pollutants, shown below, can also be found at 40 CFR Part 423, Appendix A.

These are not the only pollutants regulated in Clean Water Act programs. The list is an important starting point for EPA to consider, for example, in developing national discharge standards (such as Effluent Guidelines) or in national permitting programs (such as NPDES).

1. Acenaphthene
2. Acrolein
3. Acrylonitrile
4. Benzene
5. Benzidine
6. Carbon tetrachloride
7. Chlorobenzene
8. 1,2,4-trichlorobenzene
9. Hexachlorobenzene
10. 1,2-dichloroethane
11. 1,1,1-trichloreothane
12. Hexachloroethane
13. 1,1-dichloroethane
14. 1,1,2-trichloroethane
15. 1,1,2,2-tetrachloroethane
16. Chloroethane
17. (Removed)
18. Bis(2-chloroethyl) ether
19. 2-chloroethyl vinyl ethers
20. 2-chloronaphthalene
21. 2,4,6-trichlorophenol
22. Parachlorometa cresol
23. Chloroform
24. 2-chlorophenol
25. 1,2-dichlorobenzene
26. 1,3-dichlorobenzene
27. 1,4-dichlorobenzene
28. 3,3-dichlorobenzidine
29. 1,1-dichloroethylene
30. 1,2-trans-dichloroethylene
31. 2,4-dichlorophenol
32. 1,2-dichloropropane
33. 1,3-dichloropropylene
34. 2,4-dimethylphenol
35. 2,4-dinitrotoluene
36. 2,6-dinitrotoluene
37. 1,2-diphenylhydrazine
38. Ethylbenzene
39. Fluoranthene
40. 4-chlorophenyl phenyl ether
41. 4-bromophenyl phenyl ether
42. Bis(2-chloroisopropyl) ether
43. Bis(2-chloroethoxy) methane
44. Methylene chloride
45. Methyl chloride
46. Methyl bromide
47. Bromoform
48. Dichlorobromomethane
49. (Removed)
50. (Removed)
51. Chlorodibromomethane
52. Hexachlorobutadiene
53. Hexachlorocyclopentadiene
54. Isophorone
55. Naphthalene
56. Nitrobenzene
57. 2-nitrophenol
58. 4-nitrophenol
59. 2,4-dinitrophenol
60. 4,6-dinitro-o-cresol
61. N-nitrosodimethylamine
62. N-nitrosodiphenylamine
63. N-nitrosodi-n-propylamine
64. Pentachlorophenol
65. Phenol
66. Bis(2-ethylhexyl) phthalate
67. Butyl benzyl phthalate
68. Di-N-Butyl Phthalate

69. Di-n-octyl phthalate
70. Diethyl Phthalate
71. Dimethyl phthalate
72. Benzo(a) anthracene
73. Benzo(a) pyrene
74. Benzo(b) fluoranthene
75. Benzo(k) fluoranthene
76. Chrysene
77. Acenaphthylene
78. Anthracene
79. Benzo(ghi) perylene
80. Fluorene
81. Phenanthrene
82. Dibenzo(,h) anthracene
83. Indeno (1,2,3-cd) pyrene
84. Pyrene
85. Tetrachloroethylene
86. Toluene
87. Trichloroethylene
88. Vinyl chloride
89. Aldrin
90. Dieldrin
91. Chlordane
92. 4,4-DDT
93. 4,4-DDE
94. 4,4-DDD
95. Alpha-endosulfan
96. Beta-endosulfan
97. Endosulfan sulfate
98. Endrin
99. Endrin aldehyde
100. Heptachlor
101. Heptachlor epoxide
102. Alpha-BHC
103. Beta-BHC
104. Gamma-BHC
105. Delta-BHC
106. PCB-1242 (Arochlor 1242)
107. PCB-1254 (Arochlor 1254)
108. PCB-1221 (Arochlor 1221)
109. PCB-1232 (Arochlor 1232)
110. PCB-1248 (Arochlor 1248)
111. PCB-1260 (Arochlor 1260)
112. PCB-1016 (Arochlor 1016)
113. Toxaphene
114. Antimony
115. Arsenic
116. Asbestos
117. Beryllium
118. Cadmium
119. Chromium
120. Copper
121. Cyanide, Total
122. Lead
123. Mercury
124. Nickel
125. Selenium
126. Silver
127. Thallium
128. Zinc
129. 2,3,7,8-TCDD

Additional Information

- Toxic and Priority Pollutants Under the Clean Water Act

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ATTACHMENT 5-2.5

DEPARTMENT OF
ECOLOGY
State of Washington

Water Quality Standards for Surface Waters of the State of Washington

Chapter 173-201A WAC

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Water Quality Standards for Surface Waters of the State of Washington Chapter 173-201A WAC

Adopted August 1, 2016

by
Watershed Management Section

Water Quality Program
Washington State Department of Ecology
Olympia, Washington

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Chapter 173-201A WAC
Water Quality Standards for Surface Waters of the State of Washington

Last Update: 8/1/16

WAC Sections

PART I - INTRODUCTION

PART II - DESIGNATED USES AND CRITERIA

PART III - ANTIDEGRADATION

PART IV - TOOLS FOR APPLICATION OF CRITERIA AND USES

PART V - IMPLEMENTATION OF STANDARDS

PART VI - USE DESIGNATIONS FOR WATERS OF THE STATE

DISPOSITIONS OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

173-201A-030 General water use and criteria classes. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-030, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-030, filed 11/25/92, effective 12/26/92.] Repealed by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW.

173-201A-040 Toxic substances. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-040, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-040, filed 11/25/92, effective 12/26/92.] Amended and decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-240.

173-201A-050 Radioactive substances. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-050, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-050, filed 11/25/92, effective 12/26/92.] Decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-250.

173-201A-060 General considerations. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-060, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-060, filed 11/25/92, effective 12/26/92.] Repealed by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW.

173-201A-070 Antidegradation. [Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-070, filed 11/25/92, effective 12/26/92.] Repealed by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW.

173-201A-080 Outstanding resource waters. [Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-080, filed 11/25/92, effective 12/26/92.] Repealed by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW.

173-201A-100 Mixing zones. [Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-100, filed 11/25/92, effective 12/26/92.] Amended and decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-400.

173-201A-110	Short-term modifications. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-110, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-110, filed 11/25/92, effective 12/26/92.] Amended and decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-410.
173-201A-120	General classifications. [Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-120, filed 11/25/92, effective 12/26/92.] Repealed by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW.
173-201A-130	Specific classifications—Freshwater. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-130, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-130, filed 11/25/92, effective 12/26/92.] Repealed by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW.
173-201A-140	Specific classifications—Marine water. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-140, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-140, filed 11/25/92, effective 12/26/92.] Repealed by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW.
173-201A-150	Achievement considerations. [Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-150, filed 11/25/92, effective 12/26/92.] Decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-500.
173-201A-160	Implementation. [Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-160, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-160, filed 11/25/92, effective 12/26/92.] Amended and decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-510.
173-201A-170	Surveillance. [Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-170, filed 11/25/92, effective 12/26/92.] Amended and decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-520.
173-201A-180	Enforcement. [Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-180, filed 11/25/92, effective 12/26/92.] Decodified by WSR 03-14-129 (Order 02-14), filed 7/1/03, effective 8/1/03. Statutory Authority: Chapters 90.48 and 90.54 RCW. Recodified as § 173-201A-530.

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Part I Introduction

173-201A-010
Purpose.

(1) The purpose of this chapter is to establish water quality standards for surface waters of the state of Washington consistent with public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife, pursuant to the provisions of chapter 90.48 RCW. All actions must comply with this chapter. As part of this chapter:

(a) All surface waters are protected by numeric and narrative criteria, designated uses, and an antidegradation policy.

(b) Based on the use designations, numeric and narrative criteria are assigned to a water body to protect the existing and designated uses.

(c) Where multiple criteria for the same water quality parameter are assigned to a water body to protect different uses, the most stringent criteria for each parameter is to be applied.

(2) Surface waters of the state include lakes, rivers, ponds, streams, inland waters, saltwaters, wetlands, and all other surface waters and water courses within the jurisdiction of the state of Washington.

(3) This chapter will be reviewed periodically by the department and appropriate revisions will be undertaken.

(4) WAC 173-201A-200 through 173-201A-260 and 173-201A-600 through 173-201A-612 describe the designated water uses and criteria for the state of Washington. These criteria were established based on existing and potential water uses of the surface waters of the state. Consideration was also given to both the natural water quality potential and its limitations. Compliance with the surface water quality standards of the state of Washington requires compliance with chapter 173-201A WAC, Water quality standards for surface waters of the state of Washington, chapter 173-204 WAC, Sediment management standards, and applicable federal rules.

[Statutory Authority: RCW 90.48.035. WSR 11-09-090 (Order 10-10), § 173-201A-010, filed 4/20/11, effective 5/21/11. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-010, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-010, filed 11/25/92, effective 12/26/92.]

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173-201A-020
Definitions.

The following definitions are intended to facilitate the use of chapter 173-201A WAC:

"1-DMax" or **"1-day maximum temperature"** is the highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

"7-DADMax" or **"7-day average of the daily maximum temperatures"** is the arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

"Action value" means a total phosphorus (TP) value established at the upper limit of the trophic states in each ecoregion (see Table 230(1)). Exceedance of an action value indicates that a problem is suspected. A lake-specific study may be needed to confirm if a nutrient problem exists.

"Actions" refers broadly to any human projects or activities.

"Acute conditions" are changes in the physical, chemical, or biologic environment which are expected or demonstrated to result in injury or death to an organism as a result of short-term exposure to the substance or detrimental environmental condition.

"AKART" is an acronym for "all known, available, and reasonable methods of prevention, control, and treatment." AKART shall represent the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge. The concept of AKART applies to both point and nonpoint sources of pollution. The term "best management practices," typically applied to nonpoint source pollution controls is considered a subset of the AKART requirement.

"Background" means the biological, chemical, and physical conditions of a water body, outside the area of influence of the discharge under consideration. Background sampling locations in an enforcement action would be up-gradient or outside the area of influence of the discharge. If several discharges to any water body exist, and enforcement action is being taken for possible violations to the standards, background sampling would be undertaken immediately up-gradient from each discharge.

"Best management practices (BMP)" means physical, structural, and/or managerial practices approved by the department that, when used singularly or in combination, prevent or reduce pollutant discharges.

"Biological assessment" is an evaluation of the biological condition of a water body using surveys of aquatic community structure and function and other direct measurements of resident biota in surface waters.

"Bog" means those wetlands that are acidic, peat forming, and whose primary water source is precipitation, with little, if any, outflow.

"Carcinogen" means any substance or agent that produces or tends to produce cancer in humans. For implementation of this chapter, the term carcinogen will apply to substances on the United States Environmental Protection Agency lists of A (known human) and B (probable human) carcinogens, and any substance which causes a significant increased incidence of benign or malignant tumors in a single, well conducted animal bioassay, consistent with the weight of evidence approach specified in the United States Environmental Protection Agency's Guidelines for Carcinogenic Risk Assessment as set forth in 51 FR 33992 et seq. as presently published or as subsequently amended or republished.

"Chronic conditions" are changes in the physical, chemical, or biologic environment which are expected or demonstrated to result in injury or death to an organism as a result of repeated or constant exposure over an extended period of time to a substance or detrimental environmental condition.

"Combined sewer overflow (CSO) treatment plant" is a facility that provides at-site treatment as provided for in chapter 173-245 WAC. A CSO treatment plant is a specific facility identified in a department-approved CSO reduction plan (long-term control plan) that is designed, operated and controlled by a municipal utility to capture and treat excess combined sanitary sewage and stormwater from a combined sewer system.

"Compliance schedule" or **"schedule of compliance"** is a schedule of remedial measures included in a permit or an order, including an enforceable sequence of interim requirements (for example, actions, operations, or milestone events) leading to compliance with an effluent limit, other prohibition, or standard.

"Created wetlands" means those wetlands intentionally created from nonwetland sites to produce or replace natural wetland habitat.

"Critical condition" is when the physical, chemical, and biological characteristics of the receiving water environment interact with the effluent to produce the greatest potential adverse impact on aquatic biota and existing or designated water uses. For steady-state discharges to riverine systems the critical condition may be assumed to be equal to the 7Q10 flow event unless determined otherwise by the department.

"Damage to the ecosystem" means any demonstrated or predicted stress to aquatic or terrestrial organisms or communities of organisms which the department reasonably concludes may interfere in the health or survival success or natural structure of such populations. This stress may be due to, but is not limited to, alteration in habitat or changes in water temperature, chemistry, or turbidity, and shall consider the potential build up of discharge constituents or temporal increases in habitat alteration which may create such stress in the long term.

"Department" means the state of Washington department of ecology.

"Designated uses" are those uses specified in this chapter for each water body or segment, regardless of whether or not the uses are currently attained.

"Director" means the director of the state of Washington department of ecology.

"Drainage ditch" means that portion of a designed and constructed conveyance system that serves the purpose of transporting surplus water; this may include natural water courses or channels incorporated in the system design, but does not include the area adjacent to the water course or channel.

"Ecoregions" are defined using EPAs *Ecoregions of the Pacific Northwest* Document No. 600/3-86/033 July 1986 by Omernik and Gallant.

"Enterococci" refers to a subgroup of fecal streptococci that includes *S. faecalis, S. faecium, S. gallinarum,* and *S. avium*. The enterococci are differentiated from other streptococci by their ability to grow in 6.5% sodium chloride, at pH 9.6, and at 10°C and 45°C.

"*E. coli*" or **"*Escherichia coli*"** is an aerobic and facultative gram negative nonspore forming rod shaped bacterium that can grow at 44.5 degrees Celsius that is ortho-nitrophenyl-B-D-galactopyranoside (ONPG) positive and Methylumbelliferyl glucuronide (MUG) positive.

"Existing uses" means those uses actually attained in fresh or marine waters on or after November 28, 1975, whether or not they are designated uses. Introduced species that are not native to Washington, and put-and-take fisheries comprised of nonself-replicating introduced native species, do not need to receive full support as an existing use.

"Extraordinary primary contact" means waters providing extraordinary protection against waterborne disease or that serve as tributaries to extraordinary quality shellfish harvesting areas.

"Fecal coliform" means that portion of the coliform group which is present in the intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within twenty-four hours at 44.5 plus or minus 0.2 degrees Celsius.

"Geometric mean" means either the nth root of a product of n factors, or the antilogarithm of the arithmetic mean of the logarithms of the individual sample values.

"Ground water exchange" means the discharge and recharge of ground water to a surface water. Discharge is inflow from an aquifer, seeps or springs that increases the available supply of surface water. Recharge is outflow downgradient to an aquifer or downstream to surface water for base flow maintenance. Exchange may include ground water discharge in one season followed by recharge later in the year.

"Hardness" means a measure of the calcium and magnesium salts present in water. For purposes of this chapter, hardness is measured in milligrams per liter and expressed as calcium carbonate ($CaCO_3$).

"Intake credit" is a procedure for establishing effluent limits that takes into account the amount of a pollutant that is present in waters of the state, at the time water is removed from the same body of water by the discharger or other facility supplying the discharger with intake water.

"Irrigation ditch" means that portion of a designed and constructed conveyance system that serves the purpose of transporting irrigation water from its supply source to its place of use; this may include natural water courses or channels incorporated in the system design, but does not include the area adjacent to the water course or channel.

"Lakes" shall be distinguished from riverine systems as being water bodies, including reservoirs, with a mean detention time of greater than fifteen days.

"Lake-specific study" means a study intended to quantify existing nutrient concentrations, determine existing characteristic uses for lake class waters, and potential lake uses. The study determines how to protect these uses and if any uses are lost or impaired because of nutrients, algae, or aquatic plants. An appropriate study must recommend a criterion for total phosphorus (TP), total nitrogen (TN) in µg/l, or other nutrient that impairs characteristic uses by causing excessive algae blooms or aquatic plant growth.

"Mean detention time" means the time obtained by dividing a reservoir's mean annual minimum total storage by the thirty-day ten-year low-flow from the reservoir.

"Migration or translocation" means any natural movement of an organism or community of organisms from one locality to another locality.

"Mixing zone" means that portion of a water body adjacent to an effluent outfall where mixing results in the dilution of the effluent with the receiving water. Water quality criteria may be exceeded in a mixing zone as conditioned and provided for in WAC 173-201A-400.

"Natural conditions" or **"natural background levels"** means surface water quality that was present before any human-caused pollution. When estimating natural conditions in the headwaters of a disturbed watershed it may be necessary to use the less disturbed conditions of a neighboring or similar watershed as a reference condition. (See also WAC 173-201A-260(1).)

"New or expanded actions" mean human actions that occur or are regulated for the first time, or human actions expanded such that they result in an increase in pollution, after July 1, 2003, for the purpose of applying this chapter only.

"Nonpoint source" means pollution that enters any waters of the state from any dispersed land-based or water-based activities including, but not limited to, atmospheric deposition; surface water runoff from agricultural lands, urban areas, or forest lands; subsurface or underground sources; or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System program.

"Permit" means a document issued pursuant to chapter 90.48 RCW specifying the waste treatment and control requirements and waste discharge conditions.

"pH" means the negative logarithm of the hydrogen ion concentration.

"Pollution" means such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life.

"Primary contact recreation" means activities where a person would have direct contact with water to the point of complete submergence including, but not limited to, skin diving, swimming, and water skiing.

"Secondary contact recreation" means activities where a person's water contact would be limited (e.g., wading or fishing) to the extent that bacterial infections of eyes, ears, respiratory or digestive systems, or urogenital areas would normally be avoided.

"Shoreline stabilization" means the anchoring of soil at the water's edge, or in shallow water, by fibrous plant root complexes; this may include long-term accretion of sediment or peat, along with shoreline progradation in such areas.

"Stormwater" means 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 stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

"Stormwater attenuation" means the process by which peak flows from precipitation are reduced and runoff velocities are slowed as a result of passing through a surface water body.

"Surface waters of the state" includes lakes, rivers, ponds, streams, inland waters, saltwaters, wetlands and all other surface waters and water courses within the jurisdiction of the state of Washington.

"Temperature" means water temperature expressed in degrees Celsius (°C).

"Treatment wetlands" means those wetlands intentionally constructed on nonwetland sites and managed for the primary purpose of wastewater or stormwater treatment. Treatment wetlands are considered part of a collection and treatment system, and generally are not subject to the criteria of this chapter.

"Trophic state" means a classification of the productivity of a lake ecosystem. Lake productivity depends on the amount of biologically available nutrients in water and sediments and may be based on total phosphorus (TP). Secchi depth and chlorophyll-a measurements may be used to improve the trophic state classification of a lake. Trophic states used in this rule include, from least to most nutrient rich, ultra-oligotrophic, oligotrophic, lower mesotrophic, upper mesotrophic, and eutrophic.

"Turbidity" means the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

"Upwelling" means the natural process along Washington's Pacific Coast where the summer prevailing northerly winds produce a seaward transport of surface water. Cold, deeper more saline waters rich in nutrients and low in dissolved oxygen, rise to replace the surface water. The cold oxygen deficient water enters Puget Sound and other coastal estuaries at depth where it displaces the existing deep water and eventually rises to replace the surface water. Such surface water replacement results in an overall increase in salinity and nutrients accompanied by a depression in dissolved oxygen. Localized upwelling of the deeper water of Puget Sound can occur year-round under influence of tidal currents, winds, and geomorphic features.

"USEPA" means the United States Environmental Protection Agency.

"Variance" is a time-limited designated use and criterion as defined in 40 C.F.R. 131.3, and must be adopted by rule.

"Wetlands" means areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas to mitigate the conversion of wetlands. (Water bodies not included in the definition of wetlands as well as those mentioned in the definition are still waters of the state.)

"Wildlife habitat" means waters of the state used by, or that directly or indirectly provide food support to, fish, other aquatic life, and wildlife for any life history stage or activity.

[Statutory Authority: RCW 90.48.035, 90.48.605 and section 303(c) of the Federal Water Pollution Control Act (Clean Water Act), C.F.R. 40, C.F.R. 131. WSR 16-16-095 (Order 12-03), § 173-201A-020, filed 8/1/16, effective 9/1/16. Statutory Authority: RCW 90.48.035. WSR 11-09-090 (Order 10-10), § 173-201A-020, filed 4/20/11, effective 5/21/11. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-020, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-020, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-020, filed 11/25/92, effective 12/26/92.]

Part II – Designated Uses and Criteria

173-201A-200
Fresh water designated uses and criteria.

The following uses are designated for protection in fresh surface waters of the state. Use designations for water bodies are listed in WAC 173-201A-600 and 173-201A-602.

(1) **Aquatic life uses.** Aquatic life uses are designated based on the presence of, or the intent to provide protection for, the key uses identified in (a) of this subsection. It is required that all indigenous fish and nonfish aquatic species be protected in waters of the state in addition to the key species described below.

(a) The categories for aquatic life uses are:

(i) **Char spawning and rearing.** The key identifying characteristics of this use are spawning or early juvenile rearing by native char (bull trout and Dolly Varden), or use by other aquatic species similarly dependent on such cold water. Other common characteristic aquatic life uses for waters in this category include summer foraging and migration of native char; and spawning, rearing, and migration by other salmonid species.

(ii) **Core summer salmonid habitat.** The key identifying characteristics of this use are summer (June 15 - September 15) salmonid spawning or emergence, or adult holding; use as important summer rearing habitat by one or more salmonids; or foraging by adult and subadult native char. Other common characteristic aquatic life uses for waters in this category include spawning outside of the summer season, rearing, and migration by salmonids.

(iii) **Salmonid spawning, rearing, and migration.** The key identifying characteristic of this use is salmon or trout spawning and emergence that only occurs outside of the summer season (September 16 - June 14). Other common characteristic aquatic life uses for waters in this category include rearing and migration by salmonids.

(iv) **Salmonid rearing and migration only.** The key identifying characteristic of this use is use only for rearing or migration by salmonids (not used for spawning).

(v) **Non-anadromous interior redband trout.** For the protection of waters where the only trout species is a non-anadromous form of self-reproducing interior redband trout (*O. mykis*), and other associated aquatic life.

(vi) **Indigenous warm water species.** For the protection of waters where the dominant species under natural conditions would be temperature tolerant indigenous nonsalmonid species. Examples include dace, redside shiner, chiselmouth, sucker, and northern pikeminnow.

(b) **General criteria.** General criteria that apply to all aquatic life fresh water uses are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(i) Toxic, radioactive, and deleterious materials; and

(ii) Aesthetic values.

(c) **Aquatic life temperature criteria.** Except where noted, water temperature is measured by the 7-day average of the daily maximum temperatures (7-DADMax). Table 200 (1)(c) lists the temperature criteria for each of the aquatic life use categories.

Table 200 (1)(c)
Aquatic Life Temperature Criteria in Fresh Water

Category	Highest 7-DADMax
Char Spawning and Rearing*	12°C (53.6°F)
Core Summer Salmonid Habitat*	16°C (60.8°F)
Salmonid Spawning, Rearing, and Migration*	17.5°C (63.5°F)
Salmonid Rearing and Migration **Only**	17.5°C (63.5°F)
Non-anadromous Interior Redband Trout	18°C (64.4°F)
Indigenous Warm Water Species	20°C (68°F)

*Note: Some streams have a more stringent temperature criterion that is applied seasonally to further protect salmonid spawning and egg incubation. See (c)(B)(iv) of this subsection.

(i) When a water body's temperature is warmer than the criteria in Table 200 (1)(c) (or within 0.3°C (0.54°F) of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F).

(ii) When the background condition of the water is cooler than the criteria in Table 200 (1)(c), the allowable rate of warming up to, but not exceeding, the numeric criteria from human actions is restricted as follows:

(A) Incremental temperature increases resulting from individual point source activities must not, at any time, exceed 28/(T+7) as measured at the edge of a mixing zone boundary (where "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge); and

(B) Incremental temperature increases resulting from the combined effect of all nonpoint source activities in the water body must not, at any time, exceed 2.8°C (5.04°F).

(iii) Temperatures are not to exceed the criteria at a probability frequency of more than once every ten years on average.

(iv) Spawning and incubation protection. The department has identified waterbodies, or portions thereof, which require special protection for spawning and incubation in ecology publication 06-10-038 revised January 2011(also available on ecology's web site at www.ecy.wa.gov). This publication indicates where and when the following criteria are to be applied to protect the reproduction of native char, salmon, and trout:

• Maximum 7-DADMax temperatures of 9°C (48.2°F) at the initiation of spawning and at fry emergence for char; and

• Maximum 7-DADMax temperatures of 13°C (55.4°F) at the initiation of spawning for salmon and at fry emergence for salmon and trout.

The two criteria above are protective of incubation as long as human actions do not significantly disrupt the normal patterns of fall cooling and spring warming that provide significantly colder temperatures over the majority of the incubation period.

(v) For lakes, human actions considered cumulatively may not increase the 7-DADMax temperature more than 0.3°C (0.54°F) above natural conditions.

(vi) Temperature measurements should be taken to represent the dominant aquatic habitat of the monitoring site. This typically means samples should:

(A) Be taken from well mixed portions of rivers and streams; and

(B) Not be taken from shallow stagnant backwater areas, within isolated thermal refuges, at the surface, or at the water's edge.

(vii) The department will incorporate the following guidelines on preventing acute lethality and barriers to migration of salmonids into determinations of compliance with the narrative requirements for use protection established in this chapter (e.g., WAC 173-201A-310(1), 173-201A-400(4), and 173-201A-410 (1)(c)). The following site-level considerations do not, however, override the temperature criteria established for waters in subsection (1)(c) of this section or WAC 173-201A-600 through 173-201A-602:

(A) Moderately acclimated (16-20°C, or 60.8-68°F) adult and juvenile salmonids will generally be protected from acute lethality by discrete human actions maintaining the 7-DADMax temperature at or below 22°C (71.6°F) and the 1-day maximum (1-DMax) temperature at or below 23°C (73.4°F).

(B) Lethality to developing fish embryos can be expected to occur at a 1-DMax temperature greater than 17.5°C (63.5°F).

(C) To protect aquatic organisms, discharge plume temperatures must be maintained such that fish could not be entrained (based on plume time of travel) for more than two seconds at temperatures above 33°C (91.4°F) to avoid creating areas that will cause near instantaneous lethality.

(D) Barriers to adult salmonid migration are assumed to exist any time the 1-DMax temperature is greater than 22°C (71.6°F) and the adjacent downstream water temperatures are 3°C (5.4°F) or more cooler.

(viii) Nothing in this chapter shall be interpreted to prohibit the establishment of effluent limitations for the control of the thermal component of any discharge in accordance with 33 U.S.C. 1326 (commonly known as section 316 of the Clean Water Act).

(d) **Aquatic life dissolved oxygen (D.O.) criteria.** The D.O. criteria are measured in milligrams per liter (mg/L). Table 200 (1)(d) lists the 1-day minimum D.O. for each of the aquatic life use categories.

Table 200 (1)(d)
Aquatic Life Dissolved Oxygen Criteria in Fresh Water

Category	**Lowest 1-Day Minimum**
Char Spawning and Rearing	9.5 mg/L
Core Summer Salmonid Habitat	9.5 mg/L
Salmonid Spawning, Rearing, and Migration	8.0 mg/L
Salmonid Rearing and Migration **Only**	6.5 mg/L
Non-anadromous Interior Redband Trout	8.0 mg/L
Indigenous Warm Water Species	6.5 mg/L

(i) When a water body's D.O. is lower than the criteria in Table 200 (1)(d) (or within 0.2 mg/L of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the D.O. of that water body to decrease more than 0.2 mg/L.

(ii) For lakes, human actions considered cumulatively may not decrease the dissolved oxygen concentration more than 0.2 mg/L below natural conditions.

(iii) Concentrations of D.O. are not to fall below the criteria in the table at a probability frequency of more than once every ten years on average.

(iv) D.O. measurements should be taken to represent the dominant aquatic habitat of the monitoring site. This typically means samples should:

(A) Be taken from well mixed portions of rivers and streams; and

(B) Not be taken from shallow stagnant backwater areas, within isolated thermal refuges, at the surface, or at the water's edge.

(e) **Aquatic life turbidity criteria.** Turbidity is measured in "nephelometric turbidity units" or "NTUs." Table 200 (1)(e) lists the maximum turbidity criteria for each of the aquatic life use categories.

Table 200 (1)(e)
Aquatic Life Turbidity Criteria in Fresh Water

Category	NTUs
Char Spawning and Rearing	Turbidity shall not exceed: • 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Core Summer Salmonid Habitat	Same as above.
Salmonid Spawning, Rearing, and Migration	Same as above.
Salmonid Rearing and Migration **Only**	Turbidity shall not exceed: • 10 NTU over background when the background is 50 NTU or less; or • A 20 percent increase in turbidity when the background turbidity is more than 50 NTU.
Non-anadromous Interior Redband Trout	Turbidity shall not exceed: • 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Indigenous Warm Water Species	Turbidity shall not exceed: • 10 NTU over background when the background is 50 NTU or less; or • A 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

(i) The turbidity criteria established under WAC 173-201A-200 (1)(e) shall be modified, without specific written authorization from the department, to allow a temporary area of mixing during and immediately after necessary in-water construction activities that result in the disturbance of in-place sediments. This temporary area of mixing is subject to the constraints of WAC 173-201A-400 (4) and (6) and can occur only after the activity has received all other necessary local and state permits and approvals, and after the implementation of appropriate best management practices to avoid or minimize disturbance of in-place sediments and exceedances of the turbidity criteria. A temporary area of mixing shall be as follows:

(A) For waters up to 10 cfs flow at the time of construction, the point of compliance shall be one hundred feet downstream from the activity causing the turbidity exceedance.

(B) For waters above 10 cfs up to 100 cfs flow at the time of construction, the point of compliance shall be two hundred feet downstream of the activity causing the turbidity exceedance.

(C) For waters above 100 cfs flow at the time of construction, the point of compliance shall be three hundred feet downstream of the activity causing the turbidity exceedance.

(D) For projects working within or along lakes, ponds, wetlands, or other nonflowing waters, the point of compliance shall be at a radius of one hundred fifty feet from the activity causing the turbidity exceedance.

(f) **Aquatic life total dissolved gas (TDG) criteria.** TDG is measured in percent saturation. Table 200 (1)(f) lists the maximum TDG criteria for each of the aquatic life use categories.

Table 200 (1)(f)
Aquatic Life Total Dissolved Gas Criteria in Fresh Water

Category	**Percent Saturation**
Char Spawning and Rearing	Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.
Core Summer Salmonid Habitat	Same as above.
Salmonid Spawning, Rearing, and Migration	Same as above.
Salmonid Rearing and Migration **Only**	Same as above.
Non-anadromous Interior Redband Trout	Same as above.
Indigenous Warm Water Species	Same as above.

(i) The water quality criteria established in this chapter for TDG shall not apply when the stream flow exceeds the seven-day, ten-year frequency flood.

(ii) The TDG criteria may be adjusted to aid fish passage over hydroelectric dams when consistent with a department approved gas abatement plan. This plan must be accompanied by fisheries management and physical and biological monitoring plans. The elevated TDG levels are intended to allow increased fish passage without causing more harm to fish populations than caused by turbine fish passage. The following special fish passage exemptions for the Snake and Columbia rivers apply when spilling water at dams is necessary to aid fish passage:

• TDG must not exceed an average of one hundred fifteen percent as measured in the forebays of the next downstream dams and must not exceed an average of one hundred twenty percent as measured in the tailraces of each dam (these averages are measured as an average of the twelve highest consecutive hourly readings in any one day, relative to atmospheric pressure); and

• A maximum TDG one hour average of one hundred twenty-five percent must not be exceeded during spillage for fish passage.

(g) **Aquatic life pH criteria.** Measurement of pH is expressed as the negative logarithm of the hydrogen ion concentration. Table 200 (1)(g) lists the pH levels for each of the aquatic life use categories.

Table 200 (1) (g)
Aquatic Life pH Criteria in Fresh Water

Use Category	pH Units
Char Spawning and Rearing	pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 units.
Core Summer Salmonid Habitat	Same as above.
Salmonid Spawning, Rearing, and Migration	pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.
Salmonid Rearing and Migration **Only**	Same as above.
Non-anadromous Interior Redband Trout	Same as above.
Indigenous Warm Water Species	Same as above.

(2) **Recreational uses.** The recreational uses are extraordinary primary contact recreation, primary contact recreation, and secondary contact recreation.

(a) **General criteria.** General criteria that apply to fresh water recreational uses are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(i) Toxic, radioactive, and deleterious materials; and

(ii) Aesthetic values.

(b) **Water contact recreation bacteria criteria.** Table 200 (2)(b) lists the bacteria criteria to protect water contact recreation in fresh waters.

Table 200 (2)(b)
Water Contact Recreation Bacteria Criteria in Fresh Water

Category	Bacteria Indicator
Extraordinary Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 100 colonies/100 mL.
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL.
Secondary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 200 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 400 colonies /100 mL.

(i) When averaging bacteria sample data for comparison to the geometric mean criteria, it is preferable to average by season and include five or more data collection events within each period. Averaging of data collected beyond a thirty-day period, or beyond a specific discharge event under investigation, is not permitted when such averaging would skew the data set so as to mask noncompliance periods. The period of averaging should not exceed twelve months, and should have sample collection dates well distributed throughout the reporting period.

(ii) When determining compliance with the bacteria criteria in or around small sensitive areas, such as swimming beaches, it is recommended that multiple samples are taken throughout the area during each visit. Such multiple samples should be arithmetically averaged together (to reduce concerns with low bias when the data is later used in calculating a geometric mean) to reduce sample variability and to create a single representative data point.

(iii) As determined necessary by the department, more stringent bacteria criteria may be established for rivers and streams that cause, or significantly contribute to, the decertification or conditional certification of commercial or recreational shellfish harvest areas, even when the preassigned bacteria criteria for the river or stream are being met.

(iv) Where information suggests that sample results are due primarily to sources other than warm-blooded animals (e.g., wood waste), alternative indicator criteria may be established on a site-specific basis by the department.

(3) **Water supply uses.** The water supply uses are domestic, agricultural, industrial, and stock watering.

General criteria. General criteria that apply to the water supply uses are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(a) Toxic, radioactive, and deleterious materials; and
(b) Aesthetic values.

(4) **Miscellaneous uses.** The miscellaneous fresh water uses are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

General criteria. General criteria that apply to miscellaneous fresh water uses are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(a) Toxic, radioactive, and deleterious materials; and

(b) Aesthetic values.

[Statutory Authority: RCW 90.48.035. WSR 11-09-090 (Order 10-10), § 173-201A-200, filed 4/20/11, effective 5/21/11; WSR 06-23-117 (Order 06-04), § 173-201A-200, filed 11/20/06, effective 12/21/06. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-200, filed 7/1/03, effective 8/1/03.]

173-201A-210
Marine water designated uses and criteria.

The following uses are designated for protection in marine surface waters of the state of Washington. Use designations for specific water bodies are listed in WAC 173-201A-612.

(1) **Aquatic life uses.** Aquatic life uses are designated using the following general categories. It is required that all indigenous fish and nonfish aquatic species be protected in waters of the state.

(a) **The categories for aquatic life uses are:**

(i) **Extraordinary quality** salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

(ii) **Excellent quality** salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

(iii) **Good quality** salmonid migration and rearing; other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.

(iv) **Fair quality** salmonid and other fish migration.

(b) **General criteria.** General criteria that apply to aquatic life marine water uses are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(i) Toxic, radioactive, and deleterious materials; and

(ii) A esthetic values.

(c) **Aquatic life temperature criteria.** Except where noted, temperature is measured as a 1-day maximum temperature (1-DMax). Table 210 (1)(c) lists the temperature criteria for each of the aquatic life use categories.

Table 210 (1)(c)
Aquatic Life Temperature Criteria in Marine Water

Category	Highest 1-DMax
Extraordinary quality	13°C (55.4°F)
Excellent quality	16°C (60.8°F)
Good quality	19°C (66.2°F)
Fair quality	22°C (71.6°F)

(i) When a water body's temperature is warmer than the criteria in Table 210 (1)(c) (or within 0.3°C (0.54°F) of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F).

(ii) When the natural condition of the water is cooler than the criteria in Table

210 (1)(c), the allowable rate of warming up to, but not exceeding, the numeric criteria from human actions is restricted as follows:

(A) Incremental temperature increases resulting from individual point source activities must not, at any time, exceed 12/(T-2) as measured at the edge of a mixing zone boundary (where "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge); and

(B) Incremental temperature increases resulting from the combined effect of all nonpoint source activities in the water body must not, at any time, exceed 2.8°C (5.04°F).

(iii) Temperatures are not to exceed the criteria at a probability frequency of more than once every ten years on average.

(iv) Temperature measurements should be taken to represent the dominant aquatic habitat of the monitoring site. This typically means samples should not be taken from shallow stagnant backwater areas, within isolated thermal refuges, at the surface, or at the water's edge.

(v) The department will incorporate the following guidelines on preventing acute lethality and barriers to migration of salmonids into determinations of compliance with the narrative requirements for use protection established in this chapter (e.g., WAC 173-201A-310(1), 173-201A-400(4), and 173-201A-410 (1)(c)). The following site-level considerations do not, however, override the temperature criteria established for waters in subsection (1)(c) of this subsection or WAC 173-201A-612:

(A) Moderately acclimated (16-20°C, or 60.8-68°F) adult and juvenile salmonids will generally be protected from acute lethality by discrete human actions maintaining the 7-DADMax temperature at or below 22°C (71.6°F) and the 1-DMax temperature at or below 23°C (73.4°F).

(B) Lethality to developing fish embryos can be expected to occur at a 1-DMax temperature greater than 17.5°C (63.5°F).

(C) To protect aquatic organisms, discharge plume temperatures must be maintained such that fish could not be entrained (based on plume time of travel) for more than two seconds at temperatures above 33°C (91.4°F) to avoid creating areas that will cause near instantaneous lethality.

(D) Barriers to adult salmonid migration are assumed to exist any time the 1-DMax temperature is greater than 22°C (71.6°F) and the adjacent downstream water temperatures are 3°C (5.4°F) or more cooler.

(vi) Nothing in this chapter shall be interpreted to prohibit the establishment of effluent limitations for the control of the thermal component of any discharge in accordance with 33 U.S.C. 1326 (commonly known as section 316 of the Clean Water Act).

(d) **Aquatic life dissolved oxygen (D.O.) criteria.** Except where noted, D.O. concentrations are measured as a 1-day minimum in milligrams per liter. Table 210 (1)(d) lists the D.O. criteria for each of the aquatic life use categories.

Table 210 (1)(d)
Aquatic Life Dissolved Oxygen Criteria in Marine Water

Category	Lowest 1-Day Minimum
Extraordinary quality	7.0 mg/L
Excellent quality	6.0 mg/L
Good quality	5.0 mg/L
Fair quality	4.0 mg/L

(i) When a water body's D.O. is lower than the criteria in Table 210 (1)(d) (or within 0.2 mg/L of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the D.O. of that water body to decrease more than 0.2 mg/L.

(ii) Concentrations of D.O. are not to fall below the criteria in the table at a probability frequency of more than once every ten years on average.

(iii) D.O. measurements should be taken to represent the dominant aquatic habitat of the monitoring site. This typically means samples should not be taken from shallow stagnant backwater areas, within isolated thermal refuges, at the surface, or at the water's edge.

(e) **Aquatic life turbidity criteria.** Turbidity is measured in "nephelometric turbidity units" or "NTUs." Table 210 (1)(e) lists the one-day maximum turbidity allowed as a result of human actions for each of the aquatic life use categories.

Table 210 (1) (e)
Aquatic Life Turbidity Criteria in Marine Water

Category	NTUs
Extraordinary quality	Turbidity must not exceed: • 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Excellent quality	Same as above.
Good quality	Turbidity must not exceed: • 10 NTU over background when the background is 50 NTU or less; or • A 20 percent increase in turbidity when the background turbidity is more than 50 NTU.
Fair quality	Same as above.

(i) The turbidity criteria established under WAC 173-201A-210 (1)(e) shall be modified, without specific written authorization from the department, to allow a temporary area of mixing during and immediately after necessary in-water construction activities that result in the disturbance of in-place sediments. This temporary area of mixing is subject to the constraints of WAC 173-201A-400 (4) and (6) and can occur only after the activity has received all other necessary local and state permits and approvals, and after the implementation of appropriate best management practices to avoid or minimize disturbance of in-place sediments and exceedances of the turbidity criteria. For estuaries or marine waters, the point of compliance for a temporary area of mixing shall be at a radius of one hundred fifty feet from the activity causing the turbidity exceedance:

(f) **Aquatic life pH criteria.** Measurement of pH is expressed as the negative logarithm of the hydrogen ion concentration. Table 210 (1)(f) lists the pH levels allowed as a result of human actions for each of the aquatic life use categories.

Table 210 (1)(f)
Aquatic Life pH Criteria in Marine Water

Use Category	pH Units
Extraordinary quality	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.2 units.
Excellent quality	pH must be within the range of 7.0 to 8.5 with a human-caused variation within the above range of less than 0.5 units.
Good quality	Same as above.
Fair quality	pH must be within the range of 6.5 to 9.0 with a human-caused variation within the above range of less than 0.5 units.

(2) **Shellfish harvesting.**

(a) **General criteria**. General criteria that apply to shellfish harvesting uses for marine water are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(i) Toxic, radioactive, and deleterious materials; and

(ii) Aesthetic values.

(b) **Shellfish harvesting bacteria criteria.** To protect shellfish harvesting, fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, and not have more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.

(i) Shellfish growing areas approved for unconditional harvest by the state department of health are fully supporting the shellfish harvest goals of this chapter, even when comparison with the criteria contained in this chapter suggest otherwise.

(ii) When averaging bacteria sample data for comparison to the geometric mean criteria, it is preferable to average by season and include five or more data collection events within each period. Averaging of data collected beyond a thirty-day period, or beyond a specific discharge event under investigation, is not permitted when such averaging would skew the data set so as to mask noncompliance periods. The period of averaging should not exceed twelve months, and should have sample collection dates well distributed throughout the reporting period.

(iii) When determining compliance with the bacteria criteria in or around small sensitive areas, it is recommended that multiple samples are taken throughout the area during each visit. Such multiple samples should be arithmetically averaged together (to reduce concerns with low bias when the data is later used in calculating a geometric mean) to reduce sample variability and to create a single representative data point.

(iv) As determined necessary by the department, more stringent bacteria criteria may be established for waters that cause, or significantly contribute to, the decertification or conditional certification of commercial or recreational shellfish harvest areas, even when the preassigned bacteria criteria for the water is being met.

(v) Where information suggests that sample results are due primarily to sources other than warm-blooded animals (e.g., wood waste), alternative indicator criteria may be established on a site-specific basis by the department.

(3) **Recreational uses.** The recreational uses are primary contact recreation and secondary contact recreation.

(a) **General criteria.** General criteria that apply to water contact uses for marine water are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(i) Toxic, radioactive, and deleterious materials; and

(ii) Aesthetic values.

(b) **Water contact recreation bacteria criteria.** Table 210 (3)(b) lists the bacteria criteria to protect water contact recreation in marine water.

Table 210 (3)(b)
Water Contact Recreation Bacteria Criteria in Marine Water

Category	Bacteria Indicator
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies/100 mL.
Secondary Contact Recreation	Enterococci organism levels must not exceed a geometric mean value of 70 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 208 colonies/100 mL.

(i) When averaging bacteria sample data for comparison to the geometric mean criteria, it is preferable to average by season and include five or more data collection events within each period. Averaging of data collected beyond a thirty-day period, or beyond a specific discharge event under investigation, is not permitted when such averaging would skew the data set so as to mask noncompliance periods. The period of averaging should not exceed twelve months, and should have sample collection dates well distributed throughout the reporting period.

(ii) When determining compliance with the bacteria criteria in or around small sensitive areas, such as swimming beaches, it is recommended that multiple samples are taken throughout the area during each visit. Such multiple samples should be arithmetically averaged together (to reduce concerns with low bias when the data is later used in calculating a geometric mean) to reduce sample variability and to create a single representative data point.

(iii) As determined necessary by the department, more stringent bacteria criteria may be established for waters that cause, or significantly contribute to, the decertification or conditional certification of commercial or recreational shellfish harvest areas, even when the preassigned bacteria criteria for the water is being met.

(iv) Where information suggests that sample results are due primarily to sources other than warm-blooded animals (e.g., wood waste), alternative indicator criteria may be established on a site-specific basis by the department.

(4) **Miscellaneous uses.** The miscellaneous marine water uses are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

General criteria. General criteria that apply in miscellaneous marine water uses are described in WAC 173-201A-260 (2)(a) and (b), and are for:

(a) Toxic, radioactive, and deleterious materials; and

(b) Aesthetic values.

[Statutory Authority: RCW 90.48.035. WSR 11-09-090 (Order 10-10), § 173-201A-210, filed 4/20/11, effective 5/21/11; WSR 06-23-117 (Order 06-04), § 173-201A-210, filed 11/20/06, effective 12/21/06. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-210, filed 7/1/03, effective 8/1/03.]

173-201A-230
Establishing lake nutrient criteria.

(1) The following table shall be used to aid in establishing nutrient criteria:

Table 230(1)
The ecoregional and trophic-state action values for establishing nutrient criteria:

Coast Range, Puget Lowlands, and Northern Rockies Ecoregions:		
Trophic State	**If Ambient TP (μg/l) Range of Lake is:**	**Then criteria should be set at:**
Ultra-oligotrophic	0-4	4 or less
Oligotrophic	>4-10	10 or less
Lower mesotrophic	>10-20	20 or less
	Action value	

Coast Range, Puget Lowlands, and Northern Rockies Ecoregions:		
	>20	lake specific study may be initiated.
Cascades Ecoregion:		
Trophic State	**If Ambient TP (µg/l) Range of Lake is:**	**Then criteria should be set at:**
Ultra-oligotrophic	0-4	4 or less
Oligotrophic	>4-10	10 or less
	Action value	
	>10	lake specific study may be initiated.
Columbia Basin Ecoregion:		
Trophic State	**If Ambient TP (µg/l) Range of Lake is:**	**Then criteria should be set at:**
Ultra-oligotrophic	0-4	4 or less
Oligotrophic	>4-10	10 or less
Lower mesotrophic	>10-20	20 or less
Upper mesotrophic	>20-35	35 or less
	Action value	
	>35	lake specific study may be initiated.

Lakes in the Willamette, East Cascade Foothills, or Blue Mountain ecoregions do not have recommended values and need to have lake-specific studies in order to receive criteria as described in subsection (3) of this section.

(2) The following actions are recommended if ambient monitoring of a lake shows the epilimnetic total phosphorus concentration, as shown in Table 1 of this section, is below the action value for an ecoregion:

(a) Determine trophic status from existing or newly gathered data. The recommended minimum sampling to determine trophic status is calculated as the mean of four or more samples collected from the epilimnion between June through September in one or more consecutive years. Sampling must be spread throughout the season.

(b) Propose criteria at or below the upper limit of the trophic state; or

(c) Conduct lake-specific study to determine and propose to adopt appropriate criteria as described in subsection (3) of this section.

(3) The following actions are recommended if ambient monitoring of a lake shows total phosphorus to exceed the action value for an ecoregion shown in Table 1 of this section or

where recommended ecoregional action values do not exist:

(a) Conduct a lake-specific study to evaluate the characteristic uses of the lake. A lake-specific study may vary depending on the source or threat of impairment. Phytoplankton blooms, toxic phytoplankton, or excessive aquatic plants, are examples of various sources of impairment. The following are examples of quantitative measures that a study may describe: Total phosphorus, total nitrogen, chlorophyll-a, dissolved oxygen in the hypolimnion if thermally stratified, pH, hardness, or other measures of existing conditions and potential changes in any one of these parameters.

(b) Determine appropriate total phosphorus concentrations or other nutrient criteria to protect characteristic lake uses. If the existing total phosphorus concentration is protective of characteristic lake uses, then set criteria at existing total phosphorus concentration. If the existing total phosphorus concentration is not protective of the existing characteristic lake uses, then set criteria at a protective concentration. Proposals to adopt appropriate total phosphorus criteria to protect characteristic uses must be developed by considering technical information and stakeholder input as part of a public involvement process equivalent to the Administrative Procedure Act (chapter 34.05 RCW).

(c) Determine if the proposed total phosphorus criteria necessary to protect characteristic uses is achievable. If the recommended criterion is not achievable and if the characteristic use the criterion is intended to protect is not an existing use, then a higher criterion may be proposed in conformance with 40 C.F.R. part 131.10.

(4) The department will consider proposed lake-specific nutrient criteria during any water quality standards rule making that follows development of a proposal. Adoption by rule formally establishes the criteria for that lake.

(5) Prioritization and investigation of lakes by the department will be initiated by listing problem lakes in a watershed needs assessment, and scheduled as part of the water quality program's watershed approach to pollution control. This prioritization will apply to lakes identified as warranting a criteria based on the results of a lake-specific study, to lakes warranting a lake-specific study for establishing criteria, and to lakes requiring restoration and pollution control measures due to exceedance of an established criterion. The adoption of nutrient criteria are generally not intended to apply to lakes or ponds with a surface area smaller than five acres; or to ponds wholly contained on private property owned and surrounded by a single landowner; and nutrients do not drain or leach from these lakes or private ponds to the detriment of other property owners or other water bodies; and do not impact designated uses in the lake. However, if the landowner proposes criteria the department may consider adoption.

(6) The department may not need to set a lake-specific criteria or further investigate a lake if existing water quality conditions are naturally poorer (higher TP) than the action value and uses have not been lost or degraded, per WAC 173-201A-260(1).

[Statutory Authority: RCW 90.48.035. WSR 06-23-117 (Order 06-04), § 173-201A-230, filed 11/20/06, effective 12/21/06. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-230, filed 7/1/03, effective 8/1/03.]

173-201A-240
Toxic substances.

(1) Toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department.

(2) The department shall employ or require chemical testing, acute and chronic toxicity testing, and biological assessments, as appropriate, to evaluate compliance with subsection (1) of this section and to ensure that aquatic communities and the existing and designated uses of waters are being fully protected.

(3) USEPA Quality Criteria for Water, 1986, as revised, shall be used in the use and interpretation of the values listed in subsection (5) of this section.

(4) Concentrations of toxic, and other substances with toxic propensities not listed in Table 240 of this section shall be determined in consideration of USEPA Quality Criteria for Water, 1986, and as revised, and other relevant information as appropriate.

(5) The following criteria, found in Table 240, shall be applied to all surface waters of the state of Washington. Values are µg/L for all substances except ammonia and chloride which are mg/L, and asbestos which is million fibers/L. The department shall formally adopt any appropriate revised criteria as part of this chapter in accordance with the provisions established in chapter 34.05 RCW, the Administrative Procedure Act. The department shall ensure there are early opportunities for public review and comment on proposals to develop revised criteria.

> (a) **Aquatic life protection**. The department may revise the criteria in Table 240 for aquatic life on a statewide or water body-specific basis as needed to protect aquatic life occurring in waters of the state and to increase the technical accuracy of the criteria being applied. The department shall formally adopt any appropriate revised criteria as part of this chapter in accordance with the provisions established in chapter 34.05 RCW, the Administrative Procedure Act.
>
> (b) **Human health protection.** The following provisions apply to the human health criteria in Table 240. All waters shall maintain a level of water quality when entering downstream waters that provides for the attainment and maintenance of the water quality standards of those downstream waters, including the waters of another state. The human health criteria in the tables were calculated using a fish consumption rate of 175 g/day. Criteria for carcinogenic substances were calculated using a cancer risk level equal to one-in-one-million, or as otherwise specified in this chapter. The human health criteria calculations and variables include chronic durations of exposure up to seventy years. All human health criteria for metals are for total metal concentrations, unless otherwise noted. Dischargers have the obligation to reduce toxics in discharges through the use of AKART.

Supplemental Information for

Table 240: Toxics Substances Criteria

Table 240 includes a column listing EPA's federally promulgated human health criteria at 40 CFR 131.45. For chemicals with federal criteria, the federal criteria apply for Clean Water Act purposes, such as NPDES permits or 303(d) listings. Units of measure are µg/L for all substances except ammonia and chloride, which are in mg/L, and methylmercury which is in milligram of methylmercury per kilogram of fish (mg methylmercury/kg fish).

(*full details available at https://www.gpo.gov/fdsys/pkg/FR-2016-11-28/pdf/2016-28424.pdf, pages 85435 – 85437*)

EPA footnotes for federal Human Health Criteria for Washington:

[a] This criterion refers to the inorganic form of arsenic only.

[b] This criterion is expressed as the fish tissue concentration of methylmercury (mg methylmercury/kg fish). See *Water Quality Criterion for the Protection of Human Health: Methylmercury* (EPA–823–R–01–001, January 3, 2001) for how this value is calculated using the criterion equation in EPA's 2000 Human Health Methodology rearranged to solve for a protective concentration in fish tissue rather than in water.

[c] This criterion applies to total PCBs (*e.g.*, the sum of all congener or isomer or homolog or Aroclor analyses).

* Bis(2-Chloro-1-Methylethyl) Ether was previously listed as Bis(2-Chloroisopropyl) Ether.

** These criteria were promulgated for Washington in the National Toxics Rule at 40 CFR 131.36, and are moved into 40 CFR 131.45 to have one comprehensive human health criteria rule for Washington.

EPA Applicability language for federal Human Health Criteria for Washington:

40 CFR 131.45 (c) *Applicability*.

(1) The criteria in paragraph (b) of this section apply to waters with Washington's designated uses cited in paragraph (d) of this section and apply concurrently with other applicable water quality criteria.

(2) The criteria established in this section are subject to Washington's general rules of applicability in the same way and to the same extent as are other federally promulgated and state-adopted numeric criteria when applied to the same use classifications in paragraph (d) of this section.

(i) For all waters with mixing zone regulations or implementation procedures, the criteria apply at the appropriate locations within or at the boundary of the mixing zones; otherwise the criteria apply throughout the waterbody including at the end of any discharge pipe, conveyance or other discharge point within the waterbody.

(ii) The state must not use a low flow value below which numeric noncarcinogen and carcinogen human health criteria can be exceeded that is less stringent than the harmonic mean flow for waters suitable for the establishment of low flow return frequencies (i.e., streams and rivers). Harmonic mean flow is a long-term mean flow value calculated by dividing the number of daily flows analyzed by the sum of the reciprocals of those daily flows.

(iii) If the state does not have such a low flow value for numeric criteria, then none will apply and the criteria in paragraph (b) of this section herein apply at all flows.

For information on the applicable use designations for the federal criteria, see 40 CFR 131.45 (d).

Read more on EPA's final revision the federal Clean Water Act human health criteria applicable to waters under Washington's jurisdiction: https://www.epa.gov/wqs-tech/water-quality-standards-regulations-washington#fed

Table 240
Toxics Substances Criteria

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
Metals:										
Antimony	7440360	Metals, cyanide, and total phenols	-	-	-	-	12	180	6	90
Arsenic	7440382	Metals, cyanide, and total phenols	360.0 (c,dd)	190.0 (d,dd)	69.0 (c,ll,dd)	36.0 (d,cc,ll,dd)	10 (A)	10 (A)	0.018 [a] **	0.14 [a] **
Asbestos	1332214	Toxic pollutants and hazardous substances	-	-	-	-	7,000,000 fibers/L (C)	-	-	-
Beryllium	7440417	Metals, cyanide, and total phenols	-	-	-	-	-	-	-	-
Cadmium	7440439	Metals, cyanide, and total phenols	(i,c,dd)	(j,d,dd)	42.0 (c,dd)	9.3 (d,dd)	-	-	-	-
Chromium (III)	16065831	Metals, cyanide, and total phenols	(m,c,gg)	(n,d,gg)	-	-	-	-	-	-
Chromium (VI)	18540299	Metals, cyanide, and total phenols	15.0 (c,l,ii,dd)	10.0 (d,jj,dd)	1,100.0 (c,l,ll,dd)	50.0 (d,ll,dd)	-	-	-	-
Copper	7440508	Metals, cyanide, and total phenols	(o,c,dd)	(p,d,dd)	4.8 (c,ll,dd)	3.1 (d,ll,dd)	1,300 (C)	-	-	-

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
Lead	7439921	Metals, cyanide, and total phenols	(q,c,dd)	(r,d,dd)	210.0 (c,ll,dd)	8.1 (d,ll,dd)	-	-	-	-
Mercury	7439976	Metals, cyanide, and total phenols	2.1 (c,kk,dd)	0.012 (d,ff,s)	1.8 (c,ll,dd)	0.025 (d,ff,s)	(G)	(G)	-	-
Methylmercury	22967926	Nonconventional	-	-	-	-	-	-	-	0.03 [b]
Nickel	7440020	Metals, cyanide, and total phenols	(t,c,dd)	(u,d,dd)	74.0 (c,ll,dd)	8.2 (d,ll,dd)	150	190	80	100
Selenium	7782492	Metals, cyanide, and total phenols	20.0 (c,ff)	5.0 (d,ff)	290 (c,ll,dd)	71.0 (d,x,ll,dd)	120	480	60	200
Silver	7440224	Metals, cyanide, and total phenols	(y,a,dd)	-	1.9 (a,ll,dd)	-	-	-	-	-
Thallium	7440280	Metals, cyanide, and total phenols	-	-	-	-	0.24	0.27	1.7 **	6.3 **
Zinc	7440666	Metals, cyanide, and total phenols	(aa,c,dd)	(bb,d,dd)	90.0 (c,ll,dd)	81.0 (d,ll,dd)	2,300	2,900	1,000	1,000
Other Chemicals:										
1,1,1-Trichloroethane	71556	Volatile	-	-	-	-	47,000	160,000	20,000	50,000
1,1,2,2-Tetrachloroethane	79345	Volatile	-	-	-	-	0.12 (B)	0.46 (B)	0.1	0.3
1,1,2-Trichloroethane	79005	Volatile	-	-	-	-	0.44 (B)	1.8 (B)	0.35	0.90
1,1-Dichloroethane	75343	Volatile	-	-	-	-	-	-	-	-

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
1,1-Dichloroethylene	75354	Volatile	-	-	-	-	1200	4100	700	4,000
1,2,4-Trichlorobenzene	120821	Base/neutral compounds	-	-	-	-	0.12 (B)	0.14 (B)	0.036	0.037
1,2-Dichlorobenzene	95501	Volatile	-	-	-	-	2000	2500	700	800
1,2-Dichloroethane	107062	Volatile	-	-	-	-	9.3 (B)	120 (B)	8.9	73
1,2-Dichloropropane	78875	Volatile	-	-	-	-	0.71 (B)	3.1 (B)	-	-
1,3-Dichloropropene	542756	Volatile	-	-	-	-	0.24 (B)	2 (B)	0.22	1.2
1,2-Diphenylhydrazine	122667	Base/neutral compounds	-	-	-	-	0.015 (B)	0.023 (B)	0.01	0.02
1,2-Trans-Dichloroethylene	156605	Volatile	-	-	-	-	600	5,800	200	1,000
1,3-Dichlorobenzene	541731	Volatile	-	-	-	-	13	16	2	2
1,4-Dichlorobenzene	106467	Volatile	-	-	-	-	460	580	200	200
2,3,7,8-TCDD (Dioxin)	1746016	Dioxin	-	-	-	-	0.000000064	0.000000064	0.000000013**	0.000000014**
2,4,6-Trichlorophenol	88062	Acid compounds	-	-	-	-	0.25 (B)	0.28 (B)	-	-
2,4-Dichlorophenol	120832	Acid compounds	-	-	-	-	25	34	10	10
2,4-Dimethylphenol	105679	Acid compounds	-	-	-	-	85	97	-	-
2,4-Dinitrophenol	51285	Acid compounds	-	-	-	-	60	610	30	100
2,4-Dinitrotoluene	121142	Base/neutral compounds	-	-	-	-	0.039 (B)	0.18 (B)	-	-
2,6-Dinitrotoluene	606202	Base/neutral compounds	-	-	-	-	-	-	-	-
2-Chloroethyvinyl Ether	110758	Volatile	-	-	-	-	-	-	-	-
2-Chloronaphthalene	91587	Base/neutral compounds	-	-	-	-	170	180	100	100

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
2-Chlorophenol	95578	Acid compounds	-	-	-	-	15	17	-	-
2-Methyl-4,6-Dinitrophenol (4,6-dinitro-o-cresol)	534521	Acid compounds	-	-	-	-	7.1	25	3	7
2-Nitrophenol	88755	Acid compounds	-	-	-	-	-	-	-	-
3,3'-Dichlorobenzidine	91941	Base/neutral compounds	-	-	-	-	0.0031 (B)	0.0033 (B)	-	-
3-Methyl-4-Chlorophenol (parachlorometa cresol)	59507	Acid compounds	-	-	-	-	36	36	-	-
4,4'-DDD	72548	Pesticides/PCBs	-	-	-	-	0.000036 (B)	0.000036 (B)	0.0000079	0.0000079
4,4'-DDE	72559	Pesticides/PCBs	-	-	-	-	0.000051 (B)	0.000051 (B)	0.00000088	0.00000088
4,4'-DDT	50293	Pesticides/PCBs	-	-	-	-	0.000025 (B)	0.000025 (B)	0.0000012	0.0000012
4,4'-DDT(and metabolites)		Pesticides/PCBs	1.1 (a)	0.001 (b)	0.13 (a)	0.001 (b)	-	-	-	-
4-Bromophenyl Phenyl Ether	101553	Base/neutral compounds	-	-	-	-	-	-	-	-
4-Chorophenyl Phenyl Ether	7005723	Base/neutral compounds	-	-	-	-	-	-	-	-
4-Nitrophenol	100027	Acid compounds	-	-	-	-	-	-	-	-
Acenaphthene	83329	Base/neutral compounds	-	-	-	-	110	110	30	30
Acenaphthylene	208968	Base/neutral compounds	-	-	-	-	-	-	-	-
Acrolein	107028	Volatile	-	-	-	-	1.0	1.1	-	-
Acrylonitrile	107131	Volatile	-	-	-	-	0.019 (B)	0.028 (B)	-	-

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
Aldrin	309002	Pesticides/PCBs	2.5 (a,e)	0.0019 (b,e)	0.71 (a,e)	0.0019 (b,e)	0.0000057 (B)	0.0000058 (B)	0.000000041	0.000000041
alpha-BHC	319846	Pesticides/PCBs	-	-	-	-	0.0005 (B)	0.00056 (B)	0.000048	0.000048
alpha-Endosulfan	959988	Pesticides/PCBs	-	-	-	-	9.7	10	6	7
Anthracene	120127	Base/neutral compounds	-	-	-	-	3,100	4,600	100	100
Benzene	71432	Volatile	-	-	-	-	0.44 (B)	1.6 (B)	-	-
Benzidine	92875	Base/neutral compounds	-	-	-	-	0.00002 (B)	0.000023 (B)	-	-
Benzo(a) Anthracene	56553	Base/neutral compounds	-	-	-	-	0.014 (B)	0.021 (B)	0.00016	0.00016
Benzo(a) Pyrene	50328	Base/neutral compounds	-	-	-	-	0.0014 (B)	0.0021 (B)	0.000016	0.000016
Benzo(b) Fluoranthene	205992	Base/neutral compounds	-	-	-	-	0.014 (B)	0.021 (B)	0.00016	0.00016
Benzo(ghi) Perylene	191242	Base/neutral compounds	-	-	-	-	-	-	-	-
Benzo(k) Fluoranthene	207089	Base/neutral compounds	-	-	-	-	0.014 (B)	0.21 (B)	0.0016	0.0016
beta-BHC	319857	Pesticides/PCBs	-	-	-	-	0.0018 (B)	0.002 (B)	0.0013	0.0014
beta-Endosulfan	33213659	Pesticides/PCBs	-	-	-	-	9.7	10	-	-
Bis(2-Chloroethoxy) Methane	111911	Base/neutral compounds	-	-	-	-	-	-	-	-
Bis(2-Chloroethyl) Ether	111444	Base/neutral compounds	-	-	-	-	0.02 (B)	0.06 (B)	-	-

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
Bis(2-Chloroisopropyl) Ether	39638329	Base/neutral compounds	-	-	-	-	-	-	-	-
Bis(2-Chloro-1-Methylethyl) Ether	108601	Base/neutral compounds	-	-	-	-	-	-	400 *	900 *
Bis(2-Ethylhexyl) Phthalate	117817	Base/neutral compounds	-	-	-	-	0.23 (B)	0.25 (B)	0.045	0.046
Bromoform	75252	Volatile	-	-	-	-	5.8 (B)	27 (B)	4.6	12
Butylbenzyl Phthalate	85687	Base/neutral compounds	-	-	-	-	0.56 (B)	0.58 (B)	0.013	0.013
Carbon Tetrachloride	56235	Volatile	-	-	-	-	0.2 (B)	0.35 (B)	-	-
Chlordane	57749	Pesticides/PCBs	2.4 (a)	0.0043 (b)	0.09 (a)	0.004 (b)	0.000093 (B)	0.000093 (B)	0.000022	0.000022
Chlorobenzene	108907	Volatile	-	-	-	-	380	890	100	200
Chlorodibromomethane	124481	Volatile	-	-	-	-	0.65 (B)	3 (B)	0.60	2.2
Chloroethane	75003	Volatile	-	-	-	-	-	-	-	-
Chloroform	67663	Volatile	-	-	-	-	260	1200	100	600
Chrysene	218019	Base/neutral compounds	-	-	-	-	1.4 (B)	2.1 (B)	0.016	0.016
Cyanide	57125	Metals, cyanide, and total phenols	22.0 (c,ee)	5.2 (d,ee)	1.0 (c,mm,ee)	(d,mm,ee)	19 (D)	270 (D)	9	100
delta-BHC	319868	Pesticides/PCBs	-	-	-	-	-	-	-	-
Dibenzo(a,h) Anthracene	53703	Base/neutral compounds	-	-	-	-	0.0014 (B)	0.0021 (B)	0.000016	0.000016
Dichlorobromomethane	75274	Volatile	-	-	-	-	0.77 (B)	3.6 (B)	0.73	2.8

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
Dieldrin	60571	Pesticides/PCBs	2.5 (a,e)	0.0019 (b,e)	0.71 (a,e)	0.0019 (b,e)	0.0000061 (B)	0.0000061 (B)	0.000000070	0.000000070
Diethyl Phthalate	84662	Base/neutral compounds	-	-	-	-	4,200	5,000	200	200
Dimethyl Phthalate	131113	Base/neutral compounds	-	-	-	-	92,000	130,000	600	600
Di-n-Butyl Phthalate	84742	Base/neutral compounds	-	-	-	-	450	510	8	8
Di-n-Octyl Phthalate	117840	Base/neutral compounds	-	-	-	-	-	-	-	-
Endosulfan		Pesticides/PCBs	0.22 (a)	0.056 (b)	0.034 (a)	0.0087 (b)	-	-	-	-
Endosulfan Sulfate	1031078	Pesticides/PCBs	-	-	-	-	9.7	10	9	-
Endrin	72208	Pesticides/PCBs	0.18 (a)	0.0023 (b)	0.037 (a)	0.0023 (b)	0.034	0.035	0.002	0.002
Endrin Aldehyde	7421934	Pesticides/PCBs	-	-	-	-	0.034	0.035	-	-
Ethylbenzene	100414	Volatile	-	-	-	-	200	270	29	31
Fluoranthene	206440	Base/neutral compounds	-	-	-	-	16	16	6	6
Fluorene	86737	Base/neutral compounds	-	-	-	-	420	610	10	10
Hexachlorocyclohexane (gamma-BHC; Lindane)	58899	Pesticides/PCBs	2.0 (a)	0.08 (b)	0.16 (a)	-	15	17	0.43	0.43
Heptachlor	76448	Pesticides/PCBs	0.52 (a)	0.0038 (b)	0.053 (a)	0.0036 (b)	0.0000099 (B)	0.00001 (B)	0.00000034	0.00000034
Heptachlor Epoxide	1024573	Pesticides/PCBs	-	-	-	-	0.0000074 (B)	0.0000074 (B)	0.0000024	0.0000024
Hexachlorobenzene	118741	Base/neutral compounds	-	-	-	-	0.000051 (B)	0.000052 (B)	0.0000050	0.0000050

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
Hexachlorobutadiene	87683	Base/neutral compounds	-	-	-	-	0.69 (B)	4.1 (B)	0.01	0.01
Hexachlorocyclopentadiene	77474	Base/neutral compounds	-	-	-	-	150	630	1	1
Hexachloroethane	67721	Base/neutral compounds	-	-	-	-	0.11 (B)	0.13 (B)	0.02	0.02
Indeno(1,2,3-cd) Pyrene	193395	Base/neutral compounds	-	-	-	-	0.014 (B)	0.021 (B)	0.00016	0.00016
Isophorone	78591	Base/neutral compounds	-	-	-	-	27 (B)	110 (B)	-	-
Methyl Bromide	74839	Volatile	-	-	-	-	520	2,400	300	-
Methyl Chloride	74873	Volatile	-	-	-	-	-	-	-	-
Methylene Chloride	75092	Volatile	-	-	-	-	16 (B)	250 (B)	10	100
Napthalene	91203	Base/neutral compounds	-	-	-	-	-	-	-	-
Nitrobenzene	98953	Base/neutral compounds	-	-	-	-	55	320	30	100
N-Nitrosodimethylamine	62759	Base/neutral compounds	-	-	-	-	0.00065 (B)	0.34 (B)	-	-
N-Nitrosodi-n-Propylamine	621647	Base/neutral compounds	-	-	-	-	0.0044 (B)	0.058 (B)	-	-
N-Nitrosodiphenylamine	86306	Base/neutral compounds	-	-	-	-	0.62 (B)	0.69 (B)	-	-
Pentachlorophenol (PCP)	87865	Acid compounds	(w,c)	(v,d)	13.0 (c)	7.9 (d)	0.046 (B)	0.1 (B)	0.002	0.002
Phenanthrene	85018	Base/neutral compounds	-	-	-	-	-	-	-	-
Phenol	108952	Acid compounds	-	-	-	-	18,000	200,000	9,000	70,000

Compound/Chemical	Chemical Abstracts Service (CAS)#	Category	Aquatic Life Criteria - Freshwater		Aquatic Life Criteria - Marine Water		Human Health Criteria for Consumption of:		EPA Federally Promulgated Human Health Criteria	
			Acute	Chronic	Acute	Chronic	Water & Organisms	Organisms Only	Water & Organisms	Organisms Only
Polychlorinated Biphenyls (PCBs)		Pesticides/PCBs	2.0 (b)	0.014 (b)	10.0 (b)	0.030 (b)	0.00017 (E)	0.00017 (E)	0.000007 [c]	0.000007 [c]
Pyrene	129000	Base/neutral compounds	-	-	-	-	310	460	8	8
Tetrachloroethylene	127184	Volatile	-	-	-	-	4.9 (B)	7.1 (B)	2.4	2.9
Toluene	108883	Volatile	-	-	-	-	180	410	72	130
Toxaphene	8001352	Pesticides/PCBs	0.73 (c,z)	0.0002 (d)	0.21 (c,z)	0.0002 (d)	0.000032 (B)	0.000032 (B)	-	-
Trichloroethylene	79016	Volatile	-	-	-	-	0.38 (B)	0.86 (B)	0.3	0.7
Vinyl Chloride	75014	Volatile	-	-	-	-	0.02 (B, F)	0.26 (B, F)	-	0.18
Ammonia (hh)	-	Nonconventional	(f,c)	(g,d)	0.233 (h,c)	0.035 (h,d)	-	-	-	-
Chloride (dissolved) (k)	-	Nonconventional	860.0 (h,c)	230.0 (h,d)	-	-	-	-	-	-
Chlorine (total residual)	-	Nonconventional	19.0 (c)	11.0 (d)	13.0 (c)	7.5 (d)	-	-	-	-
Chlorpyrifos	-	Toxic pollutants and hazardous substances	0.083 (c)	0.041 (d)	0.011 (c)	0.0056 (d)	-	-	-	-
Parathion	-	Toxic pollutants and hazardous substances	0.065 (c)	0.013 (d)	-	-	-	-	-	-

Footnotes for aquatic life criteria in Table 240:

a. An instantaneous concentration not to be exceeded at any time.
b. A 24-hour average not to be exceeded.
c. A 1-hour average concentration not to be exceeded more than once every three years on the average.
d. A 4-day average concentration not to be exceeded more than once every three years on the average.
e. Aldrin is metabolically converted to Dieldrin. Therefore, the sum of the Aldrin and Dieldrin concentrations are compared with the Dieldrin criteria.
f. Shall not exceed the numerical value in total ammonia nitrogen (mg N/L) given by:

$$For\ salmonids\ present: \frac{0.275}{1+10^{7.204-pH}}+\frac{39.0}{1+10^{pH-7.204}}$$

$$For\ salmonids\ absent: \frac{0.411}{1+10^{7.204-pH}}+\frac{58.4}{1+10^{pH-7.204}}$$

g. Shall not exceed the numerical concentration calculated as follows:

- Unionized ammonia concentration for waters where salmonid habitat is an existing or designated use:

$$0.80 \div (FT)(FPH)(RATIO)$$

where:

$$\mathrm{RATIO} = 13.5;\ 7.7 \le \mathrm{pH} \le 9$$

$$\mathrm{RATIO} = \left(20.25 \times 10^{(7.7-\mathrm{pH})}\right) \div \left(1 + 10^{(7.4-\mathrm{pH})}\right); 6.5 \le \mathrm{pH} \le 7.7$$

$$\mathrm{FT} = 1.4; 15 \le \mathrm{T} \le 30$$

$$\mathrm{FT} = 10^{[0.03(20-\mathrm{T})]};\ 0 \le \mathrm{T} \le 15$$

$$\mathrm{FPH} = 1; 8 \le \mathrm{pH} \le 9$$

$$\mathrm{FPH} = \left(1 + 10^{(7.4-\mathrm{pH})}\right) \div 1.25; 6.5 \le \mathrm{pH} \le 8.0$$

- Total ammonia concentrations for waters where salmonid habitat is not an existing or designated use and other fish early life stages are absent:

$$\text{Chronic criterion} = \left(\frac{0.0577}{1+10^{7.688-\mathrm{pH}}} + \frac{2.487}{1+10^{\mathrm{pH}-7.688}}\right) \times \left(1.45 \times 10^{0.028(25-\mathrm{A})}\right)$$

where: $\mathrm{A} = \text{the greater of either T (temperature in degrees Celsius) or 7.}$

Applied as a thirty-day average concentration of total ammonia nitrogen (in mg N/L) not to be exceeded more than once every three years on average. The highest four-day average within the thirty-day period should not exceed 2.5 times the chronic criterion.

- Total ammonia concentration for waters where salmonid habitat is not an existing or designated use and other fish early life stages are present:

$$\text{Chronic criterion} = \left(\frac{0.0577}{1+10^{7.688-\text{pH}}} + \frac{2.487}{1+10^{\text{pH}-7.688}}\right) \times (\text{B})$$

where: $\text{B} = \text{the lower of either } 2.85, \text{or } 1.45 \times 10^{0.028\times(25-\text{T})}$

$\text{T} = \text{temperature in degrees Celsius.}$

Applied as a thirty-day average concentration of total ammonia nitrogen (in mg N/L) not to be exceeded more than once every three years on average. The highest four-day average within the thirty-day period should not exceed 2.5 times the chronic criterion.

h. Measured in milligrams per liter rather than micrograms per liter.

i. ≤ (0.944)(e(1.128[ln(hardness)]-3.828)) at hardness = 100. Conversion factor (CF) of 0.944 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.136672 - [(ln hardness)(0.041838)].

j. ≤ (0.909)(e(0.7852[ln(hardness)]-3.490)) at hardness = 100. Conversions factor (CF) of 0.909 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.101672 - [(ln hardness)(0.041838)].

k. Criterion based on dissolved chloride in association with sodium. This criterion probably will not be adequately protective when the chloride is associated with potassium, calcium, or magnesium, rather than sodium.

l. Salinity dependent effects. At low salinity the 1-hour average may not be sufficiently protective.

m. $\leq (0.316)(e^{(0.8190[\ln(\text{hardness})] + 3.688)})$

n. $\leq (0.860)(e^{(0.8190[\ln(\text{hardness})] + 1.561)})$

o. $\leq (0.960)(e^{(0.9422[\ln(\text{hardness})] - 1.464)})$

p. $\leq (0.960)(e^{(0.8545[\ln(\text{hardness})] - 1.465)})$

q. $\leq (0.791)(e^{(1.273[\ln(\text{hardness})] - 1.460)})$ at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(ln hardness)(0.145712)].

r. $\leq (0.791)(e^{(1.273[\ln(\text{hardness})] - 4.705)})$ at hardness = 100. Conversion factor (CF) of 0.791 is hardness dependent. CF is calculated for other hardnesses as follows: CF = 1.46203 - [(ln hardness)(0.145712)].

s. If the four-day average chronic concentration is exceeded more than once in a three-year period, the edible portion of the consumed species should be analyzed. Said edible tissue concentrations shall not be allowed to exceed 1.0 mg/kg of methylmercury.

t. $\leq (0.998)(e^{(0.8460[\ln(\text{hardness})] + 3.3612)})$

u. $\leq (0.997)(e^{(0.8460[\ln(\text{hardness})] + 1.1645)})$

v. $\leq e^{[1.005(\text{pH}) - 5.290]}$

w. $\leq e^{[1.005(\text{pH}) - 4.830]}$

x. The status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 ug/ l in salt water.

y. $\leq (0.85)(e^{(1.72[\ln(\text{hardness})] - 6.52)})$

z. Channel Catfish may be more acutely sensitive.

aa. ≤ $(0.978)(e^{(0.8473[\ln(\text{hardness})] + 0.8604)})$

bb. ≤ $(0.986)(e^{(0.8473[\ln(\text{hardness})] + 0.7614)})$

cc. Nonlethal effects (growth, C-14 uptake, and chlorophyll production) to diatoms (*Thalassiosira aestivalis* and *Skeletonema costatum*) which are common to Washington's waters have been noted at levels below the established criteria. The importance of these effects to the diatom populations and the aquatic system is sufficiently in question to persuade the state to adopt the USEPA National Criteria value (36 µg/L) as the state threshold criteria, however, wherever practical the ambient concentrations should not be allowed to exceed a chronic marine concentration of 21 µg/L.

dd. These ambient criteria in the table are for the dissolved fraction. The cyanide criteria are based on the weak acid dissociable method. The metals criteria may not be used to calculate total recoverable effluent limits unless the seasonal partitioning of the dissolved to total metals in the ambient water are known. When this information is absent, these metals criteria shall be applied as total recoverable values, determined by back-calculation, using the conversion factors incorporated in the criterion equations. Metals criteria may be adjusted on a site-specific basis when data are made available to the department clearly demonstrating the effective use of 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 by USEPA or ecology. Information which is used to develop effluent limits based on applying metals partitioning studies or the water effects ratio approach shall be identified in the permit fact sheet developed pursuant to WAC 173-220-060 or 173-226-110, as appropriate, and shall be made available for the public comment period required pursuant to WAC 173-220-050 or 173-226-130(3), as appropriate. Ecology has developed supplemental guidance for conducting water effect ratio studies.

ee. The criteria for cyanide is based on the weak acid dissociable method in the 19th Ed. Standard Methods for the Examination of Water and Wastewater, 4500-CN I, and as revised (see footnote dd, above).

ff. These criteria are based on the total-recoverable fraction of the metal.

gg. Where methods to measure trivalent chromium are unavailable, these criteria are to be represented by total-recoverable chromium.

hh. The listed fresh water criteria are based on un-ionized or total ammonia concentrations, while those for marine water are based on un-ionized ammonia concentrations. Tables for the conversion of total ammonia to un-ionized ammonia for freshwater can be found in the USEPA's Quality Criteria for Water, 1986. Criteria concentrations based on total ammonia for marine water can be found in USEPA Ambient Water Quality Criteria for Ammonia (Saltwater)-1989, EPA440/ 5-88-004, April 1989.

ii. The conversion factor used to calculate the dissolved metal concentration was 0.982.

jj. The conversion factor used to calculate the dissolved metal concentration was 0.962.

kk. The conversion factor used to calculate the dissolved metal concentration was 0.85.

ll. Marine conversion factors (CF) which were used for calculating dissolved metals concentrations are given below. Conversion factors are applicable to both acute and chronic criteria for all metals except mercury. The CF for mercury was applied to the acute criterion only and is not applicable to the chronic criterion. Conversion factors are already incorporated into the criteria in the table. Dissolved criterion = criterion x CF

Metal	CF
Arsenic	1.000
Cadmium	0.994
Chromium (VI)	0.993
Copper	0.83
Lead	0.951
Mercury	0.85
Nickel	0.990
Selenium	0.998
Silver	0.85
Zinc	0.946

mm. The cyanide criteria are: 2.8µg/l chronic and 9.1µg/l acute and are applicable only to waters which are east of a line from Point Roberts to Lawrence Point, to Green Point to Deception Pass; and south from Deception Pass and of a line from Partridge Point to Point Wilson. The chronic criterion applicable to the remainder of the marine waters is l µg/L.

Footnotes for human health criteria in Table 240:

A. This criterion for total arsenic is the maximum contaminant level (MCL) developed under the Safe Drinking Water Act. The MCL for total arsenic is applied to surface waters where consumption of organisms-only and where consumption of water + organisms reflect the designated uses. When the department determines that a direct or indirect industrial discharge to surface waters designated for domestic water supply may be adding arsenic to its wastewater, the department will require the discharger to develop and implement a pollution prevention plan to reduce arsenic through the use of AKART. Industrial wastewater discharges to a privately or publicly owned wastewater treatment facility are considered indirect discharges

B. This criterion was calculated based on an additional lifetime cancer risk of one-in-one-million (1 x 10-6 risk level).

C. This criterion is based on a regulatory level developed under the Safe Drinking Water Act.

D. This recommended water quality criterion is expressed as total cyanide, even though the integrated risk information system RfD used to derive the criterion is based on free cyanide. The multiple forms of cyanide that are present in ambient water have significant differences in toxicity due to their differing abilities to liberate the CN-moiety. Some complex cyanides require even more extreme conditions than refluxing with sulfuric acid to liberate the CN-moiety. Thus, these complex cyanides are expected to have little or no "bioavailability" to humans. If a substantial fraction of the cyanide present in a water body is present in a complexed form (e.g., Fe4[Fe(CN)6]3), this criterion may be overly conservative.

E. This criterion applies to total PCBs, (e.g., the sum of all congener or all isomer or homolog or Aroclor analyses). The PCBs criteria were calculated using a chemical-specific risk level of 4×10^{-5}. Because that calculation resulted in a higher (less protective) concentration than the current criterion concentration (40 C.F.R. 131.36) the state made a chemical-specific decision to stay at the current criterion concentration.

F. This criterion was derived using the cancer slope factor of 1.4 (linearized multistage model with a twofold increase to 1.4 per mg/kg-day to account for continuous lifetime exposure from birth).

G. The human health criteria for mercury are contained in 40 C.F.R. 131.36.

[Statutory Authority: RCW 90.48.035, 90.48.605 and section 303(c) of the Federal Water Pollution Control Act (Clean Water Act), C.F.R. 40, C.F.R. 131. WSR 16-16-095 (Order 12-03), § 173-201A-240, filed 8/1/16, effective 9/1/16. Statutory Authority: RCW 90.48.035. WSR 11-09-090 (Order 10-10), § 173-201A-240, filed 4/20/11, effective 5/21/11; WSR 06-23-117 (Order 06-04), § 173-201A-240, filed 11/20/06, effective 12/21/06. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), amended and recodified as § 173-201A-240, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-040, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-040, filed 11/25/92, effective 12/26/92.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

173-201A-250
Radioactive substances.

(1) Deleterious concentrations of radioactive materials for all classes shall be as determined by the lowest practicable concentration attainable and in no case shall exceed:

(a) 1/12.5 of the values listed in WAC 246-221-290 (Column 2, Table II, effluent concentrations, rules and regulations for radiation protection); or

(b) USEPA Drinking Water Regulations for radionuclides, as published in the Federal Register of July 9, 1976, or subsequent revisions thereto.

(2) Nothing in this chapter shall be interpreted to be applicable to those aspects of governmental regulation of radioactive waters which have been preempted from state regulation by the Atomic Energy Act of 1954, as amended, as interpreted by the United States Supreme Court in the cases of *Northern States Power Co. v. Minnesota 405 U.S. 1035 (1972) and Train v. Colorado Public Interest Research Group, 426 U.S. 1 (1976).*

[Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), recodified as § 173-201A-250, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-050, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-050, filed 11/25/92, effective 12/26/92.]

173-201A-260
Natural conditions and other water quality criteria and applications.

(1) **Natural and irreversible human conditions.**

(a) It is recognized that portions of many water bodies cannot meet the assigned criteria due to the natural conditions of the water body. When a water body does not meet its assigned criteria due to natural climatic or landscape attributes, the natural conditions constitute the water quality criteria.

(b) When a water body does not meet its assigned criteria due to human structural changes that cannot be effectively remedied (as determined consistent with the federal regulations at 40 C.F.R. 131.10), then alternative estimates of the attainable water quality conditions, plus any further allowances for human effects specified in this chapter for when natural conditions exceed the criteria, may be used to establish an alternative criteria for the water body (see WAC 173-201A-430 and 173-201A-440).

(2) **Toxics and aesthetics criteria.** The following narrative criteria apply to all existing and designated uses for fresh and marine water:

(a) Toxic, radioactive, or deleterious material concentrations must be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health (see WAC 173-201A-240, toxic substances, and 173-201A-250, radioactive substances).

(b) Aesthetic values must not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste (see WAC 173-201A-230 for guidance on establishing lake nutrient standards to protect aesthetics).

(3) **Procedures for applying water quality criteria.** In applying the appropriate water quality criteria for a water body, the department will use the following procedure:

(a) The department will establish water quality requirements for water bodies, in addition to those specifically listed in this chapter, on a case-specific basis where determined necessary to provide full support for designated and existing uses.

(b) Upstream actions must be conducted in manners that meet downstream water body criteria. Except where and to the extent described otherwise in this chapter, the criteria associated with the most upstream uses designated for a water body are to be applied to headwaters to protect nonfish aquatic species and the designated downstream uses.

(c) Where multiple criteria for the same water quality parameter are assigned to a water body to protect different uses, the most stringent criterion for each parameter is to be applied.

(d) At the boundary between water bodies protected for different uses, the more stringent criteria apply.

(e) In brackish waters of estuaries, where different criteria for the same use occurs for fresh and marine waters, the decision to use the fresh water or the marine water criteria must be selected and applied on the basis of vertically averaged daily maximum salinity, referred to below as "salinity."

(i) The fresh water criteria must be applied at any point where ninety-five percent of the salinity values are less than or equal to one part per thousand, except that the fresh water criteria for bacteria applies when the salinity is less than ten parts per thousand; and

(ii) The marine water criteria must apply at all other locations where the salinity values are greater than one part per thousand, except that the marine criteria for bacteria applies when the salinity is ten parts per thousand or greater.

(f) Numeric criteria established in this chapter are not intended for application to human created waters managed primarily for the removal or containment of pollution. This special provision also includes private farm ponds created from upland sites that did not incorporate natural water bodies.

(i) Waters covered under this provision must be managed so that:

(A) They do not create unreasonable risks to human health or uses of the water; and

(B) Discharges from these systems meet down gradient surface and ground water quality standards.

(ii) This provision does not apply to waterways designed and managed primarily to convey or transport water from one location to another, rather than to remove pollution en route.

(g) When applying the numeric criteria established in this chapter, the department will give consideration to the precision and accuracy of the sampling and analytical methods used, as well as the existing conditions at the time.

(h) The analytical testing methods for these numeric criteria must be in accordance with the "*Guidelines Establishing Test Procedures for the Analysis of Pollutants*" (*40 C.F.R. Part 136*) or superseding methods published. The department may also approve other methods following consultation with adjacent states and with the approval of the USEPA.

(i) The primary means for protecting water quality in wetlands is through implementing the antidegradation procedures described in Part III of this chapter.

(i) In addition to designated uses, wetlands may have existing beneficial uses that are to be protected that include ground water exchange, shoreline stabilization, and stormwater attenuation.

(ii) Water quality in wetlands is maintained and protected by maintaining the hydrologic conditions, hydrophytic vegetation, and substrate characteristics necessary to support existing and designated uses.

(iii) Wetlands must be delineated using the *Washington State Wetlands Identification and Delineation Manual*, in accordance with WAC 173-22-035.

[Statutory Authority: RCW 90.48.035. WSR 11-09-090 (Order 10-10), § 173-201A-260, filed 4/20/11, effective 5/21/11. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-260, filed 7/1/03, effective 8/1/03.]

Part III - Antidegradation

173-201A-300
Description.

(1) The antidegradation policy is guided by chapter 90.48 RCW, Water Pollution Control Act, chapter 90.54 RCW, Water Resources Act of 1971, and 40 C.F.R. 131.12.

(2) The purpose of the antidegradation policy is to:

(a) Restore and maintain the highest possible quality of the surface waters of Washington;

(b) Describe situations under which water quality may be lowered from its current condition;

(c) Apply to human activities that are likely to have an impact on the water quality of a surface water;

(d) Ensure that all human activities that are likely to contribute to a lowering of water quality, at a minimum, apply all known, available, and reasonable methods of prevention, control, and treatment (AKART); and

(e) Apply three levels of protection for surface waters of the state, as generally described below:

(i) Tier I is used to ensure existing and designated uses are maintained and protected and applies to all waters and all sources of pollution.

(ii) Tier II is used to ensure that waters of a higher quality than the criteria assigned in this chapter are not degraded unless such lowering of water quality is necessary and in the overriding public interest. Tier II applies only to a specific list of polluting activities.

(iii) Tier III is used to prevent the degradation of waters formally listed in this chapter as "outstanding resource waters," and applies to all sources of pollution.

(3) **Habitat restoration.** Both temporary harm and permanent loss of existing uses may be allowed by the department where determined necessary to secure greater ecological benefits through major habitat restoration projects designed to return the natural physical structure and associated uses to a water body where the structure has been altered through human action.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-300, filed 7/1/03, effective 8/1/03.]

173-201A-310
Tier I — Protection and maintenance of existing and designated uses.

(1) Existing and designated uses must be maintained and protected. No degradation may be allowed that would interfere with, or become injurious to, existing or designated uses, except as provided for in this chapter.

(2) For waters that do not meet assigned criteria, or protect existing or designated uses, the department will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.

(3) Whenever the natural conditions of a water body are of a lower quality than the assigned criteria, the natural conditions constitute the water quality criteria. Where water quality criteria are not met because of natural conditions, human actions are not allowed to further lower the water quality, except where explicitly allowed in this chapter.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-310, filed 7/1/03, effective 8/1/03.]

173-201A-320
Tier II — Protection of waters of higher quality than the standards.

(1) Whenever a water quality constituent is of a higher quality than a criterion designated for that water under this chapter, new or expanded actions within the categories identified in subsection (2) of this section that are expected to cause a measurable change in the quality of the water (see subsection (3) of this section) may not be allowed unless the department determines that the lowering of water quality is necessary and in the overriding public interest (see subsection (4) of this section).

(2) A Tier II review will only be conducted for new or expanded actions conducted under the following authorizations. Public involvement with the Tier II review will be conducted in accordance with the public involvement processes associated with these actions.

(a) National Pollutant Discharge Elimination System (NPDES) waste discharge permits;

(b) State waste discharge permits to surface waters;

(c) Federal Clean Water Act Section 401 water quality certifications; and

(d) Other water pollution control programs authorized, implemented, or administered by the department.

(3) **Definition of measurable change.** To determine that a lowering of water quality is necessary and in the overriding public interest, an analysis must be conducted for new or expanded actions when the resulting action has the potential to cause a measurable change in the physical, chemical, or biological quality of a water body. Measurable changes will be determined based on an estimated change in water quality at a point outside the source area, after allowing for mixing consistent with WAC 173-201A-400(7). In the context of this regulation,

a measurable change includes a:

(a) Temperature increase of 0.3°C or greater;

(b) Dissolved oxygen decrease of 0.2 mg/L or greater;

(c) Bacteria level increase of 2 cfu/100 mL or greater;

(d) pH change of 0.1 units or greater;

(e) Turbidity increase of 0.5 NTU or greater; or

(f) Any detectable increase in the concentration of a toxic or radioactive substance.

(4) **Necessary and overriding public interest determinations.** Once an activity has been determined to cause a measurable lowering in water quality, then an analysis must be conducted to determine if the lowering of water quality is necessary and in the overriding public interest. Information to conduct the analysis must be provided by the applicant seeking the authorization, or by the department in developing a general permit or pollution control program, and must include:

(a) **Necessary and overriding public interest determinations.** Once an activity has been determined to cause a measurable lowering in water quality, then an analysis must be conducted to determine if the lowering of water quality is necessary and in the overriding public interest. Information to conduct the analysis must be provided by the applicant seeking the authorization, or by the department in developing a general permit or pollution control program, and must include:

(i) Economic benefits such as creating or expanding employment, increasing median family income, or increasing the community tax base;

(ii) Providing or contributing to necessary social services;

(iii) The use and demonstration of innovative pollution control and management approaches that would allow a significant improvement in AKART for a particular industry or category of action;

(iv) The prevention or remediation of environmental or public health threats;

(v) The societal and economic benefits of better health protection;

(vi) The preservation of assimilative capacity for future industry and development; and

(vii) The benefits associated with high water quality for uses such as fishing, recreation, and tourism.

(b) Information that identifies and selects the best combination of site, structural, and managerial approaches that can be feasibly implemented to prevent or minimize the lowering of water quality. This information will be used by the department to determine if the lowering of water quality is necessary. Examples that may be considered as alternatives include:

(i) Pollution prevention measures (such as changes in plant processes, source reduction, and substitution with less toxic substances);

(ii) Recycle/reuse of waste by-products or production materials and fluids;

(iii) Application of water conservation methods;

(iv) Alternative or enhanced treatment technology;

(v) Improved operation and maintenance of existing treatment systems;

(vi) Seasonal or controlled discharge options to avoid critical conditions of water quality;

(vii) Establishing buffer areas with effective limits on activities;

(viii) Land application or infiltration to capture pollutants and reduce surface runoff, on-site treatment, or alternative discharge locations;

(ix) Water quality offsets as described in WAC 173-201A-450.

(5) The department retains the discretion to require that the applicant examine specific alternatives, or that additional information be provided to conduct the analysis.

(6) General permit and water pollution control programs are developed for a category of dischargers that have similar processes and pollutants. New or reissued general permits or other water pollution control programs authorized, implemented, or administered by the department will undergo an analysis under Tier II at the time the department develops and approves the general permit or program.

(a) Individual activities covered under these general permits or programs will not require a Tier II analysis.

(b) The department will describe in writing how the general permit or control program meets the antidegradation requirements of this section.

(c) The department recognizes that many water quality protection programs and their associated control technologies are in a continual state of improvement and development. As a result, information regarding the existence, effectiveness, or costs of control practices for reducing pollution and meeting the water quality standards may be incomplete. In these instances, the antidegradation requirements of this section can be considered met for general permits and programs that have a formal process to select, develop, adopt, and refine control practices for protecting water quality and meeting the intent of this section. This adaptive process must:

(i) Ensure that information is developed and used expeditiously to revise permit or program requirements;

(ii) Review and refine management and control programs in cycles not to exceed five years or the period of permit reissuance; and

(iii) Include a plan that describes how information will be obtained and used to ensure full compliance with this chapter. The plan must be developed and documented in advance of permit or program approval under this section.

(7) All authorizations under this section must still comply with the provisions of Tier I (WAC 173-201A-310).

[Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-320, filed 7/1/03, effective 8/1/03.]

173-201A-330
Tier III — Protection of outstanding resource waters.

Where a high quality water is designated as an outstanding resource water, the water quality and uses of those waters must be maintained and protected. As part of the public process, a qualifying water body may be designated as Tier III(A) which prohibits any and all future degradation, or Tier III(B) which allows for de minimis (below measurable amounts) degradation from well-controlled activities.

(1) To be eligible for designation as an outstanding resource water in Washington, one or more of the following must apply:

> (a) The water is in a relatively pristine condition (largely absent human sources of degradation) or possesses exceptional water quality, and also occurs in federal and state parks, monuments, preserves, wildlife refuges, wilderness areas, marine sanctuaries, estuarine research reserves, or wild and scenic rivers;
>
> (b) The water has unique aquatic habitat types (for example, peat bogs) that by conventional water quality parameters (such as dissolved oxygen, temperature, or sediment) are not considered high quality, but that are unique and regionally rare examples of their kind;
>
> (c) The water has both high water quality and regionally unique recreational value;
>
> (d) The water is of exceptional statewide ecological significance; or
>
> (e) The water has cold water thermal refuges critical to the long-term protection of aquatic species. For this type of outstanding resource water, the nondegradation protection would apply only to temperature and dissolved oxygen.

(2) Any water or portion thereof that meets one or more of the conditions described in subsection (1) of this section may be designated for protection as an outstanding resource water. A request for designation may be made by the department or through public nominations that are submitted to the department in writing and that include sufficient information to show how the water body meets the appropriate conditions identified in this section.

(3) After receiving a request for outstanding resource water designation, the department will:

> (a) Respond within sixty days of receipt with a decision on whether the submitted information demonstrates that the water body meets the eligibility requirements for an outstanding resource water. If the submitted information demonstrates that the water body meets the eligibility requirements, the department will schedule a review of the nominated water for designation as an outstanding resource water. The review will include a public process and consultation with recognized tribes in the geographic vicinity of the water.
>
> (b) In determining whether or not to designate an outstanding resource water, the department will consider factors relating to the difficulty of maintaining the current quality of the water body. Outstanding resource waters should not be designated where substantial and imminent social or economic impact to the local community will occur, unless local public support is overwhelmingly in favor of the designation. The department will carefully weigh the level of support from the public and affected governments in assessing whether or not to designate the water as an outstanding resource water.

(c) After considering public comments and weighing public support for the proposal, the department will make a final determination on whether a nominated water body should be adopted into this chapter as an outstanding resource water.

(4) A designated outstanding resource water will be maintained and protected from all degradation, except for the following situations:

(a) Temporary actions that are necessary to protect the public interest as approved by the department.

(b) Treatment works bypasses for sewage, waste, and stormwater are allowed where such a bypass is unavoidable to prevent the loss of life, personal injury, or severe property damage, and no feasible alternatives to the bypass exist.

(c) Response actions taken in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended, or similar federal or state authorities, to alleviate a release into the environment of substances which may pose an imminent and substantial danger to public health or welfare.

(d) The sources of degradation are from atmospheric deposition.

(5) Outstanding resources waters can be designated for either Tier III(A) or Tier III(B) protection.

(a) Tier III(A) is the highest level of protection and allows no further degradation after the waters have been formally designated Tier III(A) under this chapter.

(b) Tier III(B) is the second highest level of protection for outstanding resource waters and conditionally allows minor degradation to occur due to highly controlled actions. The requirements for Tier III(B) are as follows:

(i) To meet the goal for maintaining and protecting the quality of Tier III(B) waters, sources of pollution, considered individually and cumulatively, are not to cause measurable degradation of the water body.

(ii) Regardless of the quality of the water body, all new or expanded point sources of pollution in Tier III(B) waters must use applicable advanced waste treatment and control techniques that reasonably represent the state of the art and must minimize the degradation of water quality to nonmeasurable levels where total elimination is not feasible. Nonpoint sources must use all applicable structural and nonstructural BMPs with the goal of reducing the degradation of water quality to nonmeasurable levels where total elimination is not feasible.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-330, filed 7/1/03, effective 8/1/03.]

173-201A-400
Mixing zones.

(1) The allowable size and location of a mixing zone and the associated effluent limits shall be established in discharge permits, general permits, or orders, as appropriate.

(2) A discharger shall be required to fully apply AKART prior to being authorized a mixing zone.

(3) Mixing zone determinations shall consider critical discharge conditions.

(4) No mixing zone shall be granted unless the supporting information clearly indicates the mixing zone would not have a reasonable potential to cause a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health as determined by the department.

(5) Water quality criteria shall not be violated outside of the boundary of a mixing zone as a result of the discharge for which the mixing zone was authorized.

(6) The size of a mixing zone and the concentrations of pollutants present shall be minimized.

(7) The maximum size of a mixing zone shall comply with the following:

(a) In rivers and streams, mixing zones, singularly or in combination with other mixing zones, shall comply with the most restrictive combination of the following (this size limitation may be applied to estuaries having flow characteristics that resemble rivers):

(i) Not extend in a downstream direction for a distance from the discharge port(s) greater than three hundred feet plus the depth of water over the discharge port(s), or extend upstream for a distance of over one hundred feet;

(ii) Not utilize greater than twenty-five percent of the flow; and

(iii) Not occupy greater than twenty-five percent of the width of the water body.

(b) In estuaries, mixing zones, singularly or in combination with other mixing zones, shall:

(i) Not extend in any horizontal direction from the discharge port(s) for a distance greater than two hundred feet plus the depth of water over the discharge port(s) as measured during mean lower low water; and

(ii) Not occupy greater than twenty-five percent of the width of the water body as measured during mean lower low water. For the purpose of this section, areas to the east of a line from Green Point (Fidalgo Island) to Lawrence Point (Orcas Island) are considered estuarine, as are all of the Strait of Georgia and the San Juan Islands north of Orcas Island. To the east of Deception Pass, and to the south and east of Admiralty Head, and south of Point Wilson on the Quimper Peninsula, is Puget Sound proper, which is considered to be entirely estuarine. All waters existing within bays from Point Wilson westward to Cape Flattery and south to the North Jetty of the Columbia River shall also be categorized as estuarine.

(c) In oceanic waters, mixing zones, singularly or in combination with other mixing zones, shall not extend in any horizontal direction from the discharge port(s) for a distance greater than three hundred feet plus the depth of water over the discharge port(s) as measured during mean lower low water. For the purpose of this section, all marine waters not classified as estuarine in (b)(ii) of this subsection shall be categorized as oceanic.

(d) In lakes, and in reservoirs having a mean detention time greater than fifteen days, mixing zones shall not be allowed unless it can be demonstrated to the satisfaction of the department that:

(i) Other siting, technological, and managerial options that would avoid the need for a lake mixing zone are not reasonably achievable;

(ii) Overriding considerations of the public interest will be served; and

(iii) All technological and managerial methods available for pollution reduction and removal that are economically achievable would be implemented prior to discharge. Such methods may include, but not be limited to, advanced waste treatment techniques.

(e) In lakes, and in reservoirs having a mean detention time greater than fifteen days, mixing zones, singularly or in combination with other mixing zones, shall comply with the most restrictive combination of the following:

(i) Not exceed ten percent of the water body volume;

(ii) Not exceed ten percent of the water body surface area (maximum radial extent of the plume regardless of whether it reaches the surface); and

(iii) Not extend beyond fifteen percent of the width of the water body.

(8) Acute criteria are based on numeric criteria and toxicity tests approved by the department, as generally guided under WAC 173-201A-240 (1) through (5), and shall be met as near to the point of discharge as practicably attainable. Compliance shall be determined by monitoring data or calibrated models approved by the department utilizing representative dilution ratios. A zone where acute criteria may be exceeded is allowed only if it can be demonstrated to the department's satisfaction the concentration of, and duration and frequency of exposure to the discharge, will not create a barrier to the migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem. A zone of acute criteria exceedance shall singularly or in combination with other such zones comply with the following maximum size requirements:

(a) In rivers and streams, a zone where acute criteria may be exceeded shall comply with the most restrictive combination of the following (this size limitation may also be applied to estuaries having flow characteristics resembling rivers):

(i) Not extend beyond ten percent of the distance towards the upstream and downstream boundaries of an authorized mixing zone, as measured independently from the discharge port(s);

(ii) Not utilize greater than two and one-half percent of the flow; and

(iii) Not occupy greater than twenty-five percent of the width of the water body.

(b) In oceanic and estuarine waters a zone where acute criteria may be exceeded shall not extend beyond ten percent of the distance established in subsection (7)(b) of this section as measured independently from the discharge port(s).

(9) Overlap of mixing zones.

(a) Where allowing the overlap of mixing zones would result in a combined area of water quality criteria nonattainment which does not exceed the numeric size limits established under subsection (7) of this section, the overlap may be permitted if:

(i) The separate and combined effects of the discharges can be reasonably determined; and

(ii) The combined effects would not create a barrier to the migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.

(b) Where allowing the overlap of mixing zones would result in exceedance of the numeric size limits established under subsection (7) of this section, the overlap may be allowed only where:

(i) The overlap qualifies for exemption under subsections (12) and (13) of this section; and

(ii) The overlap meets the requirements established in (a) of this subsection.

(10) Stormwater:

(a) Stormwater discharge from any "point source" containing "process wastewater" as defined in 40 C.F.R. Part 122.2 shall fully conform to the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section.

(b) Stormwater discharges not described by (a) of this subsection may be granted an exemption to the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section, provided the discharger clearly demonstrates to the department's satisfaction that:

(i) All appropriate best management practices established for stormwater pollutant control have been applied to the discharge.

(ii) The proposed mixing zone shall not have a reasonable potential to result in a loss of sensitive or important habitat, substantially interfere with the existing or characteristic uses of the water body, result in damage to the ecosystem, or adversely affect public health as determined by the department; and

(iii) The proposed mixing zone shall not create a barrier to the migration or translocation of indigenous organisms to a degree that has the potential to cause damage to the ecosystem.

(c) All mixing zones for stormwater discharges shall be based on a volume of runoff corresponding to a design storm approved by the department. Exceedances from the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section due to precipitation events greater than the approved design storm may be allowed by the department, if it would not result in adverse impact to existing or characteristic uses of the water body or result in damage to the ecosystem, or adversely affect public health as determined by the department.

(11) Combined sewer overflows complying with the requirements of chapter 173-245 WAC, may be allowed an average once per year exemption to the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section, provided the discharge complies with subsection (4) of this section.

(12) Exceedances from the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section may be considered by the department in the following cases:

(a) For discharges existing prior to November 24, 1992, (or for proposed discharges with engineering plans formally approved by the department prior to November 24, 1992);

(b) Where altering the size configuration is expected to result in greater protection to existing and characteristic uses;

(c) Where the volume of water in the effluent is providing a greater benefit to the existing or characteristic uses of the water body due to flow augmentation than the benefit of removing the discharge, if such removal is the remaining feasible option; or

(d) Where the exceedance is clearly necessary to accommodate important economic or social development in the area in which the waters are located.

(13) Before an exceedance from the numeric size criteria in subsections (7) and (8) of this section and the overlap criteria in subsection (9) of this section may be allowed under subsection (12) of this section, it must clearly be demonstrated to the department's satisfaction that:

(a) AKART appropriate to the discharge is being fully applied;

(b) All siting, technological, and managerial options which would result in full or significantly closer compliance that are economically achievable are being utilized; and

(c) The proposed mixing zone complies with subsection (4) of this section.

(14) Any exemptions granted to the size criteria under subsection (12) of this section shall be reexamined during each permit renewal period for changes in compliance capability. Any significant increase in capability to comply shall be reflected in the renewed discharge permit.

(15) The department may establish permit limits and measures of compliance for human health based criteria (based on lifetime exposure levels), independent of this section.

(16) Sediment impact zones authorized by the department pursuant to chapter 173-204 WAC, Sediment management standards, do not satisfy the requirements of this section.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), amended and recodified as § 173-201A-400, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-100, filed 11/25/92, effective 12/26/92.]

Part IV – Tools for Application of Criteria

173-201A-410
Short-term modifications.

The criteria and special conditions established in WAC 173-201A-200 through173-201A-260 , 173-201A-320, 173-201A-602 and 173-201A-612 may be modified for a specific water body on a short-term basis (e.g., actual periods of nonattainment would generally be limited to hours or days rather than weeks or months) when necessary to accommodate essential activities, respond to emergencies, or to otherwise protect the public interest, even though such activities may result in a temporary reduction of water quality conditions.

(1) A short-term modification will:

(a) Be authorized in writing by the department, and conditioned, timed, and restricted in a manner that will minimize degradation of water quality, existing uses, and designated uses;

(b) Be valid for the duration of the activity requiring modification of the criteria and special conditions in WAC 173-201A-200 through 173-201A-260, 173-201A-602 or 173-201A-612, as determined by the department;

(c) Allow degradation of water quality if the degradation does not significantly interfere with or become injurious to existing or designated water uses or cause long-term harm to the environment; and

(d) In no way lessen or remove the proponent's obligations and liabilities under other federal, state, and local rules and regulations.

(2) The department may authorize a longer duration where the activity is part of an ongoing or long-term operation and maintenance plan, integrated pest or noxious weed management plan, water body or watershed management plan, or restoration plan. Such a plan must be developed through a public involvement process consistent with the Administrative Procedure Act (chapter 34.05 RCW) and be in compliance with SEPA, chapter 43.21C RCW, in which case the standards may be modified for the duration of the plan, or for five years, whichever is less. Such long-term plans may be renewed by the department after providing for another opportunity for public and intergovernmental involvement and review.

(3) The department may allow a major watershed restoration activity that will provide greater benefits to the health of the aquatic system in the long-term (examples include removing dams or reconnecting meander channels) that, in the short term, may cause significant impacts to existing or designated uses as a result of the activities to restore the water body and environmental conditions. Authorization will be given in accordance with subsection (2) of this section.

(4) A short-term modification may be issued in writing by the director or his/her designee to an individual or entity proposing the aquatic application of pesticides, including but not limited to those used for control of federally or state listed noxious and invasive species, and excess populations of native aquatic plants, mosquitoes, burrowing shrimp, and fish, subject to the following terms and conditions:

(a) A request for a short-term modification shall be made to the department on forms supplied by the department. Such request shall be made at least thirty days prior to initiation of the proposed activity, and after the project proponent has complied with the requirements of the State Environmental Policy Act (SEPA);

(b) Appropriate public notice as determined and prescribed by the director or his/her designee shall be given, identifying the pesticide, applicator, location where the pesticide will be applied, proposed timing and method of application, and any water use restrictions specified in USEPA label provisions;

(c) The pesticide application shall be made at times so as to:

(i) Minimize public water use restrictions during weekends; and

(ii) Avoid public water use restrictions during the opening week of fishing season, Memorial Day weekend, Independence Day weekend, and Labor Day weekend;

(d) Any additional conditions as may be prescribed by the director or his/her designee.

(5) A short-term modification may be issued for the control or eradication of noxious weeds identified as such in accordance with the state noxious weed control law, chapter 17.10 RCW, and Control of spartina and purple loosestrife, chapter 17.26 RCW. Short-term modifications for noxious weed control shall be included in a water quality permit issued in accordance with RCW 90.48.445, and the following requirements:

(a) The department may issue water quality permits for noxious weed control to the Washington state department of agriculture (WSDA) for the purposes of coordinating and conducting noxious weed control activities consistent with WSDA's responsibilities under chapters 17.10 and 17.26 RCW. Coordination may include noxious weed control activities identified in a WSDA integrated noxious weed management plan and conducted by individual landowners or land managers.

(b) T e department may also issue water quality permits to individual landowners or land managers for noxious weed control activities where such activities are not covered by a WSDA integrated noxious weed management plan.

[Statutory Authority: RCW 90.48.035. 06-23-117 (Order 06-04), § 173-201A-410, filed 11/20/06, effective 12/21/06. Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), amended and recodified as § 173-201A-410, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW and 40 CFR 131. 97-23-064 (Order 94-19), § 173-201A-110, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-110, filed 11/25/92, effective 12/26/92.]

173-201A-420
Variance.

(1) **General provisions.** Variances for individual facilities, a group of facilities, or stretches of waters may be issued for the criteria and designated uses established in WAC 173-201A-200 through 173-201A-260 and 173-201A-600 through 173-201A-612. The following conditions apply when considering issuance of a variance:

(a) A variance may be considered when the standards are expected to be attained by the end of the variance period or the attainable use cannot be reliably determined.

(b) The variance applies to specific parameters and all other applicable standards remain in effect for the water body.

(c) The modification must be consistent with the requirements of federal regulations (currently 40 C.F.R. 131.14).

(d) Reasonable progress must be made toward meeting the underlying standards during the variance period.

(e) A variance renewal may be considered if the renewal request meets the above conditions.

(2) **Types of variances.** Upon request or on its own initiative, the department will consider granting the following types of variances to existing water quality standards:

(a) An individual variance is a time-limited designated use and parameter-specific change to the standard(s) of the receiving water body for a specific discharger. The temporary standard(s) only apply at the point(s) of compliance for the individual facility.

(b) A multidischarger variance is a time-limited designated use and parameter-specific change to the standard(s) of any water body that receives discharges from a permitted facility defined within the scope of the multidischarger variance. Any permitted discharger that is defined within the scope of the variance may be covered under the variance that is granted by the department, provided all requirements of the variance for that discharger are met.

(c) A water body variance is a time-limited designated use and parameter-specific change to the standard(s) for a stretch of waters. Any discharger of the specific parameter that is defined within the geographic scope of the water body variance may be covered under the variance that is granted by the department, provided all requirements of the variance for that discharger are met.

(3) **Requirements.** Any entity initiating a variance request or applying for coverage for an individual, multidischarger, or water body variance must submit the following information to the department:

(a) The pollutant-specific criteria and designated use(s) proposed to be modified by the variance, and the proposed duration of the variance.

(b) A demonstration that attaining the water quality standard for a specific pollutant is not feasible for the requested duration of the variance based on 40 C.F.R. 131.14.

(c) An evaluation of treatment or alternative actions that were considered to meet effluent limits based on the underlying water quality criteria, and a description of why these options are not technically, economically, or otherwise feasible.

(d) Sufficient water quality data and analyses to characterize receiving and discharge water pollutant concentrations.

(e) A description and schedule of actions that the discharger(s) proposes to ensure the underlying water quality standard(s) are met or the highest attainable use is attained within the variance period. Dischargers are also required to submit a schedule for development and implementation of a pollutant minimization plan for the subject pollutant(s).

(f) If the variance is for a water body or stretch of water, the following information must also be provided to the department:

(i) The results from a pollutant source assessment that quantifies the contribution of pollution from permitted sources and nonpermitted sources;

(ii) All cost-effective and reasonable best management practices for permitted sources that address the pollutant the variance is based upon; and

(iii) Best management practices for nonpermitted sources that meet the requirements of chapter 90.48 RCW.

(g) Any additional information the department deems necessary to evaluate the application.

(4) **Public review and notification.** The decision to grant a variance is a formal rule making subject to a public and intergovernmental involvement process.

(a) The department will provide notice of the proposed variance and consult with Indian tribes or other states that have jurisdiction over adjacent and downstream waters of the proposed variance.

(b) The department shall maintain and make publicly available a list of dischargers that are covered under the variances that are in effect.

(5) **Period during which the variance is in effect.** A variance is a time-limited designated use and criterion.

(a) Each variance will be granted for the minimum time estimated to meet the underlying standard(s) or, if during the period of the variance it is determined that a designated use cannot be attained, then a use attainability analysis (WAC 173-201A-440) will be initiated.

(b) The ability to apply a variance in permits or other actions may be terminated by the department as a result of a mandatory interim review.

(c) Variances are in effect after they have been incorporated into this chapter and approved by the USEPA.

(6) **Contents of a variance.** At a minimum a variance adopted into rule will include the following:

(a) The time period for which the variance is applicable.

(b) The geographic area or specific waters in which the variance is applicable.

(c) A description of the permitted and unpermitted dischargers covered by the variance.

(d) Identification of required actions and a schedule, including any measurable milestones, for all pollution sources (permitted and unpermitted) subject to the variance. Dischargers are required to use adaptive management to fine-tune and update actions, schedules, and milestones in order to achieve the goals of the variance.

(e) A provision allowing the department to reopen and modify any permits and to revise BMP requirements for unpermitted dischargers as a result of the mandatory interim review of the variance (see subsection (8) of this section).

(7) **Variance permit conditions.** The department must establish and incorporate into NPDES permits all conditions necessary to implement and enforce an approved variance, including:

(a) Effluent limits that represent currently achieved or achievable effluent conditions, or effluent limits that are sufficient to meet the underlying water quality standard upon expiration of the variance;

(b) Monitoring and reporting requirements; and

(c) A provision allowing the department to reopen and modify the permits based on the mandatory interim review of the variance.

(8) **Mandatory interim review.** The department will conduct an interim review of each variance at least once every five years after the variance is adopted and approved to determine that conditions of the variance are being met and to evaluate whether the variance is still necessary.

(a) Review process for individual discharger and multidischarger variances:

(i) The review shall be coordinated with the public review process of the permit renewal if the variance is being implemented in a permit.

(ii) The review will be focused on the discharger's compliance with permit conditions that are required by the variance as well as an evaluation of whether the variance is still necessary.

(b) Review process for water body variances:

(i) Variances for stretches of waters will be reviewed in a public process conducted by the department every five years after the variance is adopted into this chapter and approved by the USEPA.

(ii) The review will evaluate whether the variance is still necessary, any new information on sources of the pollutant that indicates that reductions could be made that would allow water quality standards to be met in a shorter time frame, as well as any new information that indicates water quality improvements may require more time.

(c) A variance that applies to a permit will be shortened or terminated if the review determines that:

(i) The conditions and requirements of the variance and associated permit requirements have not been complied with unless reasons outside the control of the discharger prevented meeting any condition or requirement; or

(ii) Water quality standards could be met in a shorter time frame, based on new information submitted to the department.

[Statutory Authority: RCW 90.48.035, 90.48.605 and section 303(c) of the Federal Water Pollution Control Act (Clean Water Act), C.F.R. 40, C.F.R. 131. WSR 16-16-095 (Order 12-03), § 173-201A-420, filed 8/1/16, effective 9/1/16. Statutory Authority: RCW 90.48.035. WSR 11-09-090 (Order 10-10), § 173-201A-420, filed 4/20/11, effective 5/21/11. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), § 173-201A-420, filed 7/1/03, effective 8/1/03.]

173-201A-430
Site-specific criteria.

(1) Where the attainable condition of existing and designated uses for the water body would be fully protected using an alternative criterion, site-specific criteria may be adopted.

(a) The site-specific criterion must be consistent with the federal regulations on designating and protecting uses (currently 40 CFR 131.10 and 131.11); and

(b) The decision to approve a site-specific criterion must be subject to a public involvement and intergovernmental coordination process.

(2) The site-specific analyses for the development of a new water quality criterion must be conducted in a manner that is scientifically justifiable and consistent with the assumptions and rationale in "*Guidelines for Deriving National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses*," EPA 1985; and conducted in accordance with the procedures established in the "*Water Quality Standards Handbook*," EPA 1994, as revised.

(3) The decision to approve the site-specific criterion must be based on a demonstration that it will protect the existing and attainable uses of the water body.

(4) Site-specific criteria are not in effect until they have been incorporated into this chapter and approved by the USEPA.
[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-430, filed 7/1/03, effective 8/1/03.]

173-201A-440
Use attainability analysis.

(1) Removal of a designated use for a water body assigned in this chapter must be based on a use attainability analysis (UAA). A UAA is a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors. A use can only be removed through a UAA if it is not existing or attainable.

(2) A UAA proposing to remove a designated use on a water body must be submitted to the department in writing and include sufficient information to demonstrate that the use is neither existing nor attainable.

(3) A UAA must be consistent with the federal regulations on designating and protecting uses (currently 40 CFR 131.10).

(4) Subcategories of use protection that reflect the lower physical potential of the water body for protecting designated uses must be based upon federal regulations (currently 40 CFR 131.10(c)).

(5) Allowing for seasonal uses where doing so would not harm existing or designated uses occurring in that or another season must be based upon federal regulations (currently 40 CFR 131.10(f)).

(6) After receiving a proposed UAA, the department will respond within sixty days of receipt with a decision on whether to proceed toward rule making.

(7) The decision to approve a UAA is subject to a public involvement and intergovernmental coordination process, including tribal consultation.

(8) The department will maintain a list of federally recognized tribes in the state of Washington. During all stages of development and review of UAA proposals, the department will provide notice and consult with representatives of the interested affected Indian tribes on a government-to-government basis, and carefully consider their recommendations.

(9) The results of a UAA are not in effect until they have been incorporated into this chapter and approved by the USEPA.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-440, filed 7/1/03, effective 8/1/03.]

173-201A-450
Water quality offsets.

(1) A water quality offset occurs where a project proponent implements or finances the implementation of controls for point or nonpoint sources to reduce the levels of pollution for the purpose of creating sufficient assimilative capacity to allow new or expanded discharges. The purpose of water quality offsets is to sufficiently reduce the pollution levels of a water body so that a proponent's actions do not cause or contribute to a violation of the requirements of this chapter and so that they result in a net environmental benefit. Water quality offsets may be

used to assist an entity in meeting load allocations targeted under a pollution reduction analysis (such as a total maximum daily load) as established by the department. Water quality offsets may be used to reduce the water quality effect of a discharge to levels that are unmeasurable and in compliance with the water quality antidegradation Tier II analysis (WAC 173-201A-320).

(2) Water quality offsets may be allowed by the department when all of the following conditions are met:

(a) Water quality offsets must target specific water quality parameters.

(b) The improvements in water quality associated with creating water quality offsets for any proposed new or expanded actions must be demonstrated to have occurred in advance of the proposed action.

(c) The technical basis and methodology for the water quality offsets is documented through a technical analysis of pollutant loading, and that analysis is made available for review by the department. The methodology must incorporate the uncertainties associated with any proposed point or nonpoint source controls as well as variability in effluent quality for sources, and must demonstrate that an appropriate margin of safety is included. The approach must clearly account for the attenuation of the benefits of pollution controls as the water moves to the location where the offset is needed.

(d) Point or nonpoint source pollution controls must be secured using binding legal instruments between any involved parties for the life of the project that is being offset. The proponent remains solely responsible for ensuring the success of offsetting activities for both compliance and enforcement purposes.

(e) Only the proportion of the pollution controls which occurs beyond existing requirements for those sources can be included in the offset allowance.

(f) Water quality offsets must meet antidegradation requirements in WAC 173-201A-300 through 173-201A-330 and federal antibacksliding requirements in CFR 122.44(l).

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-450, filed 7/1/03, effective 8/1/03.]

173-201A-460

Intake credits.

(1) **General provisions.** The following provisions apply to the consideration of intake credits in determining reasonable potential and establishing water quality based effluent limits (WQBELs).

(a) An "intake pollutant" is the amount of a pollutant that is present in waters of the state (including groundwater except as provided in (c) of this subsection) at the time water is removed from the same body of water by the discharger or other facility supplying the discharger with intake water.

(b) An intake pollutant must be from the "same body of water" as the discharge in order to be eligible for an intake credit. An intake pollutant is considered to be from the "same body of water" as the discharge if the department finds that the intake pollutant would have reached the vicinity of the outfall point in the receiving water within a reasonable period had it not been removed by the permittee. This finding will be established if a discharger demonstrates:

(i) The background concentration of the pollutant in the receiving water (excluding any amount of the pollutant in the facility's discharge) is similar to that in the intake water; and

(ii) There is a direct hydrological connection between the intake and discharge points.

(c) An intake pollutant in groundwater partially or entirely due to human activity is not eligible for use of an intake credit.

(d) Where intake water for a facility is provided by a municipal water supply system and the supplier provides treatment of the raw water that removes an intake water pollutant, the concentration of the intake water pollutant will be determined at the point where the water enters the water supplier's distribution system.

(e) Where a facility discharges intake pollutants from multiple sources that originate from the receiving water body and from other water bodies, the department may derive an effluent limit reflecting the flow-weighted amount of each source of the pollutant provided that conditions in subsection (3) of this section are met and adequate monitoring to determine compliance can be established and is included in the permit.

(f) The department may also consider other site-specific factors relevant to the transport and fate of the pollutant to make the finding in a particular case that a pollutant would or would not have reached the vicinity of the outfall point in the receiving water within a reasonable period had it not been removed by the permittee.

(2) **Consideration of intake pollutants in reasonable potential determination.**

(a) The department may determine there is no reasonable potential for the discharge of an identified intake pollutant to cause or contribute to an exceedance of a narrative or numeric water quality criterion where a discharger demonstrates that all the following conditions are met:

(i) The facility removes the intake water containing the pollutant from the same body of water into which the discharge is made;

(ii) The facility does not alter the identified intake pollutant chemically or physically in a manner that would cause adverse water quality impacts to occur that would not occur if the pollutant had not been removed from the body of water;

(iii) The timing and location of the discharge would not cause adverse water quality impacts to occur that would not occur if the identified intake pollutant had not been removed from the body of water;

(iv) The facility does not increase the identified intake pollutant concentration at the edge of the mixing zone, or at the point of discharge if a mixing zone is not allowed, as compared to the pollutant concentration in the intake water, unless the increased concentration does not cause or contribute to an excursion above an applicable water quality standard; and

(v) The facility does not contribute any additional mass of the identified intake pollutant to its wastewater.

(b) Upon a finding under (a) of this subsection that an intake pollutant in the discharge does not cause, have the reasonable potential to cause, or contribute to an exceedance of an applicable water quality standard, the department is not required to include a water quality-based effluent limit for the identified intake pollutant in the facility's permit.

(3) **Consideration of intake pollutants in establishing water quality based effluent limits.**

(a) This subsection applies only when the ambient background concentration of the intake pollutant does not meet the most stringent applicable water quality criterion for that pollutant;

(b) The requirements of subsection (2)(a)(i) and (iv) also apply to this subsection.

(c) A discharger may add mass of the pollutant to its waste stream if an equal or greater mass is removed prior to discharge, so there is no net addition of the pollutant in the discharge compared to the intake water.

(d) Where the conditions of this subsection are met, the department may establish effluent limits using an intake credit. The facility's permit must specify how compliance with the limits will be assessed.

[Statutory Authority: RCW 90.48.035, 90.48.605 and section 303(c) of the Federal Water Pollution Control Act (Clean Water Act), C.F.R. 40, C.F.R. 131. WSR 16-16-095 (Order 12-03), § 173-201A-460, filed 8/1/16, effective 9/1/16.]

Part V - Implementation

173-201A-500
Achievement considerations.

To fully achieve and maintain the foregoing water quality in the state of Washington, it is the intent of the department to apply the various implementation and enforcement authorities at its disposal, including participation in the programs of the federal Clean Water Act (33 U.S.C. 1251 et seq.) as appropriate. It is also the intent that cognizance will be taken of the need for participation in cooperative programs with other state agencies and private groups with respect to the management of related problems. The department's planned program for water pollution control will be defined and revised annually in accordance with section 106 of said federal act. Further, it shall be required that all activities which discharge wastes into waters within the state, or otherwise adversely affect the quality of said waters, be in compliance with the waste treatment and discharge provisions of state or federal law.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), recodified as § 173-201A-500, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-150, filed 11/25/92, effective 12/26/92.]

173-201A-510
Means of implementation.

(1) **Permitting.** The primary means to be used for controlling municipal, commercial, and industrial waste discharges shall be through the issuance of waste discharge permits, as provided for in RCW 90.48.160, 90.48.162, and 90.48.260. Waste discharge permits, whether issued pursuant to the National Pollutant Discharge Elimination System or otherwise, must be conditioned so the discharges authorized will meet the water quality standards. No waste discharge permit can be issued that causes or contributes to a violation of water quality criteria, except as provided for in this chapter.

(a) Persons discharging wastes in compliance with the terms and conditions of permits are not subject to civil and criminal penalties on the basis that the discharge violates water quality standards.

(b) Permits must be modified by the department when it is determined that the discharge causes or contributes to a violation of water quality standards. Major modification of permits is subject to review in the same manner as the originally issued permits.

(2) **Miscellaneous waste discharge or water quality effect sources.** The director shall, through the issuance of regulatory permits, directives, and orders, as are appropriate, control miscellaneous waste discharges and water quality effect sources not covered by subsection (1) of this section.

(3) **Nonpoint source and stormwater pollution.**

(a) Activities which generate nonpoint source pollution shall be conducted so as to comply with the water quality standards. The primary means to be used for requiring compliance with the standards shall be through best management practices required in waste discharge permits, rules, orders, and directives issued by the department for activities which generate nonpoint source pollution.

(b) Best management practices shall be applied so that when all appropriate combinations of individual best management practices are utilized, violation of water quality criteria shall be prevented. If a discharger is applying all best management practices appropriate or required by the department and a violation of water quality criteria occurs, the discharger shall modify existing practices or apply further water pollution control measures, selected or approved by the department, to achieve compliance with water quality criteria. Best management practices established in permits, orders, rules, or directives of the department shall be reviewed and modified, as appropriate, so as to achieve compliance with water quality criteria.

(c) Activities which contribute to nonpoint source pollution shall be conducted utilizing best management practices to prevent violation of water quality criteria. When applicable best management practices are not being implemented, the department may conclude individual activities are causing pollution in violation of RCW 90.48.080. In these situations, the department may pursue orders, directives, permits, or civil or criminal sanctions to gain compliance with the standards.

(d) Activities which cause pollution of stormwater shall be conducted so as to comply with the water quality standards. The primary means to be used for requiring compliance with the standards shall be through best management practices required in waste discharge permits, rules, orders, and directives issued by the department for activities which generate stormwater pollution. The consideration and control procedures in (b) and (c) of this subsection apply to the control of pollutants in stormwater.

(4) **General allowance for compliance schedules.**

(a) Permits and orders issued by the department for existing discharges may include a schedule for achieving compliance with effluent limits and water quality standards that apply to:

(i) Aquatic life uses; and

(ii) Uses other than aquatic life.

(b) Schedules of compliance shall be developed to ensure final compliance with all water quality-based effluent limits and the water quality standards as soon as possible. The department will decide whether to issue schedules of compliance on a case-by-case basis. Schedules of compliance may not be issued for new discharges. Examples of schedules of compliance that may be issued include:

(i) Construction of necessary treatment capability;

(ii) Implementation of necessary best management practices;

(iii) Implementation of additional stormwater best management practices for discharges determined not to meet water quality standards following implementation of an initial set of best management practices; and

(iv) Completion of necessary water quality studies related to implementation of permit requirements to meet effluent limits.

(c) For the period of time during which compliance with water quality standards is deferred, interim effluent limits shall be formally established, based on the best professional judgment of the department. Interim effluent limits may be numeric or nonnumeric (e.g., construction of necessary facilities by a specified date as contained in an order or permit), or both.

(d) Prior to establishing a schedule of compliance, the department shall require the discharger to evaluate the possibility of achieving water quality standards via nonconstruction changes (e.g., facility operation, pollution prevention). Schedules of compliance shall require compliance with the specified requirements as soon as possible. Compliance schedules shall generally not exceed the term of any permit unless the department determines that a longer time period is needed to come into compliance with the applicable water quality standards.

(e) When an approved total maximum daily load has established waste load allocations for permitted dischargers, the department may authorize a compliance schedule longer than ten years if:

(i) The permittee is not able to meet its waste load allocation in the TMDL solely by controlling and treating its own effluent;

(ii) The permittee has made significant progress to reduce pollutant loading during the term of the permit;

(iii) The permittee is meeting all of its requirements under the TMDL as soon as possible; and

(iv) Actions specified in the compliance schedule are sufficient to achieve water quality standards as soon as possible.

(5) **Compliance schedules for dams:**

(a) All dams in the state of Washington must comply with the provisions of this chapter.

(b) For dams that cause or contribute to a violation of the water quality standards, the dam owner must develop a water quality attainment plan that provides a detailed strategy for achieving compliance. The plan must include:

(i) A compliance schedule that does not exceed ten years;

(ii) Identification of all reasonable and feasible improvements that could be used to meet standards, or if meeting the standards is not attainable, then to achieve the highest attainable level of improvement;

(iii) Any department-approved gas abatement plan as described in WAC 173-201A-200 (1)(f)(ii);

(iv) Analytical methods that will be used to evaluate all reasonable and feasible improvements;

(v) Water quality monitoring, which will be used by the department to track the progress in achieving compliance with the state water quality standards; and

(vi) Benchmarks and reporting sufficient for the department to track the applicant's progress toward implementing the plan within the designated time period.

(c) The plan must ensure compliance with all applicable water quality criteria, as well as any other requirements established by the department (such as through a total maximum daily load, or TMDL, analysis).

(d) If the department is acting on an application for a water quality certification, the approved water quality attainment plan may be used by the department in its determination that there is reasonable assurance that the dam will not cause or contribute to a violation of the water quality standards.

(e) When evaluating compliance with the plan, the department will allow the use of models and engineering estimates to approximate design success in meeting the standards.

(f) If reasonable progress toward implementing the plan is not occurring in accordance with the designated time frame, the department may declare the project in violation of the water quality standards and any associated water quality certification.

(g) If an applicable water quality standard is not met by the end of the time provided in the attainment plan, or after completion of all reasonable and feasible improvements, the owner must take the following steps:

(i) Evaluate any new reasonable and feasible technologies that have been developed (such as new operational or structural modifications) to achieve compliance with the standards, and develop a new compliance schedule to evaluate and incorporate the new technology;

(ii) After this evaluation, if no new reasonable and feasible improvements have been identified, then propose an alternative to achieve compliance with the standards, such as site specific criteria (WAC 173-201A-430), a use attainability analysis (WAC 173-201A-440), or a water quality offset (WAC 173-201A-450).

(h) New dams, and any modifications to existing facilities that do not comply with a gas abatement or other pollution control plan established to meet criteria for the water body, must comply with the water quality standards at the time of project completion.

(i) Structural changes made as a part of a department approved gas abatement plan to aid fish passage, described in WAC 173-201A-200 (1)(f)(ii), may result in system performance limitations in meeting water quality criteria for that parameter at other times of the year.

(6) **Combined sewer overflow treatment plant.** The influent to these facilities is highly variable in frequency, volume, duration, and pollutant concentration. The primary means to be used for requiring compliance with the human health criteria shall be through the application of narrative limitations which include, but are not limited to, best management practices required in waste discharge permits, rules, orders and directives issued by the department.
[Statutory Authority: RCW 90.48.035, 90.48.605 and section 303(c) of the Federal Water Pollution Control Act (Clean Water Act), C.F.R. 40, C.F.R. 131. WSR 16-16-095 (Order 12-03), § 173-201A-510, filed 8/1/16, effective 9/1/16. Statutory Authority: Chapters 90.48 and 90.54 RCW. WSR 03-14-129 (Order 02-14), amended and recodified as § 173-201A-510, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW and 40 C.F.R. 131. WSR 97-23-064 (Order 94-19), § 173-201A-160, filed 11/18/97, effective 12/19/97. Statutory Authority: Chapter 90.48 RCW. WSR 92-24-037 (Order 92-29), § 173-201A-160, filed 11/25/92, effective 12/26/92.]

173-201A-520
Monitoring and compliance.

A continuing surveillance program, to ascertain whether the regulations, waste disposal permits, orders, and directives promulgated and/or issued by the department are being complied with, will be conducted by the department staff as follows:

(1) Inspecting treatment and control facilities.

(2) Monitoring and reporting waste discharge characteristics.

(3) Monitoring receiving water quality.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), Amended and recodified as § 173-201A-520, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-170, filed 11/25/92, effective 12/26/92.]

173-201A-530
Enforcement.

To insure that the provisions of chapter 90.48 RCW, the standards for water quality promulgated herein, the terms of waste disposal permits, and other orders and directives of the department are fully complied with, the following enforcement tools will be relied upon by the department, in cooperation with the attorney general as it deems appropriate:

(1) Issuance of notices of violation and regulatory orders as provided for in RCW 90.48.120.

(2) Initiation of actions requesting injunctive or other appropriate relief in the various courts of the state as provided for in RCW 90.48.037.

(3) Levying of civil penalties as provided for in RCW 90.48.144.

(4) Initiation of a criminal proceeding by the appropriate county prosecutor as provided for in RCW 90.48.140.

(5) Issuance of regulatory orders or directives as provided for in RCW 90.48.240.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), recodified as § 173-201A-530, filed 7/1/03, effective 8/1/03. Statutory Authority: Chapter 90.48 RCW. 92-24-037 (Order 92-29), § 173-201A-180, filed 11/25/92, effective 12/26/92.]

Part VI – Use Designation for Waters of the State

173-201A-600
Use designations — Fresh waters.

(1) All surface waters of the state not named in Table 602 are to be protected for the designated uses of: Salmonid spawning, rearing, and migration; primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values.

(a) Additionally, the following waters are also to be protected for the designated uses of: Core summer salmonid habitat; and extraordinary primary contact recreation:

(i) All surface waters lying within national parks, national forests, and/or wilderness areas;

(ii) All lakes and all feeder streams to lakes (reservoirs with a mean detention time greater than fifteen days are to be treated as a lake for use designation);

(iii) All surface waters that are tributaries to waters designated core summer salmonid habitat; or extraordinary primary contact recreation; and

(iv) All fresh surface waters that are tributaries to extraordinary aquatic life marine waters (WAC 173-201A-610 through 173-201A-612).

(2) The water quality standards for surface waters for the state of Washington do not apply to segments of waters that are on Indian reservations, except for surface waters overlying fee lands on the Puyallup reservation consistent with the Puyallup Tribe Land Claims Settlement of 1989.

Table 600 (Key to Table 602) Abbreviation	**General Description**
Aquatic Life Uses:	(see WAC 173-201A-200(1))
Char Spawning/Rearing	**Char spawning and rearing.** The key identifying characteristics of this use are spawning or early juvenile rearing by native char (bull trout and Dolly Varden), or use by other aquatic species similarly dependent on such cold water. Other common characteristic aquatic life uses for waters in this category include summer foraging and migration of native char; and spawning, rearing, and migration by other salmonid species.

Table 600 (Key to Table 602) Abbreviation	General Description
Core Summer Habitat	**Core summer salmonid habitat**. The key identifying characteristics of this use are summer (June 15 - September 15) salmonid spawning or emergence, or adult holding; use as important summer rearing habitat by one or more salmonids; or foraging by adult and subadult native char. Other common characteristic aquatic life uses for waters in this category include spawning outside of the summer season, rearing, and migration by salmonids.
Spawning/Rearing	**Salmonid spawning, rearing, and migration**. The key identifying characteristic of this use is salmon or trout spawning and emergence that only occurs outside of the summer season (September 16 - June 14). Other common characteristic aquatic life uses for waters in this category include rearing and migration by salmonids.
Rearing/Migration Only	**Salmonid rearing and migration only.** The key identifying characteristic of this use is use only for rearing or migration by salmonids (not used for spawning).
Redband Trout	**Non-anadromous interior redband trout.** For the protection of waters where the only trout species is a nonanadromous form of self-reproducing interior redband trout (*O. mykis*), and other associated aquatic life.
Warm Water Species	**Indigenous warm water species.** For the protection of waters where the dominant species under natural conditions would be temperature tolerant indigenous nonsalmonid species. Examples include dace, redside shiner, chiselmouth, sucker, and northern pikeminnow.
Recreational Uses:	(see WAC 173-201A-200(2))
Extraordinary Primary Cont.	Extraordinary quality primary contact waters. Waters providing extraordinary protection against waterborne disease or that serve as tributaries to extraordinary quality shellfish harvesting areas.
Primary Cont.	Primary contact recreation.
Secondary Cont.	Secondary contact recreation.
Water Supply Uses:	(see WAC 173-201A-200(3))
Domestic Water	Domestic water supply.
Industrial Water	Industrial water supply.
Agricultural Water	Agricultural water supply.
Stock Water	Stock watering.
Miscellaneous Uses:	(see WAC 173-201A-200(4))
Wildlife Habitat	Wildlife habitat.

Table 600 (Key to Table 602) Abbreviation	General Description
Harvesting	Fish harvesting.
Commerce/Navigation	Commerce and navigation.
Boating	Boating.
Aesthetics	Aesthetic values.

[Statutory Authority: RCW 90.48.035. 11-09-090 (Order 10-10), § 173-201A-600, filed 4/20/11, effective 5/21/11; 06-23-117 (Order 06-04), § 173-201A-600, filed 11/20/06, effective 12/21/06. Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-600, filed 7/1/03, effective 8/1/03.]

WAC 173-201A-602
Table 602 — Use designations for fresh waters by water resource inventory area (WRIA).

(1) Table 602 lists uses for fresh waters. All surface waters of the state have designated uses assigned to them for protection under this chapter. Table 602 lists use designations for specific fresh waters. Fresh waters not assigned designated uses in Table 602 have their designated uses assigned in accordance with WAC 173-201A-600 and 173-201A-260(3). In Table 602, the Columbia River is listed first, followed by other water bodies listed by WRIA. Only the uses with the most stringent criteria are listed. The criteria notes in Table 602 take precedence over the criteria in WAC 173-201A-200 for same parameter.

(2) Table 602 is necessary to determine and fully comply with the requirements of this chapter. If you are viewing a paper copy of the rule from the office of the code reviser or are using their web site, Table 602 may be missing (it will instead say "place illustration here"). In this situation, you may view Table 602 at the department of ecology's web site at www.ecy.wa.gov, or request a paper copy of the rule with Table 602 from the department of ecology or the office of the code reviser.

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
COLUMBIA RIVER																		
Columbia River from mouth to the Washington-Oregon border (river mile 309.3).[1]			X					X		X	X	X	X	X	X	X	X	X
Columbia River from Washington-Oregon border (river mile 309.3) to Grand Coulee Dam (river mile 596.6).[2,3]			X					X		X	X	X	X	X	X	X	X	X
Columbia River from Grand Coulee Dam (river mile 596.6) to Canadian border (river mile 745.0).		X					X			X	X	X	X	X	X	X	X	X
Notes for Columbia River:																		
1. Temperature shall not exceed a 1-day maximum (1-DMax) of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed 0.3°C due to any single source or 1.1°C due to all such activities combined. Dissolved oxygen shall exceed 90 percent of saturation. Special condition - special fish passage exemption as described in WAC 173-201A-200 (1)(f).																		
2. From Washington-Oregon border (river mile 309.3) to Priest Rapids Dam (river mile 397.1). Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9).																		
3. From Washington-Oregon border (river mile 309.3) to Grand Coulee Dam (river mile 596.6). Special condition - special fish passage exemption as described in WAC 173-201A-200 (1)(f).																		
WRIA 1 - Nooksack																		
Bertrand Creek from mouth to Canadian border		X						X		X	X	X	X	X	X	X	X	X
Breckenridge Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Chilliwack River and Little Chilliwack River: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Chuckanut Creek from mouth to headwaters		X						X		X	X	X	X	X	X	X	X	X
Colony Creek and tributaries from mouth to headwaters		X						X		X	X	X	X	X	X	X	X	X
Dakota Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Dale Creek		X						X		X	X	X	X	X	X	X	X	X
Deer Creek (tributary to Barrett Lake) and tributaries		X					X			X	X	X	X	X	X	X	X	X
Depot Creek and tributaries	X						X			X	X	X	X	X	X	X	X	X
Fishtrap Creek from mouth to Canadian border		X						X		X	X	X	X	X	X	X	X	X
Hutchinson Creek and tributaries.	X							X		X	X	X	X	X	X	X	X	X
Johnson Creek, unnamed tributary just north of Pangborn Road		X						X		X	X	X	X	X	X	X	X	X
Nooksack River mainstem from mouth to Anderson Creek.		X						X		X	X	X	X	X	X	X	X	X
Nooksack River and tributaries [except where otherwise designated Char] from and including Anderson Creek (latitude 48.8675 longitude -122.3210) to confluence with South Fork.		X						X		X	X	X	X	X	X	X	X	X
Nooksack River, North Fork, and all tributaries, upstream to the confluence with Maple creek (RM 49.7).		X						X		X	X	X	X	X	X	X	X	X
Nooksack River, North Fork, and all tributaries above and including Maple Creek (RM 49.7) and tributaries.	X						X			X	X	X	X	X	X	X	X	X
Nooksack River, Middle Fork, and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Nooksack River, South Fork, from mouth to Skookum Creek (river mile 14.3).		X						X		X	X	X	X	X	X	X	X	X
Nooksack River, South Fork, from Skookum Creek (river mile 14.3) to Fobes Creek.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Nooksack River, South Fork, and all tributaries above the confluence with Fobes Creek.	X						X			X	X	X	X	X	X	X	X	X
Padden Creek and tributaries from mouth to headwaters		X						X		X	X	X	X	X	X	X	X	X
Pepin Creek from mouth to Canadian border		X						X		X	X	X	X	X	X	X	X	X
Saar Creek from latitude 48.98177 longitude -122.23846 to headwaters		X						X		X	X	X	X	X	X	X	X	X
Silesia Creek and all tributaries south of Canadian border.	X						X			X	X	X	X	X	X	X	X	X
Skookum Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Squaw Creek		X						X		X	X	X	X	X	X	X	X	X
Squalicum Creek, unnamed tributary from latitude 48.7862 longitude -122.4864 to headwaters		X						X		X	X	X	X	X	X	X	X	X
Stickney Creek (Slough) and Kamm Ditch from confluence with mainstem Nooksack River to headwaters.		X						X		X	X	X	X	X	X	X	X	X
Sumas River from Canadian border (river mile 12) to headwaters (river mile 23) except where designated otherwise.			X					X		X	X	X	X	X	X	X	X	X
Tenmile Creek below Barrett Lake		X						X		X	X	X	X	X	X	X	X	X
Tomyhoi Creek and tributaries from Canadian border to headwaters.	X						X			X	X	X	X	X	X	X	X	X
Whatcom Creek and tributaries from mouth to outlet of Lake Whatcom.		X						X		X	X	X	X	X	X	X	X	X
WRIA 2 San Juan																		
There are no specific waterbody entries for this WRIA.																		
WRIA 3 Lower Skagit-Samish																		
Fisher and Carpenter Creeks and tributaries.		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Hansen Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Nookachamps Creek and tributaries (except where designated char).		X						X		X	X	X	X	X	X	X	X	X
Nookachamps Creek, East Fork, and unnamed creek at latitude 48.4103 longitude -122.1657: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Samish River and tributaries above latitude 48.5472 longitude -122.3378 (Sect 05 T35N R04E).		X						X		X	X	X	X	X	X	X	X	X
Skagit River mainstem from mouth to Skiyou Slough-lower end (river mile 25.6).		X						X		X	X	X	X	X	X	X	X	X
Skagit River, all tributaries to the mainstem from the mouth to Skiyou Slough-lower end (river mile 25.6); except where designated otherwise.			X					X		X	X	X	X	X	X	X	X	X
Skagit River and tributaries from Skiyou Slough-lower end, (river mile 25.6) to the boundary of WRIA 3 and 4, except the other waters listed for this WRIA.[1]		X					X			X	X	X	X	X	X	X	X	X
Walker Creek and unnamed creek at latitude 48.3813 longitude -122.1639: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Notes for WRIA 3:																		
1. Skagit River (Gorge by-pass reach) from Gorge Dam (river mile 96.6) to Gorge Powerhouse (river mile 94.2). Temperature shall not exceed a 1-DMax of 21°C due to human activities. When natural conditions exceed a 1-DMax of 21°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C, nor shall such temperature increases, at any time, exceed t = 34/(T + 9).																		
WRIA 4 Upper Skagit																		
Bacon Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Baker Lake and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Bear Creek and the unnamed outlet creek of Blue Lake (Latitude 48.62036; Longitude -121.74882): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Big Beaver Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Big Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Buck Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Cascade River and Boulder Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Circle Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Clear Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Diobsud Creek and the unnamed tributary at longitude -121.4414 and latitude 48.5850: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Goodell Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Hozomeen Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Illabot Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Jordan Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Lightning Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Little Beaver Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Murphy Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Newhalem Creek, and all tributaries	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Rocky Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Ruby Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Sauk River and Dutch Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Silver Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Skagit River and tributaries, except where listed otherwise for this WRIA.[1]		X					X			X	X	X	X	X	X	X	X	X
Stetattle Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Straight Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Suiattle River all tributaries above Harriet Creek.	X						X			X	X	X	X	X	X	X	X	X
Sulphur Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Tenas Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Thunder Creek (upstream of Lake Shannon at Latitude 48.59867, Longitude -121.71359) and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Thunder Creek (upstream of Diablo Lake at Latitude 48.69469, Longitude -121.09830) and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
White Chuck River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X

Notes for WRIA 4:

1. Skagit River (Gorge by-pass reach) from Gorge Dam (river mile 96.6) to Gorge Powerhouse (river mile 94.2). Temperature shall not exceed a 1-DMax of 21°C due to human action. When natural conditions exceed a 1-DMax of 21°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C, nor shall such temperature increases, at any time, exceed t = 34/(T + 9).

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
WRIA 5 Stillaguamish																		
Brooks Creek and the unnamed tributary at latitude 48.2967 longitude -121.9031: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Canyon Creek above unnamed tributary at latitude 48.1242 longitude -121.8894 (Sect. 34 T31N R7E) to headwaters (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
Canyon Creek's unnamed tributaries at latitude 48.1522 longitude -121.9677.	X						X			X	X	X	X	X	X	X	X	X
Unnamed tributaries at latitude 48.1461 longitude -122.9649 located upstream of unnamed tributary at river mile 3 of Canyon Creek	X						X			X	X	X	X	X	X	X	X	X
Crane Creek and unnamed tributary at latitude 48.3295 longitude -122.1005: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Crane Creek's unnamed tributaries at latitude 48.3323 longitude -122.1059: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Cub Creek and the unnamed tributary at latitude 48.1655 longitude -121.9376: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Deer Creek (on N.F. Stillaguamish) and the unnamed tributary at longitude -121.9565 and latitude 48.3195: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Dicks Creek and unnamed outlet of Myrtle Lake at latitude 48.3187 longitude -121.8129: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Jim Creek and Little Jim Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Jorgenson Slough (Church Creek) from latitude 48.23409 longitude -121.32346 between West Pass and Hat Slough: All waters (including tributaries) above the confluence.		X						X		X	X	X	X	X	X	X	X	X
Lake Cavanaugh and all tributaries above outlet at latitude 48.3127 longitude -121.9802.	X						X			X	X	X	X	X	X	X	X	X
Pilchuck Creek and Bear Creek: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Pilchuck Creek's unnamed tributaries at latitude 48.3104 longitude -122.1305: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Pilchuck Creek from latitude 48.2395 longitude -122.2015 (above 268th St) to headwaters including tributaries(except where designated Char)		X						X		X	X	X	X	X	X	X	X	X
Unnamed tributary to Portage Creek at latitude 48.1837 longitude -122.2314: All waters (including tributaries) above the confluence		X						X		X	X	X	X	X	X	X	X	X
Stillaguamish River from mouth to confluence of north and south forks (river mile 17.8).			X					X		X	X	X	X	X	X	X	X	X
Stillaguamish River, North Fork, from mouth to Boulder River (including tributaries) except where designated Char.		X						X		X	X	X	X	X	X	X	X	X
Stillaguamish River, North Fork, and Boulder River: All waters (including tributaries) from the confluence up to Squire Creek, downstream of the Mt. Baker Snoqualmie National Forest.	X							X		X	X	X	X	X	X	X	X	X
Stillaguamish River, North Fork, and Boulder River: All waters (including tributaries) from the confluence up to Squire Creek that are in or above the Mt. Baker Snoqualmie National Forest.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Stillaguamish River, North Fork, from Squire Creek (river mile 31.2) to headwaters, including all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Stillaguamish River, South Fork, from mouth to Canyon Creek (river mile 33.7).		X						X		X	X	X	X	X	X	X	X	X
Stillaguamish River, South Fork, from Canyon Creek (river mile 33.7) to the unnamed tributary at latitude 48.0921 longitude -121.8797 (near Cranberry Creek).		X					X			X	X	X	X	X	X	X	X	X
Stillaguamish River, South Fork, and the unnamed tributary at latitude 48.0921 longitude -121.8797 (near Cranberry Creek): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
WRIA 6 Island																		
There are no specific waterbody entries for this WRIA.																		
WRIA 7 Snohomish																		
Cherry Creek and tributaries from mouth to headwaters.		X						X		X	X	X	X	X	X	X	X	X
Cripple Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Kelly Creek and tributaries.	X						X			X	X	X	X	X	X	X	X	X
Miller River, East Fork, and West Fork Miller River: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
North Fork Creek and unnamed creek at latitude 47.7409 longitude -121.8231 (Sect. 18 T26N R8E): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Pilchuck River from mouth to Boulder Creek.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Pilchuck River and Boulder Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Pratt River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Skykomish River and tributaries from mouth to May Creek (above Gold Bar at river mile 41.2).		X						X		X	X	X	X	X	X	X	X	X
Skykomish River and May Creek (above Gold Bar at river mile 41.2): All waters (including tributaries) above confluence (Except where designated Char).		X					X			X	X	X	X	X	X	X	X	X
Skykomish River, North Fork, beginning below Salmon Creek at latitude 47.8790 longitude –121.4594) to headwaters (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
Skykomish River, South Fork, and Beckler River: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Snohomish River from mouth to latitude 47.942 longitude -122.1719 (southern tip of Ebey Island at river mile 8.1).[1]			X					X		X	X	X	X	X	X	X	X	X
Snohomish River from latitude 47.942, longitude -122.1719 (southern tip of Ebey Island at river mile 8.1) to below Pilchuck Creek at latitude 47.9045 longitude -122.0917.			X					X		X	X	X	X	X	X	X	X	X
Snohomish River from below Pilchuck Creek (latitude 47. 9045 longitude -122.0917) to confluence with Skykomish and Snoqualmie River (river mile 20.5).		X						X		X	X	X	X	X	X	X	X	X
Snoqualmie River from mouth to confluence with Harris Creek (latitude 47.7686 longitude -121.9605; Sect.5 T25N R6E)			X					X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Snoqualmie River and tributaries from and including Harris Creek (latitude 47.7686 longitude -121.9605; Sect.5 T25N R6E) to west boundary of Twin Falls State Park on south fork (river mile 9.1).		X						X		X	X	X	X	X	X	X	X	X
Snoqualmie River, South Fork, from west boundary of Twin Falls State Park (river mile 9.1) to headwaters (including tributaries).		X					X			X	X	X	X	X	X	X	X	X
Snoqualmie River, North Fork, from mouth to Sunday Creek.		X					X			X	X	X	X	X	X	X	X	X
Snoqualmie River, North Fork, and Sunday Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Snoqualmie River, Middle Fork, from mouth to Dingford Creek (Except where designated char).		X					X			X	X	X	X	X	X	X	X	X
Snoqualmie River, Middle Fork, and Dingford Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Snoqualmie River's Middle Fork's unnamed tributaries at latitude 47.5389 longitude -121.5629 (Sect. 29 T24N R10E).	X						X			X	X	X	X	X	X	X	X	X
Sultan River and tributaries from mouth to Chaplain Creek (river mile 5.9).		X						X		X	X	X	X	X	X	X	X	X
Sultan River and tributaries from Chaplain Creek (river mile 5.9) to headwaters.[2]		X					X			X	X	X	X	X	X	X	X	X
Taylor River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Tolt River, North Fork, and unnamed creek at latitude 47.7183 longitude -121.7775: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Tolt River, South Fork, and tributaries from mouth to unnamed creek at latitude 47.6925 longitude -121.7392; river mile 5.4		X					X			X	X	X	X	X	X	X	X	X
Tolt River, South Fork, and unnamed creek at latitude 47.6925 longitude -121.7392 (river mile 5.4): All waters (including tributaries) above the confluence[3].	X						X			X	X	X	X	X	X	X	X	X
Tolt River's South Fork's unnamed tributaries at latitude 47.6889 longitude -121.7856 (Sect.33 T26N R8E).	X						X			X	X	X	X	X	X	X	X	X
Trout Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Notes for WRIA 7:																		
1. Fecal coliform organism levels shall both not exceed a geometric mean value of 200 colonies/100 mL and not have more than 10 percent of the samples obtained for calculating the mean value exceeding 400 colonies/100 mL.																		
2. No waste discharge will be permitted above city of Everett Diversion Dam (river mile 9.4).																		
3. No waste discharge will be permitted for the South Fork Tolt River and tributaries from latitude 47.6925 longitude -121.7392 (river mile 5.4) to headwaters.																		
WRIA 8 Cedar-Sammamish																		
Cedar River from Lake Washington to the Maplewood Bridge (river mile 4.1).		X						X		X	X	X	X	X	X	X	X	X
Cedar River and tributaries from the Maplewood Bridge (river mile 4.1) to Landsburg Dam (river mile 21.6).		X					X			X	X	X	X	X	X	X	X	X
Cedar River and tributaries from Landsburg Dam (river mile 21.6) to Chester Morse Lake.[1]		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Cedar River at Chester Morse Lake Cedar Falls Dam: All waters (including tributaries) to headwaters.[2]	X						X			X	X	X	X	X	X	X	X	X
Holder Creek and the unnamed tributary at latitude 47.4581 longitude -121.9496: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Issaquah Creek from Lake Sammamish to headwaters (including tributaries) except where designated Char.		X						X		X	X	X	X	X	X	X	X	X
Lake Washington Ship Canal from Government Locks (river mile 1.0) to Lake Washington (river mile 8.6).[3,4]		X					X			X	X	X	X	X	X	X	X	X
Notes for WRIA 8:																		
1. No waste discharge will be permitted.																		
2. No waste discharge will be permitted.																		
3. Salinity shall not exceed one part per thousand (1.0 ppt) at any point or depth along a line that transects the ship canal at the University Bridge (river mile 6.1).																		
4. This waterbody is to be treated as a Lake for purposes of applying this chapter.																		
WRIA 9 Duwamish-Green																		
Duwamish River from mouth south of a line bearing 254° true from the NW corner of berth 3, terminal No. 37 to the Black River (river mile 11.0) (Duwamish River continues as the Green River above the Black River).				X					X		X	X	X	X	X	X	X	X
Green River from and including the Black River (river mile 11.0 and point where Duwamish River continues as the Green River) to latitude 47.3699 longitude -122.246 (Sect. 25 T22N R4E) above confluence with unnamed tributary.			X					X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Green River from above confluence with Mill Creek at latitude 47.3699 longitude -122.2461 (Sect. 25 T22N R4E) (east of the West Valley highway) to west boundary of Flaming Geyser State Park (including all tributaries)		X						X		X	X	X	X	X	X	X	X	X
Green River from W. Boundary of Flaming Geyser State Park to headwaters (including tributaries) except where designated Char, Core, and Ex. Primary~~.~~		X					X			X	X	X	X	X	X	X	X	X
Green River and Sunday Creek: All waters (including tributaries) above the confluence.[1]	X						X			X	X	X	X	X	X	X	X	X
Smay Creek and West Fork Smay Creek: All waters (including tributaries) above the confluence.[1]	X						X			X	X	X	X	X	X	X	X	X
Notes for WRIA 9:																		
1. No waste discharge will be permitted for the Green River and tributaries (King County) from west boundary of Sec. 13-T21N-R7E (river mile 59.1) to headwaters.																		
WRIA 10 Puyallup-White																		
Carbon River and tributaries above latitude 46.9998 longitude -121.9794, downstream of the Snoqualmie National Forest or Mt. Rainier National Park.	X							X		X	X	X	X	X	X	X	X	X
Carbon River and tributaries above latitude 46.9998 longitude -121.9794 that are in or above the Snoqualmie National Forest or Mt. Rainier National Park.	X						X			X	X	X	X	X	X	X	X	X
Clarks Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Clear Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Clearwater River and Milky Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Greenwater River from confluence with White River to headwaters (including all tributaries).	X						X			X	X	X	X	X	X	X	X	X
Puyallup River from mouth to river mile 1.0.				X					X		X	X	X	X	X	X	X	X
Puyallup River from river mile 1.0 to confluence with White River.		X						X		X	X	X	X	X	X	X	X	X
Puyallup River and tributaries from confluence with White River to Mowich River (Except where designated char).		X						X		X	X	X	X	X	X	X	X	X
Puyallup River at and including Mowich River: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
South Prairie Creek and all tributaries above the Kepka Fishing Pond, except those waters in or above the Snoqualmie National Forest.	X							X		X	X	X	X	X	X	X	X	X
South Prairie Creek and all tributaries above the-Kepka Fishing Pond that are in or above the Snoqualmie National Forest.	X						X			X	X	X	X	X	X	X	X	X
Swam Creek		X						X		X	X	X	X	X	X	X	X	X
Voight Creek and Bear Creek: All waters (including tributaries) above the confluence that are downstream of the Snoqualmie National Forest or Mt. Rainier National Park.	X							X		X	X	X	X	X	X	X	X	X
Voight Creek and Bear Creek: All waters (including tributaries) above the confluence that are in or above the Snoqualmie National Forest or Mt. Rainier National Park.	X						X			X	X	X	X	X	X	X	X	X
White River from mouth to latitude 47.2438 longitude -122.2422 (Sect. 1 T20N R4E).			X					X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
White River from latitude 47.2438 longitude -122.2422 (Sect. 1 T20N R4E) to Mud Mountain dam (including tributaries).		X						X		X	X	X	X	X	X	X	X	X
White River from Mud Mountain Dam (river mile 27.1) to West Fork White River at (latitude 47. 3699 longitude -121.6197) except where designated Char.		X					X			X	X	X	X	X	X	X	X	X
White River from and including West Fork White River: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Wilkeson Creek and Gale Creek: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
WRIA 11 Nisqually																		
Big Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Copper Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
East Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Horn Creek and tributaries			X					X		X	X	X	X	X	X	X	X	X
Little Nisqually River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Mashel River and Little Mashel River: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Mineral Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Muck Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Murray Creek and tributaries			X					X		X	X	X	X	X	X	X	X	X
Nisqually River mainstem from mouth to Alder Dam (river mile 44.2).		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Nisqually River from Alder Dam (river mile 44.2) to Tahoma Creek (including tributaries) except where designated Char.		X					X			X	X	X	X	X	X	X	X	X
Nisqually River and Tahoma Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Rocky Slough from latitude 46.8882 longitude -122.4339 to latitude 46.9109 longitude -122.4012.			X					X		X	X	X	X	X	X	X	X	X
Tanwax Creek and tributaries downstream of lakes			X					X		X	X	X	X	X	X	X	X	X
WRIA 12 Chambers-Clover																		
Clover Creek from inlet to Lake Steilacoom, upstream and including Spanaway Creek to outlet of Spanaway Lake			X					X		X	X	X	X	X	X	X	X	X
WRIA 13 Deschutes																		
Deschutes River from mouth to and including tributary to Offutt Lake.			X					X		X	X	X	X	X	X	X	X	X
Deschutes River, and tributaries, upstream of the tributary to Offutt Lake (all waters in or above the national forest boundary).		X					X			X	X	X	X	X	X	X	X	X
Deschutes River, and tributaries, upstream of the tributary to Offutt Lake (all waters below the national forest boundary).		X						X		X	X	X	X	X	X	X	X	X
McLane Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
WRIA 14 Kennedy-Goldsborough																		
Campbell Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Coffee Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Cranberry Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Deer Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Goldsborough Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Hiawata Creek and tributaries			X					X		X	X	X	X	X	X	X	X	X
Jarrell Creek and tributaries			X					X		X	X	X	X	X	X	X	X	X
John’s Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Jones Creek and tributaries			X					X		X	X	X	X	X	X	X	X	X
Malaney Creek (at Spencer Lake)		X						X		X	X	X	X	X	X	X	X	X
Mill Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Perry Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Shelton Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Uncle John Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Unnamed stream (latitude 47.2237 longitude -122.9135) at Peale Passage inlet on west side of Hartstene Island.			X					X		X	X	X	X	X	X	X	X	X
WRIA 15 Kitsap																		
Anderson Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Barker Creek and tributaries from Dyes Inlet to Island Lake		X						X		X	X	X	X	X	X	X	X	X
Blackjack Creek and tributaries downstream of Square Lake		X						X		X	X	X	X	X	X	X	X	X
Chico Creek and tributaries above confluence with Kitsap Creek (tributaries to Chico Bay in Dyes Inlet).		X						X		X	X	X	X	X	X	X	X	X
Clear Creek from Dyes Inlet to headwaters (including tributaries)		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Gamble Creek and tributaries (latitude 47.8116 longitude -122.5797).		X						X		X	X	X	X	X	X	X	X	X
Gorst Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Martha John Creek and tributaries (latitude 47.8252 longitude -122.5632).		X						X		X	X	X	X	X	X	X	X	X
Ross Creek and tributaries		X						X		X	X	X	X	X	X	X	X	X
Strawberry Creek and tributaries (latitude 47.6458 longitude -122.6933)		X						X		X	X	X	X	X	X	X	X	X
Union River and tributaries from Bremerton Waterworks Dam (river mile 6.9) to headwaters.[1]		X					X			X	X	X	X	X	X	X	X	X
Unnamed tributary to Sinclair Inlet between Gorst and Anderson Creeks (latitude 47.5270 longitude -122.6932).		X						X		X	X	X	X	X	X	X	X	X
Unnamed tributary to Sinclair Inlet (latitude 47.5471 longitude -122.6123) east of Blackjack Creek.			X					X		X	X	X	X	X	X	X	X	X
Unnamed tributary west of Port Gamble Bay at latitude 47.8220 longitude -122.5831.		X						X		X	X	X	X	X	X	X	X	X
Notes for WRIA 15:																		
1. No waste discharge will be permitted.																		
WRIA 16 Skokomish-Dosewallips																		
Dosewallips River and tributaries.		X					X			X	X	X	X	X	X	X	X	X
Duckabush River and tributaries.		X					X			X	X	X	X	X	X	X	X	X
Hamma Hamma River and tributaries.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Rock Creek and unnamed tributary at latitude 47.3894 longitude -123.3496: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Skokomish River and tributaries, except where designated char.		X					X			X	X	X	X	X	X	X	X	X
Skokomish River, North Fork, from latitude 47.4160 longitude -123.2233 (below Cushman Upper Dam) to headwaters (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
Skokomish River, South Fork, and Brown Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Vance Creek and Cabin Creek all waters above the confluence.	X						X			X	X	X	X	X	X	X	X	X
WRIA 17 Quilcene-Snow																		
Big Quilcene River and tributaries.		X					X			X	X	X	X	X	X	X	X	X
WRIA 18 Elwha-Dungeness																		
Boulder Creek and Deep Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Dungeness River mainstem from mouth to Canyon Creek (river mile 10.8).		X						X		X	X	X	X	X	X	X	X	X
Dungeness River, tributaries to mainstem, above and between confluence with Matriotti Creek to Canyon Creek (river mile 10.8).			X					X		X	X	X	X	X	X	X	X	X
Dungeness River and Canyon Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Elwha River and tributaries from mouth to Cat Creek, except where designated Char.		X					X			X	X	X	X	X	X	X	X	X

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Elwha River and Cat Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Ennis Creek and White Creek (and all tributaries) from the confluence with the Strait of Juan De Fuca to the Olympic National Park Boundary.		X						X		X	X	X	X	X	X	X	X	X
Ennis Creek and tributaries lying above the Olympic National Park Boundary.		X					X			X	X	X	X	X	X	X	X	X
Griff Creek and the unnamed tributary at latitude 48.0135 longitude -123.5440 (Sect. 11 T29N R7W): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Hughes Creek and the unnamed tributary at latitude 48.0298 longitude -123.6322 (Sect. 6 T29N R7W): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Little River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Matriotti Creek		X						X		X	X	X	X	X	X	X	X	X
Wolf Creek and the unnamed tributary at latitude 47.9654 longitude -123.5374 (Sect. 35 T29N R7W): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
WRIA 19 Lyre-Hoko																		
There are no specific waterbody entries for this WRIA.																		
WRIA 20 Soleduc																		
Dickey River and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Hoh River and tributaries from mouth to South Fork Hoh River.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Hoh River and South Fork Hoh River: All waters above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Quillayute and Bogachiel Rivers.		X					X			X	X	X	X	X	X	X	X	X
Soleduck River and tributaries from mouth to Canyon Creek.		X					X			X	X	X	X	X	X	X	X	X
Soleduck River and all tributaries above Canyon Creek.	X						X			X	X	X	X	X	X	X	X	X
WRIA 21 Queets-Quinault																		
Clearwater River and the unnamed tributary at latitude 47.7270 longitude -124.0361 (Sect.26 T26N R11W): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Kunamakst Creek and the unnamed tributary at latitude 47.7285 longitude -124.0771 (Sect.26 T26N R11W): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Matheny Creek and the unnamed tributary at latitude 47.5592 longitude -123.9538: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Queets River and tributaries from mouth to Tshletshy Creek.		X					X			X	X	X	X	X	X	X	X	X
Queets River and tributaries above the confluence with Tshletshy Creek.	X						X			X	X	X	X	X	X	X	X	X
Quinault River and tributaries from mouth to the confluence with the North Fork Quinalt River.		X					X			X	X	X	X	X	X	X	X	X
Quinault River and North Fork Quinault: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Salmon River, Middle Fork, and the unnamed tributary at latitude 47.5208 longitude -123.9899: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Sams River and the unnamed tributary at latitude 47.6059 longitude -123.8941: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Solleks River and the unnamed tributary at latitude 47.6937 longitude -124.0133: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Stequaleho Creek and the unnamed tributary at latitude 47.6620 longitude -124.0426: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Tshletshy Creek and the unnamed tributary at latitude 47.6585 longitude -123.8668: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
WRIA 22 Lower Chehalis																		
Andrews Creek and tributaries above confluence with West Fork.		X						X		X	X	X	X	X	X	X	X	X
Baker Creek and the unnamed tributary at latitude 47.3301 longitude -123.4142: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Big Creek and Middle Fork Big Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Canyon River and the unnamed tributary at latitude 47.3473 longitude -123.4936: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Chehalis River from upper boundary of Grays Harbor at Cosmopolis (river mile 3.1, longitude 123°45'45"W) to latitude 46.6004 and			X					X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
longitude -123.1472 (Section 23 T13N R43W on main stem and to latitude 46.6013 and longitude -123.1253 on South Fork.																		
Chester Creek and the unnamed tributary at latitude 47.4196 longitude -123.7841: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Cloquallum Creek.		X						X		X	X	X	X	X	X	X	X	X
Decker Creek.		X					X			X	X	X	X	X	X	X	X	X
Delezene Creek and tributaries above latitude 46.9413 longitude -123.3893.		X						X		X	X	X	X	X	X	X	X	X
Elk River, West Branch and tributaries above latitude 46.8111 longitude -123.9774.		X						X		X	X	X	X	X	X	X	X	X
Goforth Creek and the unnamed tributary at latitude 47.3560 longitude -123.7323: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Hoquiam River, East Fork and tributaries above latitude 47.0524 longitude -123.8428 (above Lytle Creek).		X						X		X	X	X	X	X	X	X	X	X
Hoquiam River and tributaries above latitude 47.0571 longitude -123.9287 (above river mile 9.3 - Dekay Road Bridge) (upper limit of tidal influence).		X						X		X	X	X	X	X	X	X	X	X
Hoquiam River, Middle Fork and tributaries above latitude 47.0418 longitude -123.9052.		X						X		X	X	X	X	X	X	X	X	X
Hoquiam River mainstem (continues as west fork above east fork) from mouth to river mile 9.3 - Dekay Road Bridge) (upper limit of tidal influence).				X					X		X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Humptulips River and tributaries from mouth to latitude 47.0810 longitude -124.0655 (Section 4 T18N R11W).			X					X		X	X	X	X	X	X	X	X	X
Humptulips River and tributaries from latitude 47.0810 longitude -124.0655 (Section 4 T18N R11W) to Olympic National Forest boundary (except where designated Char).		X						X		X	X	X	X	X	X	X	X	X
Humptulips River and tributaries from Olympic National Forest boundary to headwaters (except where designated Char).		X					X			X	X	X	X	X	X	X	X	X
Humptulips River, East Fork, and the unnamed tributary at latitude 47.3821 longitude -123.7163: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Humptulips River, West Fork, and Petes Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Johns River and North Fork Johns River: All waters above the confluence.		X						X		X	X	X	X	X	X	X	X	X
Little Hoquiam River, North Fork and tributaries above latitude 47.0001 longitude -123.9269.		X						X		X	X	X	X	X	X	X	X	X
Little Hoquiam River and tributaries above latitude 46.9934 longitude -123.9364.		X						X		X	X	X	X	X	X	X	X	X
Mox Chehalis Creek and tributaries above and latitude 46.9680 longitude -123.3083.		X						X		X	X	X	X	X	X	X	X	X
Newskah Creek and tributaries above latitude 46.9163 longitude -123.8235 (Section 32 T16N R9W).		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Satsop River and tributaries from latitude 46.9854 longitude -123.4887 (Section 6 T17N R6W) to headwaters, except where designated Char.		X					X			X	X	X	X	X	X	X	X	X
Satsop River, West Fork, and Robertson Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Satsop River, Middle Fork, and the unnamed tributary at latitude 47.3340 longitude -123.4451: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Wildcat Creek and tributaries above confluence with Cloquallum Creek.		X						X		X	X	X	X	X	X	X	X	X
Wishkah River, East Fork and tributaries above latitude 47.0801 longitude -123.7560.		X						X		X	X	X	X	X	X	X	X	X
Wishkah River from mouth to river mile 6 (SW 1/4 SW 1/4 NE 1/4 Sec. 21-T18N-R9W).				X					X		X	X	X	X	X	X	X	X
Wishkah River from river mile 6 (SW 1/4 SW 1/4 NE 1/4 Sec. 21-T18N-R9W) to latitude 47.1089 longitude -123.7908.			X					X		X	X	X	X	X	X	X	X	X
Wishkah River and tributaries from latitude 47.1089 longitude -123.7908 to confluence with West Fork.		X						X		X	X	X	X	X	X	X	X	X
Wishkah River and tributaries from and including West Fork to headwaters.[1]		X					X			X	X	X	X	X	X	X	X	X
Wynoochee River and tributaries from latitude 46.9709 longitude -123.6252 (near railroad crossing) to Olympic National Forest boundary (river mile 45.9).		X						X		X	X	X	X	X	X	X	X	X
Wynoochee River and tributaries from Olympic National Forest boundary (river mile 45.9) to Wynoochee Dam.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Wynoochee River and all tributaries above Wynoochee Dam.	X						X			X	X	X	X	X	X	X	X	X
Notes for WRIA 22:																		
1. No waste discharge will be permitted from south boundary of Sec. 33-T21N-R8W (river mile 32.0) to headwaters.																		
WRIA 23 Upper Chehalis																		
Bunker Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Cedar Creek and tributaries above latitude 46.8760 longitude -123.2714 (near intersection with Highway 12).		X						X		X	X	X	X	X	X	X	X	X
Chehalis River, South Fork (including tributaries) above latitude 46.6014 longitude -123.1253 (near junction with State Route 6), except where specifically designated Char.		X						X		X	X	X	X	X	X	X	X	X
Chehalis River (including tributaries) above latitude 46.6004 longitude -123.1473 (Section 23 T13N R4W), except where specifically designated Char.		X						X		X	X	X	X	X	X	X	X	X
Chehalis River mainstem from upper boundary of Grays Harbor at Cosmopolis (river mile 3.1, longitude 123°45'45"W) to latitude 46.6004 longitude -123.1473 (Section 23 T13N R4W) on main stem and to latitude 46.6014 longitude -123.1253 on South Fork.[1]			X					X		X	X	X	X	X	X	X	X	X
Chehalis River, South Fork, and the unnamed tributary at latitude 46.179 longitude -123.4127 (Sect. 10 T10N R4W): All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Chehalis River, West Fork, and East Fork Chehalis River: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Coffee Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Eight Creek and the unnamed tributary at latitude 46.6211 longitude -123.4127: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Fall Creek and the unnamed tributary at Sect. 22 T15N R1E: All waters (including tributaries) above their confluence.	X						X			X	X	X	X	X	X	X	X	X
Garrard Creek, South Fork, and tributaries above latitude 46.8013 longitude -123.3060.		X						X		X	X	X	X	X	X	X	X	X
Hanaford Creek and all tributaries from east boundary of Sec. 25-T15N-R2W (river mile 4.1) to the unnamed tributary at latitude 46.7295 longitude -122.6812 except where designated Char.			X					X		X	X	X	X	X	X	X	X	X
Hanaford Creek and all tributaries from mouth to east boundary of Sec. 25-T15N-R2W (river mile 4.1)[2].			X					X		X	X	X	X	X	X	X	X	X
Hanaford Creek and the unnamed tributary at latitude 46.7295 longitude -122.6812 (Sect. 4 T14N R1E): All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Kearney Creek and the unnamed tributary at latitude 46.6256 longitude -122.5683: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Laramie Creek and the unnamed tributary at latitude 46.7901 longitude -122.5901: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Lincoln Creek, North Fork and tributaries above latitude 46.7370 longitude -123.7370 and (Section 36 T15N R5W).		X						X		X	X	X	X	X	X	X	X	X
Lincoln Creek, South Fork and tributaries above latitude 46.7253 longitude -123.2306 (Section 6 T14N R4W).		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Mima Creek and tributaries above latitude 46.8588 longitude -123.0856.		X						X		X	X	X	X	X	X	X	X	X
Newaukum River and tributaries (except where designated Char).		X						X		X	X	X	X	X	X	X	X	X
Newaukum River, North Fork, and the unnamed tributary at latitude 46.6793 longitude -122.6677: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Newaukum River, South Fork, and Frase Creek: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Pheeny Creek and the unnamed tributary at latitude 46.7836 longitude -122.6276 (Sect. 13 T15N R1E): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Porter Creek and Jamaica Day Creek: All waters above the confluence.		X						X		X	X	X	X	X	X	X	X	X
Rock Creek (upstream of Callow): All waters above confluence with Chehalis River (Section 15, T16N, R5W), except where designated otherwise in this table.		X						X		X	X	X	X	X	X	X	X	X
Rock Creek (upstream of Pe Ell) and the unnamed tributary at latitude 46.5279 longitude -123.3782 (Sect. 11 T12N R6W): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Scatter Creek and tributaries from latitude 46.8025 longitude -123.0863 (near mouth) to headwaters.		X						X		X	X	X	X	X	X	X	X	X
Seven Creek and the unnamed tributary at latitude 46.6192 longitude -123.3723: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
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Skookumchuck River and tributaries from confluence with Hanaford Creek to headwaters (except where designated char).		X					X			X	X	X	X	X	X	X	X	X
Skookumchuck River mainstem from mouth to Hanaford Creek.		X					X			X	X	X	X	X	X	X	X	X
Skookumchuck River and Hospital Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Stearns Creek’s, unnamed (GIS Ripple Creek) tributary at latitude 46.5711 longitude -122.9692 (Section 30 T13N R2W).		X						X		X	X	X	X	X	X	X	X	X
Stearns Creek’s, unnamed tributary to West Fork at latitude 46.5824 longitude -123.0222 (Section 26 T13N R3W.		X						X		X	X	X	X	X	X	X	X	X
Stillman Creek and Little Mill Creek (Sect. 23 T12N R4W): All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Thrash Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Waddel Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Notes for WRIA 23:																		
1. Chehalis River from Scammon Creek (RM 65.8) to Newaukum River (RM 75.2); dissolved oxygen shall exceed 5.0 mg/L from June 1 to September 15. For the remainder of the year, the dissolved oxygen shall meet standard criteria.																		
2. Dissolved oxygen shall exceed 6.5 mg/L.																		
WRIA 24 Willapa																		
Bear River, unnamed south flowing tributary at latitude 46.3342 longitude -123.9394 (Section 20 T10N R10W).		X						X		X	X	X	X	X	X	X	X	X
Bear River and tributaries above latitude 46.3284 longitude -123.9172 (Section 28 T10N R10W) to headwaters.		X						X		X	X	X	X	X	X	X	X	X

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Canon River and tributaries above latitude 46.5879 longitude -123.8672 (Section 25 T13N R10W).		X						X		X	X	X	X	X	X	X	X	X
Lower Salmon Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Middle Nemah River and tributaries above latitude 46.4873 longitude -123.8855 (Section 35 T12N R10W).		X						X		X	X	X	X	X	X	X	X	X
Mill Creek and tributaries above latitude 46.6448 longitude -123.6251 (Section 1 T13N R8W).		X						X		X	X	X	X	X	X	X	X	X
Naselle River from O'Conner Creek to headwaters (including tributaries).		X					X			X	X	X	X	X	X	X	X	X
North Nemah River and tributaries above latitude 46.5172 longitude -123.8665 (Section 14 T12N R10W).		X						X		X	X	X	X	X	X	X	X	X
North River and Fall River: All waters above the confluence (Section 24 T15N R7W).		X						X		X	X	X	X	X	X	X	X	X
Pioneer Creek and tributaries above latitude 46.8149 longitude -123.5502 (Section 4 T15N R7W).		X						X		X	X	X	X	X	X	X	X	X
Salmon Creek and tributaries above latitude 46.8904 longitude -123.6829 (Section 9 T16N R8W).		X						X		X	X	X	X	X	X	X	X	X
Smith Creek and tributaries above latitude 46.7554 longitude -123.8424 (Section 30 T15N R9W).		X						X		X	X	X	X	X	X	X	X	X
South Naselle River above latitude 46.3499 longitude -123.8093 (Section 16 T10N R9W).		X						X		X	X	X	X	X	X	X	X	X

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South Nemah River above latitude 46.4406 longitude -123.8630 (Section 13 T11N R10W).		X						X		X	X	X	X	X	X	X	X	X
Stringer Creek and tributaries (Section 25 T13N R8W).		X						X		X	X	X	X	X	X	X	X	X
Willapa River South Fork and tributaries above latitude 46.6479 longitude -123.7267 (Section 6 T13N R8W).		X						X		X	X	X	X	X	X	X	X	X
Willapa River and Oxbow Creek: All waters upstream of the confluence (Section 26 T13N R8W).		X						X		X	X	X	X	X	X	X	X	X
Williams Creek and tributaries above latitude 46.5284 longitude -123.8668 (Section 14 T12N R10W).		X						X		X	X	X	X	X	X	X	X	X
WRIA 25 Grays-Elochoman																		
Abernathy Creek and Cameron Creek: All waters above the confluence.		X						X		X	X	X	X	X	X	X	X	X
Coal Creek and Tributaries above and latitude 46.1839 longitude -123.0338 (just below Harmony Creek).		X						X		X	X	X	X	X	X	X	X	X
Elochoman River and tributaries from mouth to latitude 46.2292 longitude -123.3606 (Section 25 T9N R6W).			X					X		X	X	X	X	X	X	X	X	X
Elochoman River and tributaries from latitude 46.2292 longitude -123.3606 (Section 25 T9N R6W) to headwaters.		X						X		X	X	X	X	X	X	X	X	X
Germany Creek from latitude 46.1946 longitude -123.1259 (near mouth) to headwaters.		X						X		X	X	X	X	X	X	X	X	X
Grays River from latitude 46.3454 longitude -123.6099 to headwaters.		X						X		X	X	X	X	X	X	X	X	X
Hull Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X

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Mill Creek and Tributaries above latitude 46.1906 longitude -123.1802 (near mouth).		X						X		X	X	X	X	X	X	X	X	X
Skomokawa Creek and Wilson Creek: All waters above the confluence.		X						X		X	X	X	X	X	X	X	X	X
WRIA 26 Cowlitz																		
Cispus River and tributaries.		X					X			X	X	X	X	X	X	X	X	X
Coweeman River and tributaries from mouth to latitude 46.1405 longitude -122.8532 (Section 31 T8N R1W).			X					X		X	X	X	X	X	X	X	X	X
Coweeman River and tributaries from latitude 46.1405 longitude -122.8532 (Section 31 T8N R1W) to Mulholland Creek (river mile 18.4).		X						X		X	X	X	X	X	X	X	X	X
Coweeman River and tributaries from Mulholland Creek (river mile 18.4) to headwaters.		X					X			X	X	X	X	X	X	X	X	X
Cowlitz River and tributaries from mouth to latitude 46.2622 longitude -122.9001 (Section 14 T9N R2W).			X					X		X	X	X	X	X	X	X	X	X
Cowlitz River from latitude 46.2622 longitude -122.9001 (Section 14 T9N R2W) base of Mayfield Dam (river mile 52.0).		X						X		X	X	X	X	X	X	X	X	X
Cowlitz River, and tributaries from base of Mayfield Dam (river mile 52.0) to headwaters.		X					X			X	X	X	X	X	X	X	X	X
Green River and tributaries.		X					X			X	X	X	X	X	X	X	X	X
Toutle River and tributaries from mouth to Green River on North Fork.		X						X		X	X	X	X	X	X	X	X	X
Toutle River, North Fork, and tributaries from Green River to headwaters.		X					X			X	X	X	X	X	X	X	X	X
Toutle River, South Fork, and tributaries.		X					X			X	X	X	X	X	X	X	X	X

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WRIA 27 Lewis																		
Alec Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Big Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Chickoon Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Clear Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Clearwater Creek and unnamed creek: All waters (including tributaries) above the confluence (Sect. 15 T8N R6E – below confluence of Smith and Muddy Creeks).	X						X			X	X	X	X	X	X	X	X	X
Curly Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Cussed Hollow Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Kalama River east of Interstate 5 to Kalama River Falls (river mile 10.4) (including tributaries).		X						X		X	X	X	X	X	X	X	X	X
Kalama River from lower Kalama River Falls (river mile 10.4) to headwaters (including tributaries).		X					X			X	X	X	X	X	X	X	X	X
Lewis River from Houghton Creek (including tributaries) to Lake Merwin.		X						X		X	X	X	X	X	X	X	X	X
Lewis River and Pass Creek (alternately known as Swamp Creek): All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Lewis River's unnamed tributaries at latitude 46.1122 longitude -121.9174 (Sect. 11 T7N R7E).	X						X			X	X	X	X	X	X	X	X	X
Lewis River, East Fork, from and including Mason Creek to Multon Falls (river mile 24.6) including tributaries.		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Lewis River, East Fork, and tributaries from Multon Falls (river mile 24.6) to headwaters.		X					X			X	X	X	X	X	X	X	X	X
Little Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Panamaker Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Pin Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Pine Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Quartz Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Rush Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Spencer Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Steamboat Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Tillicum Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
WRIA 28 Salmon-Washougal																		
Burnt Bridge Creek.			X					X		X	X	X	X	X	X	X	X	X
Duncan Creek and unnamed tributary just east of Duncan Creek: All waters north of highway 14.		X						X		X	X	X	X	X	X	X	X	X
Green Leaf Creek and Hamilton Creek: All waters above the confluence.		X						X		X	X	X	X	X	X	X	X	X
Hardy Creek and tributaries above lake inlet.		X						X		X	X	X	X	X	X	X	X	X
Lawton Creek and tributaries above latitude 45.5708 longitude -122.2576 (Section 13).		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Salmon Creek from latitude 45.7176 longitude -122.6958 (below confluence with Cougar Creek) and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Washougal River from latitude 45.5883 longitude -122.3711 (Section 7 T1N R4E) (including tributaries).		X						X		X	X	X	X	X	X	X	X	X
Woodward Creek and tributaries north of highway 14.		X						X		X	X	X	X	X	X	X	X	X
WRIA 29 Wind-White Salmon																		
Bear Creek (tributary to White Salmon River (at Latitude 45.98290 Longitude -121.52946) below National Forest Boundary			X					X		X	X	X	X	X	X	X	X	X
Buck Creek and all tributaries (Two Buck Creeks drain to the White Salmon River, the mouth of this creek is found in Section 21 T7NR10E).	X						X			X	X	X	X	X	X	X	X	X
Carson Creek.		X						X		X	X	X	X	X	X	X	X	X
Catherine Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Cave Creek below National Forest Boundary			X					X		X	X	X	X	X	X	X	X	X
Gilmer Creek and all tributaries, except as noted otherwise.	X							X		X	X	X	X	X	X	X	X	X
Gilmer Creek’s unnamed tributary in Sections 29 and 32 T5N R11E.			X					X		X	X	X	X	X	X	X	X	X
Gotchen Creek and all tributaries, except those waters in or above the Gifford Pinchot National Forest.	X							X		X	X	X	X	X	X	X	X	X
Gotchen Creek and all tributaries that are in or above the Gifford Pinchot National Forest.	X						X			X	X	X	X	X	X	X	X	X
Green Canyon Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Jewett Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Killowatt Canyon Creek below National Forest Boundary and unnamed creek at latitude 45.963 longitude -121.5154			X					X		X	X	X	X	X	X	X	X	X
Little White Salmon River and tributaries downstream of National Forest boundary.		X						X		X	X	X	X	X	X	X	X	X
Little White Salmon River and tributaries in or above National Forest boundary.		X					X			X	X	X	X	X	X	X	X	X
Major Creek and tributaries.		X						X		X	X	X	X	X	X	X	X	X
Morrison Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Rattlesnake Creek and the unnamed tributary at latitude 45.8512 longitude -121.4081: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Rock Creek and tributaries downstream of Gifford Pinchot National Forest boundaries from Latitude 45.68557 Longitude -121.88523.		X						X		X	X	X	X	X	X	X	X	X
Spring Creek below National Forest Boundary (Latitude 45.99170 Longitude -121.57855).			X					X		X	X	X	X	X	X	X	X	X
Trout Lake Creek and all tributaries below Trout Lake.	X							X		X	X	X	X	X	X	X	X	X
Trout Lake Creek and all tributaries at and above Trout Lake.	X						X			X	X	X	X	X	X	X	X	X
White Salmon River (including all natural tributaries) occurring downstream of National Forest boundary, not otherwise designated Char.		X						X		X	X	X	X	X	X	X	X	X
White Salmon River (including all natural tributaries) occurring in or upstream of National Forest boundary, not otherwise designated Char.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
White Salmon River drainage’s unnamed tributaries that originate in Section 13 T6N R10E (latitude 46.0042 longitude 121.5001); all portions occurring downstream of the Gifford Pinchot National Forest boundary.	X							X		X	X	X	X	X	X	X	X	X
White Salmon River drainage’s unnamed tributaries that originate in Section 13 T6NR10E (latitude 46.0042 longitude 121.5001); all portions occurring upstream of the Gifford Pinchot National Forest boundary.	X						X			X	X	X	X	X	X	X	X	X
White Salmon River and Cascade Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Wind River and tributaries downstream of Gifford Pinchot National Forest boundaries.		X						X		X	X	X	X	X	X	X	X	X
Wind River and tributaries in or upstream of Gifford Pinchot National Forest.		X					X			X	X	X	X	X	X	X	X	X
WRIA 30 Klickitat																		
Clearwater Creek and Trappers Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Cougar Creek and Big Muddy Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Diamond Fork and Cuitin Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Diamond Fork's unnamed tributaries at latitude 46.4205 longitude -121.1562.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Diamond Fork's unnamed tributaries at latitude 46.4355 longitude -121.1590 (outlet of Maiden Springs).	X						X			X	X	X	X	X	X	X	X	X
Fish Lake Stream and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Frasier Creek and Outlet Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Klickitat River mainstem from mouth to Little Klickitat River (river mile 19.8).		X						X		X	X	X	X	X	X	X	X	X
Klickitat River from Little Klickitat River (river mile 19.8) to Diamond Fork.		X					X			X	X	X	X	X	X	X	X	X
Klickitat River and all tributaries above the confluence with Diamond Fork.	X						X			X	X	X	X	X	X	X	X	X
Little Klickitat River and all tributaries above the confluence with Cozy Nook Creek.			X					X		X	X	X	X	X	X	X	X	X
Little Muddy Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
McCreedy Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
WRIA 31 Rock-Glade																		
Squaw Creek and unnamed tributary at latitude 45.8758 longitude -120.4324 (Section 33 T5N R19E): all waters above confluence.		X						X		X	X	X	X	X	X	X	X	X
Rock Creek and Quartz Creek: all waters above confluence.		X						X		X	X	X	X	X	X	X	X	X
WRIA 32 Walla Walla																		
Blue Creek and tributaries above latitude 46.0581 and longitude 118.0971	X							X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Coppei Creek, North and South Forks (including tributaries).		X						X		X	X	X	X	X	X	X	X	X
Dry Creek and tributaries above confluence with unnamed creek at latitude 46.1197 longitude -118.1378 (Seaman Rd).		X						X		X	X	X	X	X	X	X	X	X
Mill Creek from mouth to 13th Street Bridge in Walla Walla (river mile 6.4).[1]				X					X		X	X	X	X	X	X	X	X
Mill Creek from 13th Street Bridge in Walla Walla (river mile 6.4) to diversion structure at confluence of Mill Creek and unnamed creek (river mile 11.4); latitude 46.0800 longitude -118.2541			X					X		X	X	X	X	X	X	X	X	X
Mill Creek from river mile 11.4; latitude 46.080 longitude -118.2541 to headwaters (including tributaries) except where otherwise designated Char		X						X		X	X	X	X	X	X	X	X	X
Mill Creek and Railroad Canyon: All waters (including tributaries) above the confluence to the Oregon state line (river mile 21.6).	X							X		X	X	X	X	X	X	X	X	X
Mill Creek and tributaries within Washington that are above the city of Walla Walla Waterworks Dam (river mile 25.2) to headwaters .[2]	X						X			X	X	X	X	X	X	X	X	X
Touchet River above latitude 46.3172 longitude -118.0000 (Sect. 25 T10N R38E) (including tributaries) not otherwise designated Char.		X						X		X	X	X	X	X	X	X	X	X
Touchet River, North Fork, and Wolf Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Touchet River, South Fork, and the unnamed tributary at latitude 46.2307 longitude -117.9397: All waters (including tributaries) above the confluence, except those waters in or above the Umatilla National Forest.	X							X		X	X	X	X	X	X	X	X	X

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Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Touchet River, South Fork, and the unnamed tributary at latitude 46.2307 longitude -117.9397: All waters (including tributaries) above the confluence that are in or above the Umatilla National Forest.	X						X			X	X	X	X	X	X	X	X	X
Walla Walla River from mouth to Lowden (Dry Creek at river mile 27.2).				X					X		X	X	X	X	X	X	X	X
Walla Walla River from Lowden (Dry Creek at river mile 27.2) to Oregon border (river mile 40).[3]			X					X		X	X	X	X	X	X	X	X	X
Whiskey Creek, and unnamed tributary system at and latitude 46.2176 longitude -118.0667 (Section 33 T9N R38E), all waters above confluence.		X						X		X	X	X	X	X	X	X	X	X
Notes for WRIA 32:																		
1. Dissolved oxygen concentration shall exceed 5.0 mg/L.																		
2. No waste discharge will be permitted for Mill Creek and tributaries in Washington from city of Walla Walla Waterworks Dam (river mile 25.2) to headwaters.																		
3. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).																		
WRIA 33 Lower Snake																		
Snake River from mouth to Washington-Idaho-Oregon border (river mile 176.1).[1]			X					X		X	X	X	X	X	X	X	X	X
Notes for WRIA 33:																		
1. Below Clearwater River (river mile 139.3). Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater																		

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9). Special condition - special fish passage exemption as described in WAC 173-201A-200 (1)(f).																		
WRIA 34 Palouse																		
Palouse River from Palouse Falls to south fork (Colfax, river mile 89.6).				X					X		X	X	X	X	X	X	X	X
Palouse River mainstem from mouth to Palouse Falls			X					X		X	X	X	X	X	X	X	X	X
Palouse River, main river, from confluence with south fork (Colfax, river mile 89.6) to Idaho border (river mile 123.4).[1]			X					X		X	X	X	X	X	X	X	X	X
Notes on WRIA 34:																		
1. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).																		
WRIA 35 Middle Snake																		
All streams flowing into Oregon from North Fork Wenaha River east to, and including, Fairview Creek.	X						X			X	X	X	X	X	X	X	X	X
Asotin River from and including Charley Creek to headwaters (including tributaries) not otherwise designated Char.		X					X			X	X	X	X	X	X	X	X	X
Asotin River, North Fork, and all tributaries above Lick Creek, except those waters in or above the Umatilla National Forest.	X							X		X	X	X	X	X	X	X	X	X
Asotin River, North Fork, and all tributaries above Lick Creek that are in or above the Umatilla National Forest.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Charley Creek and the unnamed tributary at latitude 46.2851 longitude -117.3216: All waters (including tributaries) above the confluence, except those waters in or above the Umatilla National Forest.	X							X		X	X	X	X	X	X	X	X	X
Charley Creek and the unnamed tributary at latitude 46.2851 longitude -117.3216: All waters (including tributaries) above the confluence that are in or above the Umatilla National Forest.	X						X			X	X	X	X	X	X	X	X	X
Cottonwood Creek and the unnamed tributary at latitude 46.0678 longitude -117.3015 (Section 21 T7N R44E) all waters above the confluence.		X					X			X	X	X	X	X	X	X	X	X
Crooked Creek (including tributaries) from Oregon Border to headwaters.	X						X			X	X	X	X	X	X	X	X	X
Cummings Creek and all tributaries, except those waters in or above the Umatilla National Forest.	X							X		X	X	X	X	X	X	X	X	X
Cummings Creek and all tributaries that are in or above the Umatilla National Forest.	X						X			X	X	X	X	X	X	X	X	X
George Creek, above and including Coombs Canyon (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
George Creek and the unnamed tributary at latitude 46.2292 longitude -117.1874 (Section 29 T9N R45E), all waters above confluence not otherwise designated Char.		X					X			X	X	X	X	X	X	X	X	X
Grande Ronde River from mouth to Oregon border (river mile 37).[1]			X					X		X	X	X	X	X	X	X	X	X
Grouse Creek and tributaries from Oregon border.		X					X			X	X	X	X	X	X	X	X	X
Grub Canyon and all tributaries.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
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Hixon Canyon and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Little Tucannon River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Menatchee Creek and West Fork Menatchee Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Pataha Creek and Dry Pataha Creek: All waters (including tributaries) above the confluence, except those waters in or above the Umatilla National Forest.	X							X		X	X	X	X	X	X	X	X	X
Pataha Creek and Dry Pataha Creek: All waters (including tributaries) above the confluence that are in or above the Umatilla National Forest.	X						X			X	X	X	X	X	X	X	X	X
Snake River from mouth to Washington-Idaho-Oregon border (river mile 176.1).[2]			X					X		X	X	X	X	X	X	X	X	X
Tenmile Creek, all waters above confluence with unnamed creek at latitude 46.2156 longitude -117.0386 (Section 33 T9N R46E).		X					X			X	X	X	X	X	X	X	X	X
Tucannon River and tributaries from latitude 46.4592 longitude -117.8461 (Section 6, T11N R40E) to Panjab Creek (except where designated char).		X					X			X	X	X	X	X	X	X	X	X
Tucannon River mainstem from between Little Tucannon River and Panjab Creek.	X						X			X	X	X	X	X	X	X	X	X
Tucannon River and Panjab Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Tucannon River's unnamed tributaries in Sect. 1 T10N R40E and in Sect. 35 T11N R40E (South of Marengo): all waters above their forks.	X							X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Tumalum Creek and the unnamed tributary at latitude 46.3594 longitude -117.6488: All waters (including tributaries) above the confluence, except those waters in or above the Umatilla National Forest.	X							X		X	X	X	X	X	X	X	X	X
Tumalum Creek and the unnamed tributary at latitude 46.3594 longitude -117.6488: All waters (including tributaries) above the confluence that are in or above the Umatilla National Forest.	X						X			X	X	X	X	X	X	X	X	X
Willow Creek and the unnamed tributary at latitude 46.4182 longitude -117.8314: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X

Notes for WRIA 35:

1. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).

2. The following two notes apply:

(a) Below Clearwater River (river mile 139.3). Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t = 34/(T + 9). Special condition - special fish passage exemption as described in WAC 173-201A-200 (1)(f).

(b) Above Clearwater River (river mile 139.3). Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed 0.3°C due to any single source or 1.1°C due to all such activities combined.

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
WRIA 36 Esquatzel Coulee																		
There are no specific waterbody entries for this WRIA.																		
WRIA 37 Lower Yakima																		
Ahtanum Creek North Fork's unnamed tributaries at latitude 46.5465 longitude -120.8857.	X							X		X	X	X	X	X	X	X	X	X
Ahtanum Creek North Fork's unnamed tributaries at latitude 46.5395 longitude -120.9851.	X							X		X	X	X	X	X	X	X	X	X
Ahtanum Creek, between confluence with South Fork and confluence of North and Middle Forks (including tributaries) except where designated Char		X						X		X	X	X	X	X	X	X	X	X
Ahtanum Creek, North Fork, and Middle Fork Ahtanum Creek: All waters (including tributaries) above the confluence.	X							X		X	X	X	X	X	X	X	X	X
Ahtanum Creek, South Fork, and all tributaries.	X							X		X	X	X	X	X	X	X	X	X
Carpenter Gulch and all tributaries.	X							X		X	X	X	X	X	X	X	X	X
Foundation Creek and all tributaries.	X							X		X	X	X	X	X	X	X	X	X
Nasty Creek and all tributaries.	X							X		X	X	X	X	X	X	X	X	X
Sulphur Creek				X					X		X	X	X	X	X	X	X	X
Yakima River from mouth to Cle Elum River (river mile 185.6) except where specifically designated otherwise in Table 602.[1]			X					X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics

Notes for WRIA 37:

1. Temperature shall not exceed a 1-DMax of 21.0°C due to human activities. When natural conditions exceed a 1-DMax of 21.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).

WRIA 38 Naches																		
American River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Barton Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Bumping Lake's unnamed tributaries at latitude 46.8464 longitude -121.3106.	X						X			X	X	X	X	X	X	X	X	X
Bumping River's unnamed tributaries at latitude 46.9317 longitude -121.2067 (outlet of Flat Iron Lake).	X						X			X	X	X	X	X	X	X	X	X
Bumping River and tributaries downstream of the upper end of Bumping Lake (except where designated char).		X					X			X	X	X	X	X	X	X	X	X
Bumping River (and tributaries) upstream of Bumping Lake.	X						X			X	X	X	X	X	X	X	X	X
Cedar Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Clear Creek and tributaries (including Clear Lake).	X						X			X	X	X	X	X	X	X	X	X
Crow Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Deep Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Goat Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Granite Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Indian Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Little Naches River and Bear Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Little Naches River, South Fork and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Naches River and tributaries from latitude 46.7640 longitude -120.8286 (just upstream of Cougar Canyon) to Snoqualmie National Forest boundary (river mile 35.7) (except where designated Char).		X						X		X	X	X	X	X	X	X	X	X
Naches River from Snoqualmie National Forest boundary (river mile 35.7) to headwaters (except where designated Char).		X					X			X	X	X	X	X	X	X	X	X
Pileup Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Quartz Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Rattlesnake Creek: All waters above the confluence with North Fork Rattlesnake Creek.	X						X			X	X	X	X	X	X	X	X	X
Rattlesnake Creek, North Fork, all waters above latitude 46.8107 longitude 121.0694 (from and including the unnamed tributary just above confluence with mainstem).	X						X			X	X	X	X	X	X	X	X	X
Sand Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Sunrise Creek (latitude 46.9042 longitude -121.2431) and all tributaries	X						X			X	X	X	X	X	X	X	X	X
Tieton River and tributaries (except where otherwise designated).		X					X			X	X	X	X	X	X	X	X	X
Tieton River, North Fork (including tributaries) above the confluence with Clear Lake.	X						X			X	X	X	X	X	X	X	X	X
Tieton River, South Fork, and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
WRIA 39 Upper Yakima																		

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Cle Elum River from mouth to latitude 47.3805 longitude -121.0983 (above Little Salmon la Sac Creek).		X					X			X	X	X	X	X	X	X	X	X
Cle Elum River and all tributaries from confluence with unnamed tributary at and latitude 47.3805 longitude -121.0983 to headwaters.	X						X			X	X	X	X	X	X	X	X	X
Indian Creek and tributaries downstream of Wenatchee National Forest boundary below.		X						X		X	X	X	X	X	X	X	X	X
Indian Creek and tributaries in or above National Forest boundary.		X					X			X	X	X	X	X	X	X	X	X
Jack Creek and tributaries downstream of Wenatchee National Forest boundary below.	X							X		X	X	X	X	X	X	X	X	X
Jack Creek and tributaries in or above National Forest boundary.	X						X			X	X	X	X	X	X	X	X	X
Little Kachess Lake (narrowest point dividing Kachess Lake from Little Kachess Lake) and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Manastash Creek: All waters above the confluence of the North and South Forks that are downstream of the Wenatchee National Forest boundary.		X						X		X	X	X	X	X	X	X	X	X
Manastash Creek: All waters above the confluence of the North and South Forks that are in or above the Wenatchee National Forest.		X					X			X	X	X	X	X	X	X	X	X
Manastash Creek mainstem from mouth to confluence of North and South Forks.		X						X		X	X	X	X	X	X	X	X	X
Manastash Creek, tributaries to mainstem, between the mouth and the confluence of North and South Forks.			X					X		X	X	X	X	X	X	X	X	X
Swauk Creek mainstem from mouth to confluence with First Creek.		X						X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Swauk Creek from confluence with First Creek to Wenatchee National Forest (including tributaries).		X						X		X	X	X	X	X	X	X	X	X
Taneum Creek, tributaries to mainstem, from mouth to Wenatchee National Forest boundary.			X					X		X	X	X	X	X	X	X	X	X
Taneum Creek mainstem from mouth to Wenatchee National Forest boundary.		X						X		X	X	X	X	X	X	X	X	X
Teanaway River mainstem from mouth to West Fork Teanaway River.		X						X		X	X	X	X	X	X	X	X	X
Teanaway River, tributaries to mainstem, from mouth to West Fork Teanaway River.			X					X		X	X	X	X	X	X	X	X	X
Teanaway River, West Fork and Middle Fork, and tributaries downstream of the Wenatchee National Forest.		X						X		X	X	X	X	X	X	X	X	X
Teanaway River, West Fork and Middle Fork, and tributaries upstream of the Wenatchee National Forest.		X						X		X	X	X	X	X	X	X	X	X
Teanaway River, North Fork (and tributaries) from mouth to Jungle Creek that are downstream of the Wenatchee National Forest boundary (except where designated otherwise).		X						X		X	X	X	X	X	X	X	X	X
Teanaway River, North Fork (and tributaries) from mouth to Jungle Creek that are in or above the Wenatchee National Forest boundary (except where designated otherwise).		X					X			X	X	X	X	X	X	X	X	X
Teanaway River, North Fork, and all tributaries above and including Jungle Creek.	X						X			X	X	X	X	X	X	X	X	X
Yakima River mainstem from mouth to Cle Elum River (river mile 185.6) except where specifically designated otherwise in Table 602.[1]			X					X		X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Yakima River and tributaries from Cle Elum River (river mile 185.6) to headwaters (except where designated otherwise).		X					X			X	X	X	X	X	X	X	X	X
Yakima River and tributaries above but not including Cedar Creek (latitude 47.2892 longitude -121.2947) in Sect.25 T21NR12E.	X						X			X	X	X	X	X	X	X	X	X
Notes for WRIA 39:																		
1. Temperature shall not exceed a 1-DMax of 21.0°C due to human activities. When natural conditions exceed a 1-DMax of 21.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).																		
WRIA 40 Alkaki-Squilchuck																		
There are no specific water body entries for this WRIA.																		
WRIA 41 Lower Crab																		
Crab Creek and tributaries.				X					X		X	X	X	X	X	X	X	X
WRIA 42 Grand Coulee																		
Crab Creek and tributaries.				X					X		X	X	X	X	X	X	X	X
WRIA 43 Upper Crab-Wilson																		
Crab Creek and tributaries.				X					X		X	X	X	X	X	X	X	X
WRIA 44 Moses Coulee																		
There are no specific waterbody entries for this WRIA.																		
WRIA 45 Wenatchee																		
Chiwaukum Creek from confluence with Skinney Creek to headwaters (including tributaries).	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Chiwawa River from mouth to Chikamin Creek (including tributaries).		X					X			X	X	X	X	X	X	X	X	X
Chiwawa River (and all tributaries) above and including Chikamin Creek.	X						X			X	X	X	X	X	X	X	X	X
Chumstick Creek and tributaries downstream of the National Forest boundary (not otherwise designated char).		X						X		X	X	X	X	X	X	X	X	X
Chumstick Creek and tributaries in or above the National Forest boundary (not otherwise designated char).		X					X			X	X	X	X	X	X	X	X	X
Dry Creek and Chumstick Creek: All waters (including tributaries) above the confluence, except those waters in or above the Wenatchee National Forest.	X							X		X	X	X	X	X	X	X	X	X
Dry Creek and Chumstick Creek: All waters (including tributaries) above the confluence that are in or above the Wenatchee National Forest.	X						X			X	X	X	X	X	X	X	X	X
Eagle Creek and the unnamed tributary at latitude 47.6544 longitude -120.5165: All waters (including tributaries) above the junction, except those waters in or above the Wenatchee National Forest.	X							X		X	X	X	X	X	X	X	X	X
Eagle Creek and the unnamed tributary at latitude 47.6544 longitude -120.5165: All waters (including tributaries) above the confluence that are in or above the Wenatchee National Forest.	X						X			X	X	X	X	X	X	X	X	X
Icicle Creek (including tributaries) from mouth to the National Forest Boundary.		X						X		X	X	X	X	X	X	X	X	X
Icicle Creek (including tributaries) from National Forest boundary to confluence with Jack Creek.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Icicle Creek above and including Jack Creek (including all tributaries).	X						X			X	X	X	X	X	X	X	X	X
Ingalls Creek (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
Mission Creek from latitude 47.4496 longitude -120.4945 to headwaters (including tributaries) downstream of the National Forest boundary.		X						X		X	X	X	X	X	X	X	X	X
Mission Creek from latitude 47.4496 longitude -120.4945 to headwaters (including tributaries) in or above the National Forest boundary.		X					X			X	X	X	X	X	X	X	X	X
Peshastin Creek from National Forest Boundary to headwaters (including tributaries) except where designated char.		X					X			X	X	X	X	X	X	X	X	
Peshastin Creek from confluence with Mill Creek to National Forest Boundary (including tributaries).		X						X		X	X	X	X	X	X	X	X	
Second Creek and the unnamed tributary at latitude 47.7384 longitude -120.5935: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Van Creek and the unnamed tributary at latitude 47.6722 longitude -120.5373: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Wenatchee River mainstem between Peshastin Creek and the boundary of the Wenatchee National Forest (river mile 27.1).		X						X		X	X	X	X	X	X	X	X	X
Wenatchee River from Wenatchee National Forest boundary (river mile 27.1) to Chiwawa River (including tributaries) except where designated otherwise.		X					X			X	X	X	X	X	X	X	X	X
Wenatchee River and all tributaries above Chiwawa River confluence.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
WRIA 46 Entiat																		
Brennegan Creek and the unnamed tributary at and latitude 47.9098 longitude -120.4185: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Entiat River and tributaries occurring below the National Forest boundary from and including the Mad River to Wenatchee National Forest boundary on the mainstem Entiat River (river mile 20.5).		X					X			X	X	X	X	X	X	X	X	X
Entiat River and all tributaries above the unnamed creek at and latitude 47.9135 longitude -120.4942 (below Fox Creek).	X						X			X	X	X	X	X	X	X	X	X
Entiat River's unnamed tributaries upstream of latitude 47.9106 longitude -121.5010 (below Fox Creek).	X						X			X	X	X	X	X	X	X	X	X
Gray Canyon, North Fork, and South Fork Gray Canyon: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Hornet Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Mad River and all tributaries above latitude 47.8015 longitude -120.4920 (below Young Creek).	X						X			X	X	X	X	X	X	X	X	X
Mud Creek and Switchback Canyon: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Potato Creek and Gene Creek: All waters above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Preston Creek and South Fork Preston Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Stormy Creek and the unnamed tributary at latitude 47.8387 longitude -120.3865: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Tillicum Creek and Indian Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
WRIA 47 Chelan																		
Stehekin River.		X					X			X	X	X	X	X	X	X	X	X
WRIA 48 Methow																		
Bear Creek from mouth to headwaters (including tributaries) in or above the National Forest boundary.		X					X			X	X	X	X	X	X	X	X	X
Bear Creek from mouth to headwaters (including tributaries) downstream of the National Forest boundary.		X						X		X	X	X	X	X	X	X	X	X
Beaver Creek and South Fork Beaver Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Big Hidden Lake and all tributaries, and the outlet stream that flows into the East Fork Pasayten River.	X						X			X	X	X	X	X	X	X	X	X
Boulder Creek and Pebble Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Buttermilk Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Chewuch River and tributaries from mouth to headwaters (except where designated otherwise).		X					X			X	X	X	X	X	X	X	X	X
Chewuch River and tributaries above Buck Creek at Section 30, T38, R22E.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Eagle Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Early Winters Creek (including tributaries) from mouth to headwaters.	X						X			X	X	X	X	X	X	X	X	X
Eureka Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Goat Creek above the confluence with Roundup Creek to headwaters (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
Gold Creek and all tributaries, except those waters in or above the Okanogan National Forest.	X							X		X	X	X	X	X	X	X	X	X
Gold Creek and all tributaries that are in or above the Okanogan National Forest.	X						X			X	X	X	X	X	X	X	X	X
Lake Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Libby Creek and Hornel Draw: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Little Bridge Creek and tributaries	X						X			X	X	X	X	X	X	X	X	X
Lost River Gorge and all tributaries upstream of confluence with Sunset Creek.	X						X			X	X	X	X	X	X	X	X	X
Methow River from mouth to confluence with Twisp River.			X					X		X	X	X	X	X	X	X	X	X
Methow River from confluence with Twisp River to Chewuch River (river mile 50.1).		X						X		X	X	X	X	X	X	X	X	X
Methow River and tributaries from Chewuch River (river mile 50.1) to headwaters (except where designated char.		X					X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Methow River, West Fork, (including tributaries) from and including Robinson Creek and its tributaries to headwaters (except unnamed tributary above mouth at latitude 48.6591 longitude -120.5493.	X						X			X	X	X	X	X	X	X	X	X
Pipestone Canyon Creek and all tributaries below Campbell Lake.	X							X		X	X	X	X	X	X	X	X	X
Pipestone Canyon Creek and all tributaries above Campbell Lake, Campbell Lake, and all tributaries to Campbell Lake.	X						X			X	X	X	X	X	X	X	X	X
Smith Canyon Creek and Elderberry Canyon: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Twisp River from mouth to War Creek.		X					X			X	X	X	X	X	X	X	X	X
Twisp River and War Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Wolf Creek from and including unnamed tributary at latitude 48.4849 longitude -120.3180 to headwaters (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
WRIA 49 Okanogan																		
Okanogan River.			X					X		X	X	X	X	X	X	X	X	X
WRIA 50 Foster																		
There are no specific waterbody entries for this WRIA.																		
WRIA 51 Nespelem																		
There are no specific waterbody entries for this WRIA.																		
WRIA 52 Sanpoil																		
There are no specific waterbody entries for this WRIA.																		

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
WRIA 53 Lower Lake Roosevelt																		
There are no specific waterbody entries for this WRIA.																		
WRIA 54 Lower Spokane																		
Spokane River from mouth to Long Lake Dam (river mile 33.9).[1]			X					X		X	X	X	X	X	X	X	X	X
Spokane River from Long Lake Dam (river mile 33.9) to Nine Mile Bridge (river mile 58.0).[2]		X					X			X	X	X	X	X	X	X	X	X
Spokane River from Nine Mile Bridge (river mile 58.0) to the Idaho border (river mile 96.5).[3]			X					X		X	X	X	X	X	X	X	X	X
Notes for WRIA 54:																		
1. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).																		
2. a. The average euphotic zone concentration of total phosphorus (as P) shall not exceed 25µg/L during the period of June 1 to October 31. b. Temperature shall not exceed a 1-DMax of 20.0°C, due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).																		
3. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time exceed t=34/(T+9).																		
WRIA 55 Little Spokane																		
There are no specific waterbody entries for this WRIA.																		

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
WRIA 56 Hangman																		
There are no specific waterbody entries for this WRIA.																		
WRIA 57 Middle Spokane																		
Lake Creek and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Spokane River from Nine Mile Bridge (river mile 58.0) to the Idaho border (river mile 96.5).[1]			X					X		X	X	X	X	X	X	X	X	X
Notes on WRIA 57:																		
1. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time exceed t=34/(T+9).																		
WRIA 58 Middle Lake Roosevelt																		
There are no specific waterbody entries for this WRIA.																		
WRIA 59 Colville																		
Colville River.			X					X		X	X	X	X	X	X	X	X	X
WRIA 60 Kettle																		
There are no specific waterbody entries for this WRIA.																		
WRIA 61 Upper Lake Roosevelt																		
There are no specific waterbody entries for this WRIA.																		
WRIA 62 Pend Oreille																		
All streams flowing into Idaho from Bath Creek (latitude 48.5865 longitude 117.0351) to the Canadian border.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Calispell Creek (including tributaries) from Small Creek to Calispell Lake.	X							X		X	X	X	X	X	X	X	X	X
Calispell Lake and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Cedar Creek from latitude 48.7500 longitude -117.4349 (including tributaries) to headwaters: all waters that are in the Colville National Forest.	X						X			X	X	X	X	X	X	X	X	X
Cedar Creek from latitude 48.7500 longitude -117.4349 to (including tributaries) to headwaters: all waters that are outside the Colville National Forest.	X							X		X	X	X	X	X	X	X	X	X
Cedar Creek from mouth to latitude 48.7500 longitude -117.4349 (including tributaries) in or above Colville National Forest boundary.		X					X			X	X	X	X	X	X	X	X	X
Cedar Creek from mouth to latitude 48.7500 longitude -117.4349 (including tributaries) downstream of the Colville National Forest.		X						X		X	X	X	X	X	X	X	X	X
Harvey Creek (also called Outlet Creek) and Paupac Creek: All waters (including tributaries) above the confluence.	X						X			X	X	X	X	X	X	X	X	X
Indian Creek from mouth to headwaters.	X						X			X	X	X	X	X	X	X	X	X
Le Clerc Creek, East Branch, and West Branch Le Clerc Creek: All waters (including tributaries) above the confluence, except those waters in or above the Colville National Forest.	X							X		X	X	X	X	X	X	X	X	X
Le Clerc Creek, East Branch, and West Branch Le Clerc Creek: All waters (including tributaries) above the confluence that are in or above the Colville National Forest.	X						X			X	X	X	X	X	X	X	X	X

TABLE 602	Aquatic Life Uses						Recreation Uses			Water Supply Uses				Misc. Uses				
Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Char Spawning /Rearing	Core Summer Habitat	Spawning/Rearing	Rearing/Migration Only	Redband Trout	Warm Water Species	Ex Primary Cont	Primary Cont	Secondary Cont	Domestic Water	Industrial Water	Agricultural Water	Stock Water	Wildlife Habitat	Harvesting	Commerce/Navigation	Boating	Aesthetics
Le Clerc Creek from mouth to confluence with West Branch le Clerc Creek (including tributaries).		X						X		X	X	X	X	X	X	X	X	X
Mill Creek from mouth to headwaters (including tributaries).		X					X			X	X	X	X	X	X	X	X	X
Pend Oreille River from Canadian border (river mile 16.0) to Idaho border (river mile 87.7).[1]			X					X		X	X	X	X	X	X	X	X	X
Slate Creek from mouth to headwaters (including tributaries).	X						X			X	X	X	X	X	X	X	X	X
Small Creek and all tributaries, except those waters in or above the National Forest.	X							X		X	X	X	X	X	X	X	X	X
Small Creek and all tributaries that are in or above the National Forest.	X						X			X	X	X	X	X	X	X	X	X
South Salmo River and all tributaries.	X						X			X	X	X	X	X	X	X	X	X
Sullivan Creek above confluence with Harvey Creek (including tributaries) to headwaters.	X						X			X	X	X	X	X	X	X	X	X
Tacoma Creek, South Fork, upstream of Tacoma Creek and downstream of the Colville National Forest boundary (including tributaries).	X							X		X	X	X	X	X	X	X	X	X
Tacoma Creek, South Fork, and tributaries upstream of the Colville National Forest boundary (including tributaries).	X						X			X	X	X	X	X	X	X	X	X

Notes for WRIA 62:

1. Temperature shall not exceed a 1-DMax of 20.0°C due to human activities. When natural conditions exceed a 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T + 9).

[Statutory Authority: RCW 90.48.035. 11-09-090 and 11-11-022 (Order 10-10), § 173-201A-602, filed 4/20/11 and 5/9/11, effective 5/21/11 and 6/9/11; 06-23-117 (Order 06-04), § 173-201A-602, filed 11/20/06, effective 12/21/06. Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-602, filed 7/1/03, effective 8/1/03.]

173-201A-610
Use designations — Marine waters.

All marine surface waters have been assigned specific uses for protection under Table 612.

Table 610 (Key to Table 612)

Abbreviation	General Description
Aquatic Life Uses:	(see WAC 173-201A-210(1))
Extraordinary	Extraordinary quality salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.
Excellent	Excellent quality salmonid and other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.
Good	Good quality salmonid migration and rearing; other fish migration, rearing, and spawning; clam, oyster, and mussel rearing and spawning; crustaceans and other shellfish (crabs, shrimp, crayfish, scallops, etc.) rearing and spawning.
Fair	Fair quality salmonid and other fish migration.
Shellfish Harvesting:	(see WAC 173-201A-210(2))
Shellfish Harvest	Shellfish (clam, oyster, and mussel) harvesting.
Recreational Uses:	(see WAC 173-201A-210(3))
Primary Contact	Primary contact recreation.
Secondary Contact	Secondary contact recreation.
Miscellaneous Uses:	(see WAC 173-201A-210(4))
Wildlife Habitat	Wildlife habitat.
Harvesting	Salmonid and other fish harvesting, and crustacean and other shellfish (crabs, shrimp, scallops, etc.) harvesting.
Com./Navig.	Commerce and navigation.
Boating	Boating.
Aesthetics	Aesthetic values.

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-610, filed 7/1/03, effective 8/1/03.]

173-201A-612
Table 612 — Use designations for marine waters.

(1) Table 612 lists uses for marine waters. Only the uses with the most stringent criteria are listed. The criteria notes in Table 612 take precedence over the criteria in WAC 173-201A-210 for the same parameter.

(2) Table 612 is necessary to determine and fully comply with the requirements of this chapter. If you are viewing a paper copy of the rule from the office of the code reviser or are using their web site, Table 612 may be missing (it will instead say "place illustration here"). In this

situation, you may view Table 612 at the department of ecology's web site at www.ecy.wa.gov, or request a paper copy of the rule with Table 612 from the department of ecology or the office of the code reviser.

Table 612	Aquatic Life Uses				Shellfish Harvest	Recreational Uses		Misc. Uses				
Use Designations for Marine Waters	Extraordinary	Excellent	Good	Fair		Primary Contact	Secondary Contact	Wildlife	Harvesting	Com/Navig.	Boating	Aesthetics
Budd Inlet south of latitude 47°04'N (south of Priest Point Park).			X				X	X	X	X	X	X
Coastal waters: Pacific Ocean from Ilwaco to Cape Flattery.	X				X	X		X	X	X	X	X
Commencement Bay south and east of a line bearing 258° true from "Brown's Point" and north and west of line bearing 225° true through the Hylebos waterway light.		X			X	X		X	X	X	X	X
Commencement Bay, inner, south and east of a line bearing 225° true through Hylebos waterway light except the city waterway south and east of south 11th Street.			X				X	X	X	X	X	X
Commencement Bay, city waterway south and east of south 11th Street.				X			X	X		X	X	X
Drayton Harbor, south of entrance.		X			X	X		X	X	X	X	X
Dyes and Sinclair inlets west of longitude 122°37'W.		X			X	X		X	X	X	X	X
Elliott Bay east of a line between Pier 91 and Duwamish Head.		X			X	X		X	X	X	X	X
Everett Harbor, inner, northeast of a line bearing 121° true from approximately 47°59'5"N and 122°13'44"W (southwest corner of the pier).			X				X	X	X	X	X	X
Grays Harbor west of longitude 123°59'W.		X			X	X		X	X	X	X	X
Grays Harbor east of longitude 123°59'W to longitude 123°45'45"W (Cosmopolis Chehalis River, river mile 3.1). Special condition - dissolved oxygen shall exceed 5.0 mg/L.			X				X	X	X	X	X	X
Guemes Channel, Padilla, Samish and Bellingham bays east of longitude 122°39'W and north of latitude 48°27'20"N.		X			X	X		X	X	X	X	X
Hood Canal.	X				X	X		X	X	X	X	X

Table 612	Aquatic Life Uses				Shellfish Harvest	Recreational Uses		Misc. Uses				
Use Designations for Marine Waters	Extraordinary	Excellent	Good	Fair		Primary Contact	Secondary Contact	Wildlife	Harvesting	Com/Navig.	Boating	Aesthetics
Mukilteo and all North Puget Sound west of longitude 122°39'W (Whidbey, Fidalgo, Guemes and Lummi islands and State Highway 20 Bridge at Deception Pass), except as otherwise noted.	X				X	X		X	X	X	X	X
Oakland Bay west of longitude 123°05'W (inner Shelton harbor).			X				X	X	X	X	X	X
Port Angeles south and west of a line bearing 152° true from buoy "2" at the tip of Ediz Hook.		X			X	X		X	X	X	X	X
Port Gamble south of latitude 47°51'20"N.		X			X	X		X	X	X	X	X
Port Townsend west of a line between Point Hudson and Kala Point.		X			X	X		X	X	X	X	X
Possession Sound, south of latitude 47°57'N.	X				X	X		X	X	X	X	X
Possession Sound, Port Susan, Saratoga Passage, and Skagit Bay east of Whidbey Island and State Highway 20 Bridge at Deception Pass between latitude 47°57'N (Mukilteo) and latitude 48°27'20"N (Similk Bay), except as otherwise noted.		X			X	X		X	X	X	X	X
Puget Sound through Admiralty Inlet and South Puget Sound, south and west to longitude 122°52'30"W (Brisco Point) and longitude 122°51'W (northern tip of Hartstene Island).	X				X	X		X	X	X	X	X
Sequim Bay southward of entrance.	X				X	X		X	X	X	X	X
South Puget Sound west of longitude 122°52'30"W (Brisco Point) and longitude 122°51'W (northern tip of Hartstene Island, except as otherwise noted).		X			X	X		X	X	X	X	X
Strait of Juan de Fuca.	X				X	X		X	X	X	X	X
Totten Inlet and Little Skookum Inlet, west of longitude 122°56'32" (west side of Steamboat Island).	X				X	X		X	X	X	X	X
Willapa Bay seaward of a line bearing 70° true through Mailboat Slough light (Willapa River, river mile 1.8).		X			X	X		X	X	X	X	X

[Statutory Authority: Chapters 90.48 and 90.54 RCW. 03-14-129 (Order 02-14), § 173-201A-612, filed 7/1/03, effective 8/1/03.]

APPENDIX 6-1

General Process	General Description	Alternative	Description	Pasco Feasible	WWTP Size/ Type Typical	Future Uncertainty/ Flexibility (Regs)	Future Uncertainty/ Flexibility (Growth)	Functional/ Operational	Economics (Capital)	Economics (O&M)	Societal	Environment	Additional Factors			Pasco Alternative Preference
Attached Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth on media (fixed film).	Trickling Filters Only	Biological growth covered media filled tower with natural or force ventilated pore space that is dosed with wastewater on regular basis.	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Medium footprint	Well Established Technology	$$$	$	Odors if not force ventilated. Potential for flies	Treatment level not consistent with permit				No. Alternative will not satisfy City's needs.
		Moving Bed Biological Reactor (MBBR)	Single pass aeration basins with suspended plastic media based biological growth. Like a submerged trickling filter	No	No		Medium footprint	Newer, but proven technology	$$$	$$$						No. Alternative will not satisfy City's needs.
		Rotating Biological Contactor (RBC)	Rotating partially submerged discs that support biological growth	No	No		Large footprint	Antiquated technology	$$$	$$$						No. Alternative will not satisfy City's needs.
Suspended Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth floating in water suspension. Denitrification and biological phosphorous removal possible with addition of anoxic and anaerobic selectors/zones.	Activated Sludge - Complete Mix	SIMILAR TO EXISTING PASCO WWTP - Aeration basins with less than 4:1 aspect ratio. Typical of early versions of aeration basin technology	No	Yes	Compatible with biological nutrient removal, but not efficient nitrification	Medium footprint	Antiquated technology	$$	$$			short-circuiting	filament growth		No. Alternative will not satisfy City's needs.
		Activated Sludge - Plug Flow	Aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages	Yes	Yes	Compatible with biological nutrient removal	Medium footprint	Well Established Technology	$$$	$$						YES
		Activated Sludge - Step Feed	Aeration basins with staged wastewater feed and RAS to increase overall basin mixed liquor mass.	No	Yes		Small Footprint	Well Established Technology	$$$	$$						No. Alternative not considered feasible
		Activated Sludge - with granular sludge	aeration basin with mixed liquor that is predominantly in a granular form which allows for higher mixed liquor concentration and rapid solids separation	No	Yes	Very compatible with biological nutrient removal	Small Footprint	Emerging Technology	$$$	$$						No. Alternative not considered feasible
		Oxidation Ditch	Circular or oval aeration basin with mixed liquor rotating in a continuous loop.	No	Yes	Compatible with biological nutrient removal	Large footprint	Well Established Technology	$$$	$						No. Alternative not considered feasible
		Deep Shaft Aeration Basin	A deep vertical orientated aeration basin that has a low footprint and high oxygen transfer rate.	No	No		Small Footprint	Novel Technology	$$$	$$$						No. Alternative not considered feasible
		Membrane Bioreactor (MBR)	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent	Yes	Yes		Small Footprint	Established technology	$$$$	$$$$		Higher level treatment	Potentially installed in existing basins/infrastructure.	Requires headworks expansion to increase screening removal system capacity and capabilities.	Potential to maintain existing capacity during construction	YES
		Sequencing Batch Reactor - Conventional	Standard mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes		Medium footprint	Well Established Technology	$$$$	$$$				Requires multiple trains to continue treatment process		No. Alternative not considered feasible
		Sequencing Batch Reactor - Granular (Nerada)	Granular Sludge based mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes	Very compatible with biological nutrient removal	Small footprint	Newer technology	$$$$	$$$			Potential patent issues			No. Alternative not considered feasible
		Facultative/partially aerated lagoons	Typically large lined one-pass earthen diked basins that utilize algae and other naturally occurring microbiology to treat wastewater	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Very large footprint	Well Established Technology	$$$$$	$	Attractive Nuisance Odors and Vectors	Waterfowl habitat				No. Alternative will not satisfy City's needs.

General Process	General Description	Alternative	Description	Pasco Feasible	WWTP Size/ Type Typical	Future Uncertainty/ Flexibility (Regs)	Future Uncertainty/ Flexibility (Growth)	Functional/ Operational	Economics (Capital)	Economics (O&M)	Societal	Environment	Additional Factors			Pasco Alternative Preference
Combination Suspended and Attached Growth Biological Secondary Treatment	Removal of organics and nutrients through growth of microbiology in both water suspension and on media.	Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth	Conventional activated sludge type basin with addition of suspended plastic media with biological growth to generate a higher total microbiological mass.	Yes	Yes	Very compatible with biological nutrient removal	Small Footprint	Newer, but proven technology	$$	$$$$			Installed in existing basins/infrastructure.	Potential to maintain existing capacity during construction		YES
		Zee lung membrane aeration bioreactor – Fixed Growth	Conventional activated sludge type basin with submerged gas permeable membranes that support fixed film growth	Yes	Yes	Compatible with biological nutrient removal	Small Footprint	New and emerging technology	$$$$	$$$			Installed in existing basins/infrastructure.	Potential to maintain existing capacity during construction		YES, but only this option or IFAS will be fully evaluated in FP. Choice made after preliminary vendor costing complete
		Trickling Filter/Activated Sludge	SIMILAR TO EXISTING PASCO WWTP - all plant flow treated over fixed film based trickling filter followed by conventional activated sludge	Yes	Yes	Partially compatible with biological nutrient removal . Requires chemical P removal	Medium footprint	Well Established Technology	$$$	$$						YES
Secondary Solids Separation	Separation of microbiology used to consume organics/nutrients from the treated liquid stream	Secondary Clarifier	Gravity separation in quiescent tanks	Yes	Yes		Medium footprint	Well Established Technology	$$	$						YES
		Dissolved Air Flotation	Solids separation based on small air bubble flotation	No	No		Medium footprint	Well Established Technology	$$$	$$$						No. Alternative not selected for further analysis.
		Tertiary Filtration (Cloth, media, membrane ultrafiltration, etc....)	Removal of suspended solids via filtration after secondary solids separation.	No	Yes	Added flexibility	Additional modest footprint	Well Established Technology	$$$$	$$$		Higher level treatment				No. Alternative not selected for further analysis.
		Ballasted Settling	Addition of supplemental higher density particulates to generate high rate gravity settling	No	No	Added flexibility	Additional modest footprint	Newer, but proven technology	$$$$	$$$		Higher level treatment				No. Alternative not selected for further analysis.
Treated WW Reuse/End-use	End use of treated wastewater	Gravity pipeline and in river diffuser	SAME AS EXISTING	Yes	Yes			Well Established Technology	$	$	Maintained Water Right		Gravity is free and reliable			YES
		Effluent lift station, pressure pipeline and diffuser	Effluent pumping through pipeline and diffuser.	Yes	Yes			Well Established Technology	$$	$$	Maintained Water Right		Smaller pipeline	Requires pump station (point of failure)		Only to be considered if gravity pipeline and diffuser will not be acceptable as determined during future predesign efforts.
		Reuse System	Supplemental treatment and disinfection to allow direct reuse of treated effluent for City based irrigation or other non-potable beneficial uses (car wash, etc..)	No	Yes	Added flexibility	Additional very large footprint	Newer, but proven technology	$$$$$	$$$$$	Decreased Water Right	Beneficial reuse of water	More ways to use/dispose of water	Affects the City's Quad City Water Right mitigation	Extensive pump and piping network	No. Alternative will not satisfy City's needs.
		Rapid Infiltration	Use of flat land infiltration basins to transmit treated wastewater to the groundwater aquifer	No	Yes	Higher flexibility	Additional large footprint	Well Established Technology	$$$$$	$$$	Decreased Water Right	Beneficial reuse of water	Land acquisition			No. Alternative will not satisfy City's needs.
		Land Application	Storage and use of treated wastewater for large scale agricultural irrigation	No	No	Higher flexibility	Additional very large footprint	Well Established Technology	$$$$	$$$$	Decreased Water Right	Crop irrigation and beneficial water reuse	Land acquisition			No. Alternative will not satisfy City's needs.

APPENDIX 6-2

Treatment Area	Unit Process	Number of Units	Max Month Capacity of Process (MGD)	Limiter	Project Year of Deficiency	Orangebook Reliability and Redundancy	Workshop R/R Discussions	Pasco Specific R/R Criteria
Preliminary Treatment	Screens	2 perforated plate 1 reciprocating rake	13.7	Capacity	Beyond 2040	A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.	Orangebook as minimum Risks: Increased O&M	Use Orangebook Reliability and Redundancy Criteria
			10.1	Reliability and Redundancy Limit	2038			
	Grit	2	12.7	Capacity Limit	Beyond 2040	None listed	Minimum of 2 units with ability to bypass Risk: Increased O&M	Minimum of 2 units with ability to bypass
Primary Treatment	Primary Clarifier	2 new + 2 old	W/ CEPT 19.7	Capacity Limit	Beyond 2040	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.	Orangebook as minimum Risks: Short-term O&M and Additional load to the secondary system	Use Orangebook Reliability and Redundancy Criteria.
			W/o CEPT 13.8	Capacity Limit	Beyond 2040			
Secondary Treatment	CEPT	1	X	X	X	None listed	Redundancy in mechanical components Risk: Additional load to the secondary system	Redundancy in mechanical components. Future planning and designs should be completed with CEPT offline.
	Trickling Filter and Pump Station	1 trickling filter 2 pumps	2.7	Capacity Limit	2015	The units shall be sufficient in number and size so that, with the largest- flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow. A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Orangebook as minimum Risk: Additional treatment in the aeration basin	Firm Capacity - with largest unit offline, able to pass/treat MM flow. Future planning and designs should be coordinated for reasonable level of secondary treatment system firm capacity (e.g. aeration basins, trickling filters, secondary clarifiers, MBR modules).
	Intermediate Clarifier and Pump Station	1 clarifier 2 pumps	7.6	Capacity Limit	2027	None listed	No backup needed Risk: Additional treatment in the aeration basin	
	Aeration Basins (with TF and IC on)	2 basins	6.8	Capacity Limit	W/ CEPT 2023	A backup basin will not be required; however, at least two equal-volume basins shall be provided. (For the purpose of this criterion, the two zones of a contact stabilization process are considered as only one basin.)	Firm Capacity - with largest unit offline, able to pass/treat MM flow Risk: Level of treatment, Permit violation	
			4.7		W/o CEPT 2015			
	Alkalinity Feed System	Lime System Caustic System	X	X	X	X	Firm capacity in mechanical components with allowance for storage Risk: Level of treatment	Firm capacity in mechanical components with allowance for storage. Future planning and designs should be completed consistent with potential for denitrification/alkalinity recovery.
	Blowers	4	7.6	Capacity	2027	There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed.	Orangebook as minimum as this is a similar to firm capacity Risk: level of treatment, permit violation	Use Orangebook Reliability and Redundancy Criteria.
			5.7	Reliability and Redundancy Limit	Existing (2016)			
	Air Diffusers	Grid layout in multiple sections	7	Capacity	2024	The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.	Orangebook as minimum Risk: level of treatment, permit violation	Use Orangebook Reliability and Redundancy Criteria.
	Secondary Clarifiers	2	6.5	Capacity Limit	2022	The units shall be sufficient in number and size so that, with the largest- flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.	Firm Capacity - with largest unit offline, able to pass/treat MM flow Risk: Level of treatment, Permit violation	Firm Capacity - with largest unit offline in each channel, able to pass/treat MM flow. Future planning and designs should shall be coordinated for reasonable level of secondary treatment system firm capacity (e.g. aeration basins, trickling filters, secondary clarifiers, MBR modules).
	UV Disinfection	1	19.1	Capacity Limit	Beyond 2040	The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the total design flow.	Firm Capacity - with largest unit (bank) offline, able to pass/treat MM flow Risk: Level of treatment, permit violation	Firm Capacity - with largest unit (bank) offline, able to pass/treat MM flow.
Treated Effluent	Effluent Flow Meter	1	X	X	X	None listed	Typical for plants to have only one effluent/influent flow meter	One effluent flow meter.
	Outfall and Diffuser	1	5.9	Capacity Limit	Existing (2015)	None listed	Typical for plants to have only one gravity outfall Risk: Loss of containment/UV flooding	One gravity outfall.

Treatment Area	Unit Process	Number of Units	Max Month Capacity of Process (MGD)	Limiter	Project Year of Deficiency	Orangebook Reliability and Redundancy	Workshop R/R Discussions	Pasco Specific R/R Criteria
Solids	Primary Sludge Pump Station	1	77	Capacity Limit	Beyond 2040	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Orangebook/Firm Capacity Risks: Increased O&M	Use Orangebook Reliability and Redundancy Criteria.
	Intermediate Sludge Pump Station	1	X	X	X	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Orangebook/Firm Capacity Risks: Increased O&M	Use Orangebook Reliability and Redundancy Criteria.
	RAS/WAS Pump Station	1	13	Capacity Limit	Beyond 2040	A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.	Orangebook/Firm Capacity Risks: Increased O&M	Use Orangebook Reliability and Redundancy Criteria.
	Dissolved Air Floatation Thickener (DAFT)	1	6.7	Capacity Limit	2020	None listed	Redundancy in equipment/process- At least two units and/or pump back to headworks to capture in the PC. Risk: Increased O&M	Equipment redundancy (at least two units) with flow back to headworks as a short-term backup option if easily implemented.
	Anaerobic Digester	2	7.2	Capacity Limit	W/ Recoup. thickening - 2025	None listed	Firm Capacity - with largest unit offline, able to maintain 15 day SRT Risk: Economics to handle solids of lower quality	Firm Capacity - with largest unit offline, able to maintain 15 day SRT.
			6.4		W/o Recoup. Thickening - 2021			
	Sludge Storage	1	X	X	X	None listed	Risk: Increased O&M	One unit with no redundancy.
	Gas Storage	1	X	X	X	None listed	Risk: excess biogas disposal	One unit with no redundancy.
	Rotary Screen thickener (RST)	1	8	Capacity Limit	2029	None listed	Redundancy in equipment/process - at least two units or another methods to handle solids. Risk: Increased O&M	Redundancy in equipment/process - at least two units or another method to handle solids.
	Drying Beds	Multiple	9.2	Capacity Limit	2034	None listed	Firm Capacity - with largest unit offline, able to pass/treat MM flow Biosolids Storage Building provides some flexibility Risk: Increased O&M	Multiple existing units are acceptable with no redundancy required provided solids can be utilized or disposed.
	Biosolids Storage Building	1	X	X	X	None listed		No redundancy required provided solids can be utilized or disposed.

APPENDIX 6-3

murraysmith

City of Pasco

WWTP Facility Plan

Workshop 2: WWTP Deficiencies & Alternatives

Presented by: Craig Anderson, Mark Cummings, Dale Richwine, & Tracy Cork

August 22, 2018

WELCOME & INTRODUCTIONS

1. Project Review & Update
2. Risk - Reliability and Redundancy
3. Alternatives
4. Project Next Steps – alternative development

AGENDA

Project Review:
Overview & Update

Facility Plan Sections

01 Introduction

02 Existing Conditions — General

03 Existing Conditions — WWTP

04 Capacity Analysis

05 Future Conditions

06 Liquids Stream Alternatives

07 Solids Stream Alternatives

08 Project Implementation

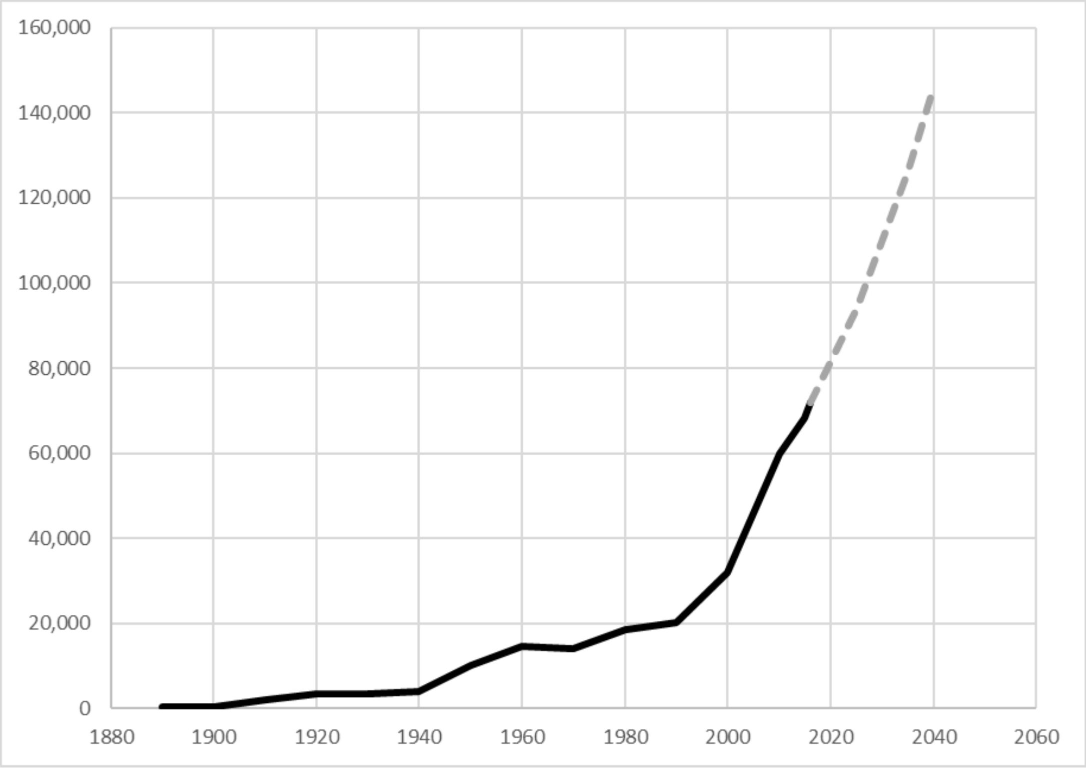
Draft Document Developed (last workshop)

Today

Future Work

Population

- Historical US Census Data
  - 3.4% since 1910
- Projection
  - 3% growth
  - Roughly doubles between 2017 and 2040

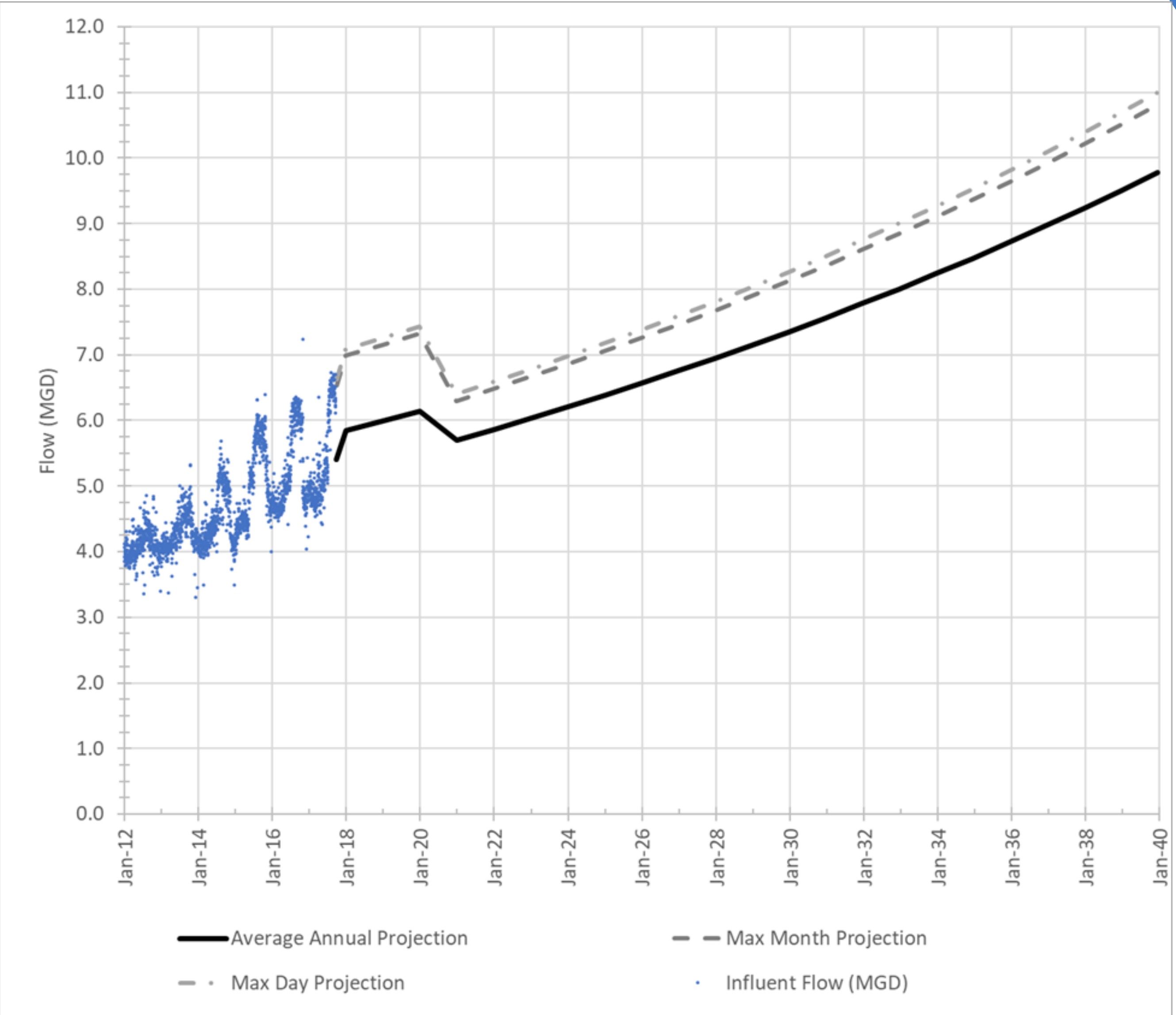


Future Flow and Loads (2040)

- Municipal Component
- Industrial Component
- Other Agency Commitments

- Overall Average Annual
  - 5.9 MGD now
  - 9.8 MGD 2040

- **Overall Max Month**
  - **6.5 MGD now**
  - 10.9 MGD 2040



WWTP Aerial

Item	Description
1	Headworks
2	Screen
3	Grit Removal
4	Primary Clarifier
5	PC Effluent Box
6	Trickling Filter Recirculation Pump Station
7	Trickling Filter
8	Intermediate Clarifier
9	ICE Box

Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River (not pictured)
17	Columbia River Diffuser (not pictured)
18	Primary Sludge Pump Station

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
23	Sludge Storage
24	Gas Storage
25	Flare
26	Solids Thickening
27	Drying Bed

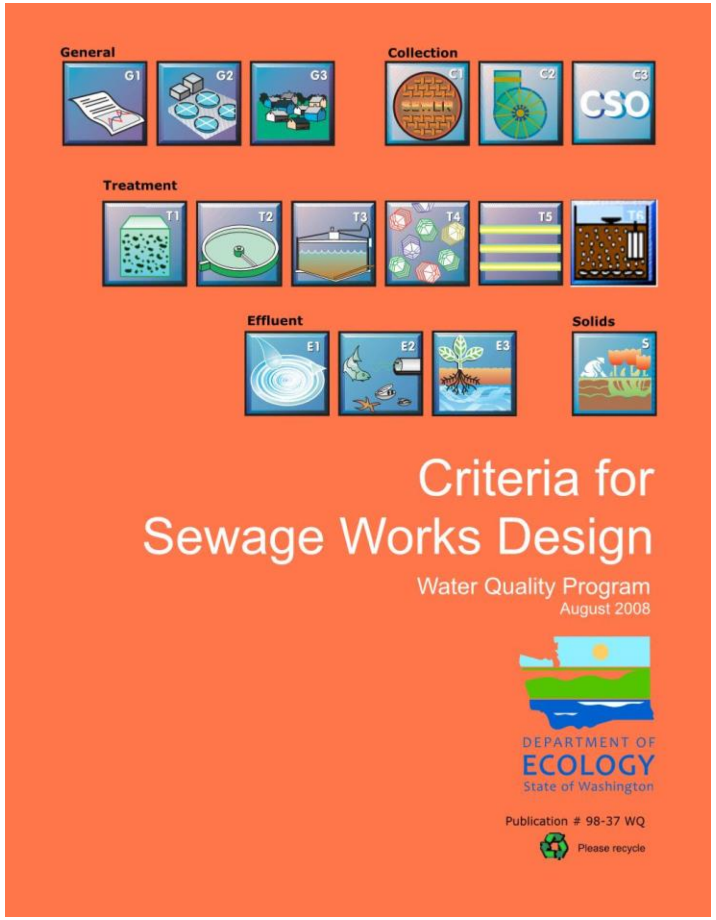
Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building
33	Laboratory
34	Blower Building
35	Machine Shop (not pictured)
36	Equipent Building

Unit Process Capacity Results (all)

Unit Process	Parameter	MM	Capacity Limit
Screens	Flow	13.7	28.1 PI
Grit Chambers	Flow	12.7	15.0 MD
Primary Clarifier with CEPT	Flow	19.7	33.1 PH
Primary Clarifiers without CEPT	Flow	13.8	23.6 PH
Trickling Filter System	BOD Loading	2.7	2.7 MW
Intermediate Clarifier	Overflow Rate, Average	6.8	6.8 PH
Tricking Filter Pump Station	Flow	16.0	16.0 PI
Aeration Basins	BOD Loading	6.8	6.9 MW
Aeration System	Blower Capacity	7.6	13.0 PH
	Diffuser Capacity	7.0	12.0 PH
Secondary Clarifiers	Solids Loading Rate	6.5	11.2 PH
	Overflow Rate	9.9	17.0 PH
UV Disinfection	Disinfection	19.1	22.5 MD
Hydraulic Backbone (Outfall)	Flow	5.9	12.0 PI
DAFT	Solids Loading Rate	6.7	7.9 MD
Anaerobic Digestion with Recuperative Thickening	Solids Retention Time	7.2	8.5 MD
Anaerobic Digestion without Recuperative Thickening	Solids Retention Time	6.4	7.6 MD
Rotary Screen Thickener	Solids Loading Rate	8.0	9.5 MD
Drying Beds	Solids Loading Rate	9.2	9.2 MM

Unit Process Capacity Results (R/R)

Unit Process	Parameter	MM	Capacity Limit
Screens	Flow	10.1	20.6 PI
Grit Chambers	Flow	12.7	15.0 MD
Primary Clarifier with CEPT	Flow	19.7	33.1 PH
Primary Clarifiers without CEPT	Flow	13.8	23.6 PH
Trickling Filter System	BOD Loading	2.7	2.7 MW
Intermediate Clarifier	Overflow Rate, Average	6.8	6.8 PH
Tricking Filter Pump Station	Flow	16.0	16.0 PI
Aeration Basins	BOD Loading	6.8	6.9 MW
Aeration System	Blower Capacity	5.7	9.8 PH
	Diffuser Capacity	6.1	10.5 PH
Secondary Clarifiers	Solids Loading Rate	6.5	11.2 PH
	Overflow Rate	9.9	17.0 PH
UV Disinfection	Disinfection	19.1	22.5 MD
Hydraulic Backbone (Outfall)	Flow	5.9	12.0 PI
DAFT	Solids Loading Rate	6.7	7.9 MD
Anaerobic Digestion with Recuperative Thickening	Solids Retention Time	7.2	8.5 MD
Anaerobic Digestion without Recuperative Thickening	Solids Retention Time	6.4	7.6 MD
Rotary Screen Thickener	Solids Loading Rate	8.0	9.5 MD
Drying Beds	Solids Loading Rate	9.2	9.2 MM

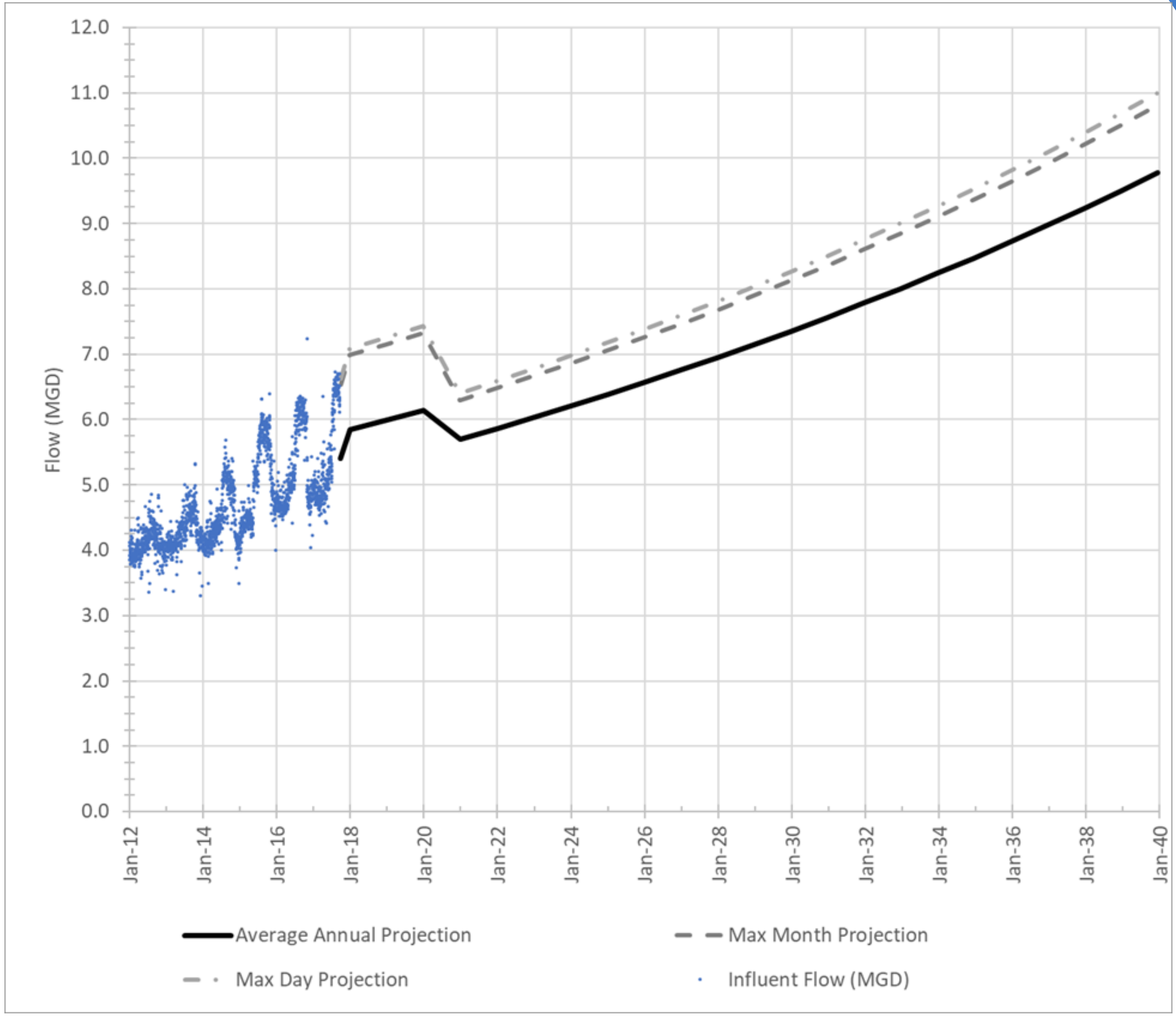


Future Flow and Loads (2040)

- Municipal Component
- Industrial Component
- Other Agency Commitments

- Overall Average Annual
  - 5.9 MGD now
  - 9.8 MGD 2040

- **Overall Max Month**
  - 6.5 MGD now
  - **10.9 MGD 2040**



Unit Process Future Deficiency Results

Unit Process	Parameter	MM	Capacity Limit
Screens	Flow	10.1	20.6 PI
Grit Chambers	Flow	12.7	15.0 MD
Primary Clarifier with CEPT	Flow	19.7	33.1 PH
Primary Clarifiers without CEPT	Flow	13.8	23.6 PH
Trickling Filter System	BOD Loading	2.7	2.7 MW
Intermediate Clarifier	Overflow Rate, Average	6.8	6.8 PH
Tricking Filter Pump Station	Flow	16.0	16.0 PI
Aeration Basins	BOD Loading	6.8	6.9 MW
Aeration System	Blower Capacity	5.7	9.8 PH
	Diffuser Capacity	6.1	10.5 PH
Secondary Clarifiers	Solids Loading Rate	6.5	11.2 PH
	Overflow Rate	9.9	17.0 PH
UV Disinfection	Disinfection	19.1	22.5 MD
Hydraulic Backbone (Outfall)	Flow	5.9	12.0 PI
DAFT	Solids Loading Rate	6.7	7.9 MD
Anaerobic Digestion with Recuperative Thickening	Solids Retention Time	7.2	8.5 MD
Anaerobic Digestion without Recuperative Thickening	Solids Retention Time	6.4	7.6 MD
Rotary Screen Thickener	Solids Loading Rate	8.0	9.5 MD
Drying Beds	Solids Loading Rate	9.2	9.2 MM

CONSIDERATIONS:

- Today's Permit Requirements
- Minimum Reliability & Redundancy
- Unit Process O&M/Replacement

NEW WORK

WWTP Antidegradation Analysis & Future Permit

Issuance Date: June 29, 2010
Effective Date: July 1, 2010
Expiration Date: June 30, 2015

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT No. WA-004496-2

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7600

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 Pasco
P.O. Box 293
1015 S Grey Street
Pasco, WA 99301

is authorized to discharge in accordance with the Special and General Conditions that follow.

Plant Location: 1015 South Grey Street	Receiving Water: Columbia River, at RM 327.6 of the McNary Pool reach of the river. Aka Lake Wallula
Waterbody I.D. No.: - 1189897461506	Discharge Location: Latitude: 46° 12' 58" N Longitude: 119° 05' 12" W
Plant Type: Advanced Secondary treatment with activated sludge and ultraviolet light disinfection	

James M. Bellatty
Water Quality Section Manager
Eastern Regional Office
Washington State Department of Ecology

Tier II Antidegradation Study

- Measurable Change – WAC 173-201A-320(3)
  - Temperature increase of 0.3 degrees Celsius or greater
  - Dissolved oxygen decrease of 0.2 mg/L (milligram per liter) or greater
  - Bacteria level increase of 2 colony forming units/100 mL or greater
  - Hydrogen potential (pH) change of 0.1 units or greater
  - Turbidity increase of 0.5 NTU (nephelometric turbidity unit) or greater, or
  - Any detectable increase in the concentration of a toxic or radioactive substance

Tier II Antidegradation Study

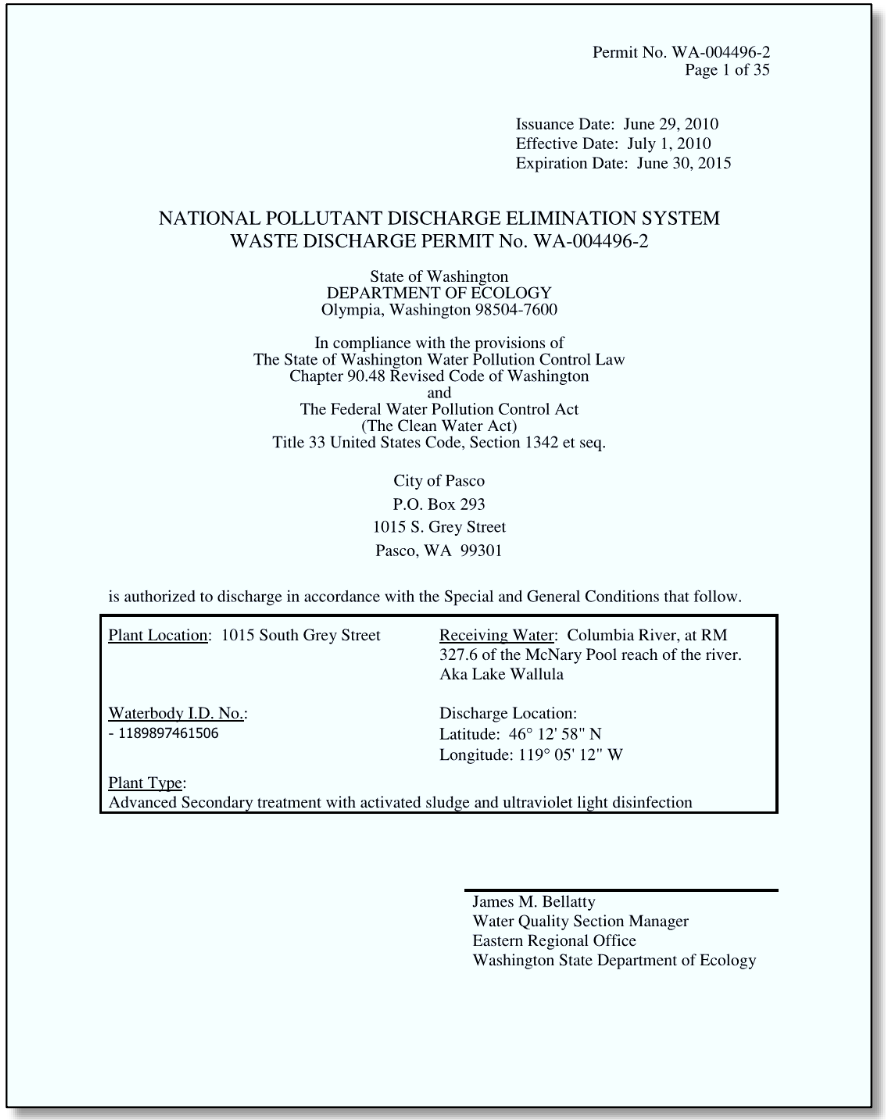
Analysis of the following constituents:

- Dioxin
- Dichlorodiphenyldichloroethylene, 4,4’-DDE
- Polychlorinated biphenyls (PCBs)
- Temperature
- Dissolved Oxygen
- Turbidity
- pH
- Bacteria
- Radioisotopes
- Toxic Substances
- *Acid Compounds – Phenol*
- *Base-neutral compounds* - Bis(2-ethylhexyl)phthalate, Di-n-octyl phthalate
- *Volatile Compounds* – Chloroform, Chloromethane
- Other Chemicals Present – 4-Chloroanaline, Acetone, Diethylphthalate, Pyridine, Toluene
- Ammonia
- Arsenic
- Cadmium
- Chlorine
- Copper
- Cyanide
- Lead
- Mercury
- Molybdenum
- Selenium
- Zinc

Tier II Antidegradation Study…Results

- The proposed discharge of treated WWTP effluent will not cause a "measurable change" in water quality at the chronic mixing zone boundary, as defined by WAC 173-201A-320(3).
- In addition, the proposed treated effluent discharge will not violate the water quality standards for acute or chronic conditions. The proposed expanded discharge along with the improved wastewater treatment train, as described, complies with the intent of the antidegradation standards regulations and will not cause measurable degradation and will improve water quality of the Columbia River.

Expected Future Permit



Permit No. WA-004496-2
Page 1 of 35

Issuance Date: June 29, 2010
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Plant Type: Advanced Secondary treatment with activated sludge and ultraviolet light disinfection	

James M. Bellatty
Water Quality Section Manager
Eastern Regional Office
Washington State Department of Ecology

- Similar to today but with larger mass loading
- In the future, potential for nutrient removal
  - *consistent with permit trends across country*
  - *nutrient removal not required in Facility Plan*
  - *prudent to have nutrient flexibility*

WWTP Risk: Reliability and Redundancy

Identified Minimum Deficiencies

Unit Process
Influent Screens
Aeration Basins/Trickling Filter
Secondary Clarifiers
River Outfall
Dissolved Air Floatation Thickener (DAFT)
Rotary Drum Thickener
Anaerobic Digestion with recuperative thickening
Drying Beds

Reliability and Redundancy Discussion

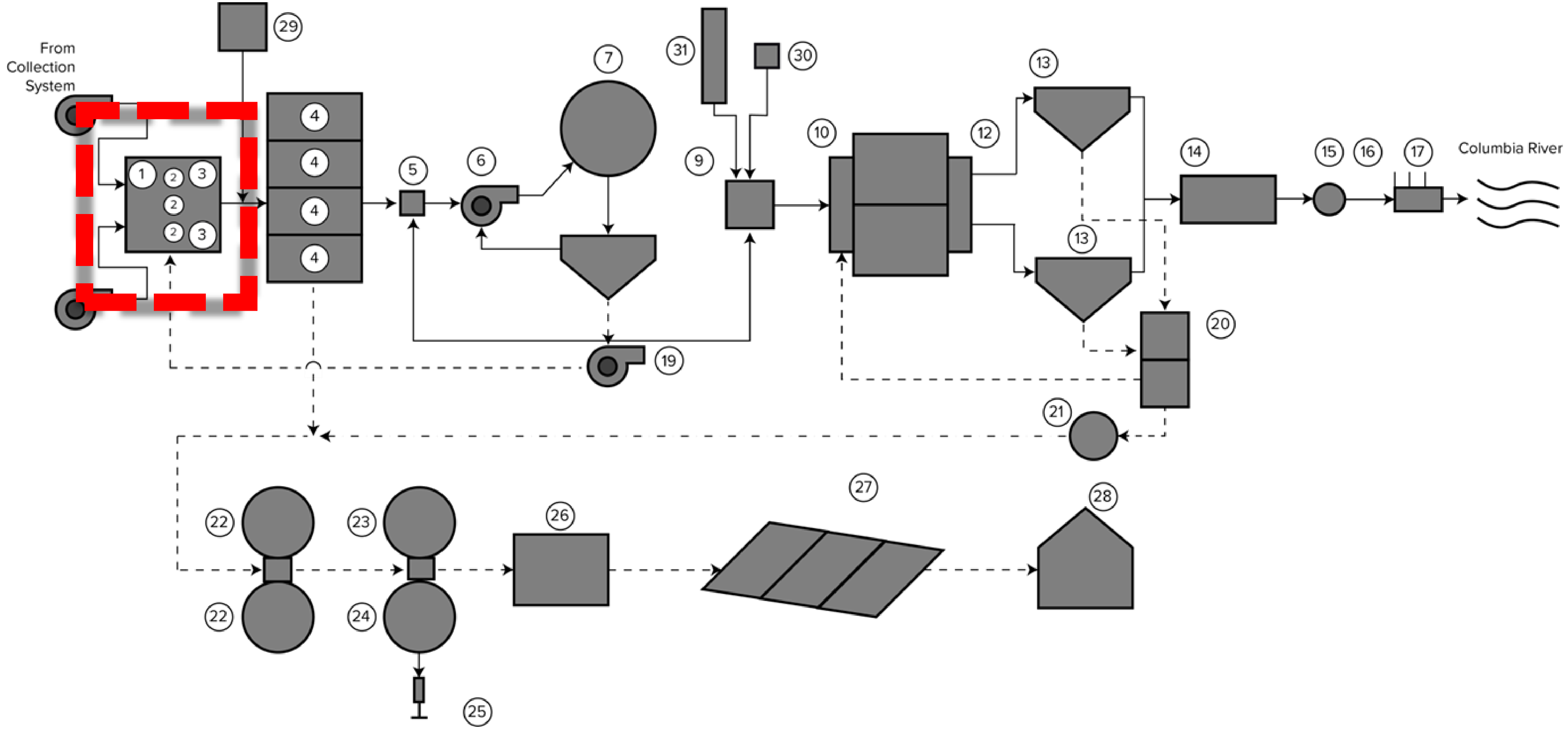
What causes a deficiency?

- Capacity
- New permit requirements
- Reliability and Redundancy
    - Orangebook
    - Operation and Maintenance/Condition
    - **Pasco Specific Reliability and Redundancy (*Firm Capacity?*)**

Already completed

Reliability and Redundancy Discussion

- **Reliability**– Orangebook
  - Guideline for operability, flexibility and maintainability based on EPA's technical bulletin, "Design Criteria for Mechanical, Electrical, and Fluid System Component Reliability," EPA 430-99-74-001.
- **Redundancy** – Orangebook
  - Multiple units, components or process
- **Firm Capacity**
  - With largest capacity unit out of service, process able to handle/treat design condition



Preliminary Treatment

R/R – Preliminary Treatment

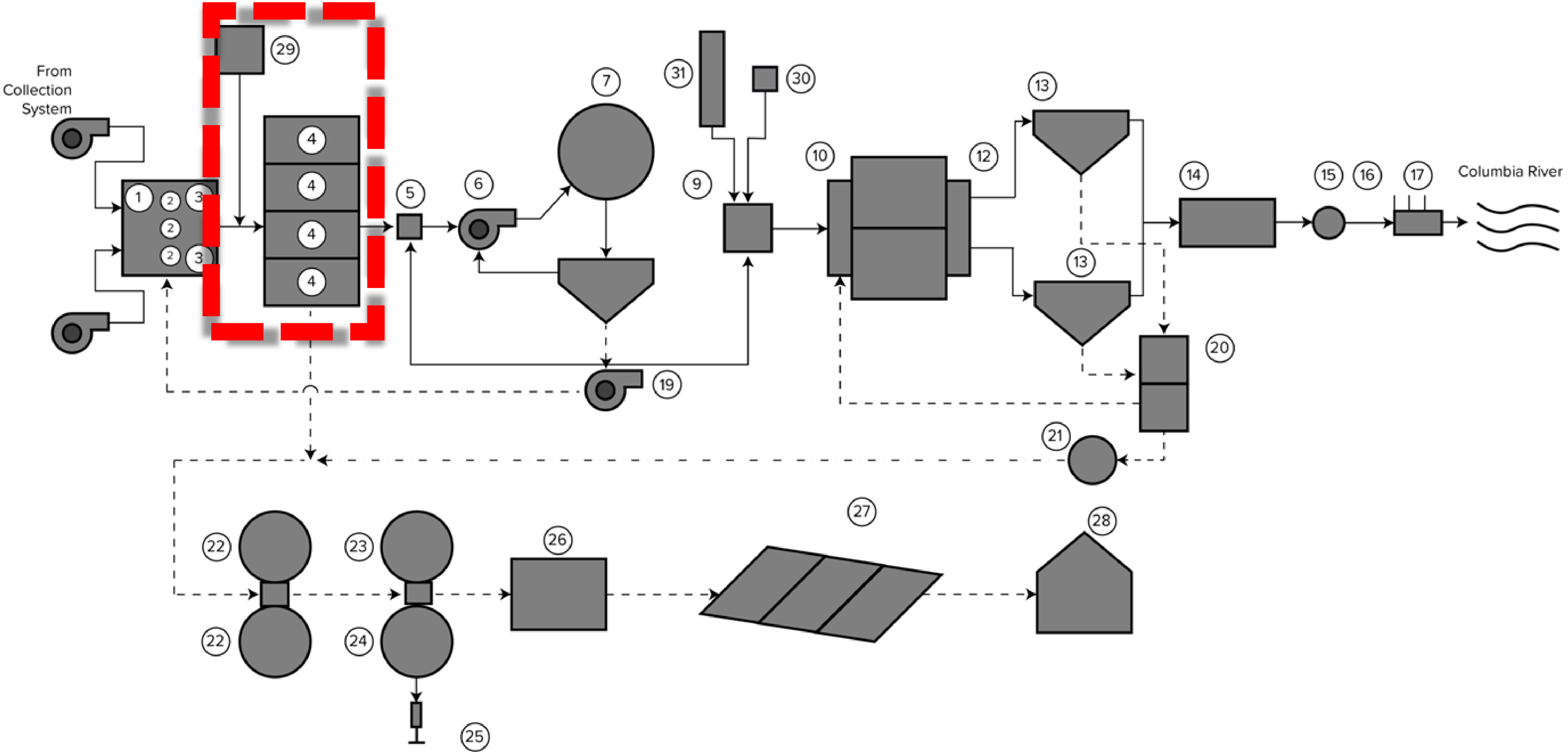
Screens

- Number of units =2 perforated plate, 1 reciprocating rake
- Max Month Capacity = 10.1 MGD R/R
- Orangebook R/R
  - A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.
- **Pasco Specific R/R Consideration**
  - Orangebook
  - **Risks**: Increased O&M

R/R – Preliminary Treatment

Grit

- Number of units = 2
- Max Month Capacity = 12.7 MGD
- Orangebook R/R
  - None listed
- **Pasco Specific R/R Consideration**
  - Minimum of 2 units with ability to bypass
  - **Risk**: Increased O&M



Primary Treatment

R/R – Primary Treatment

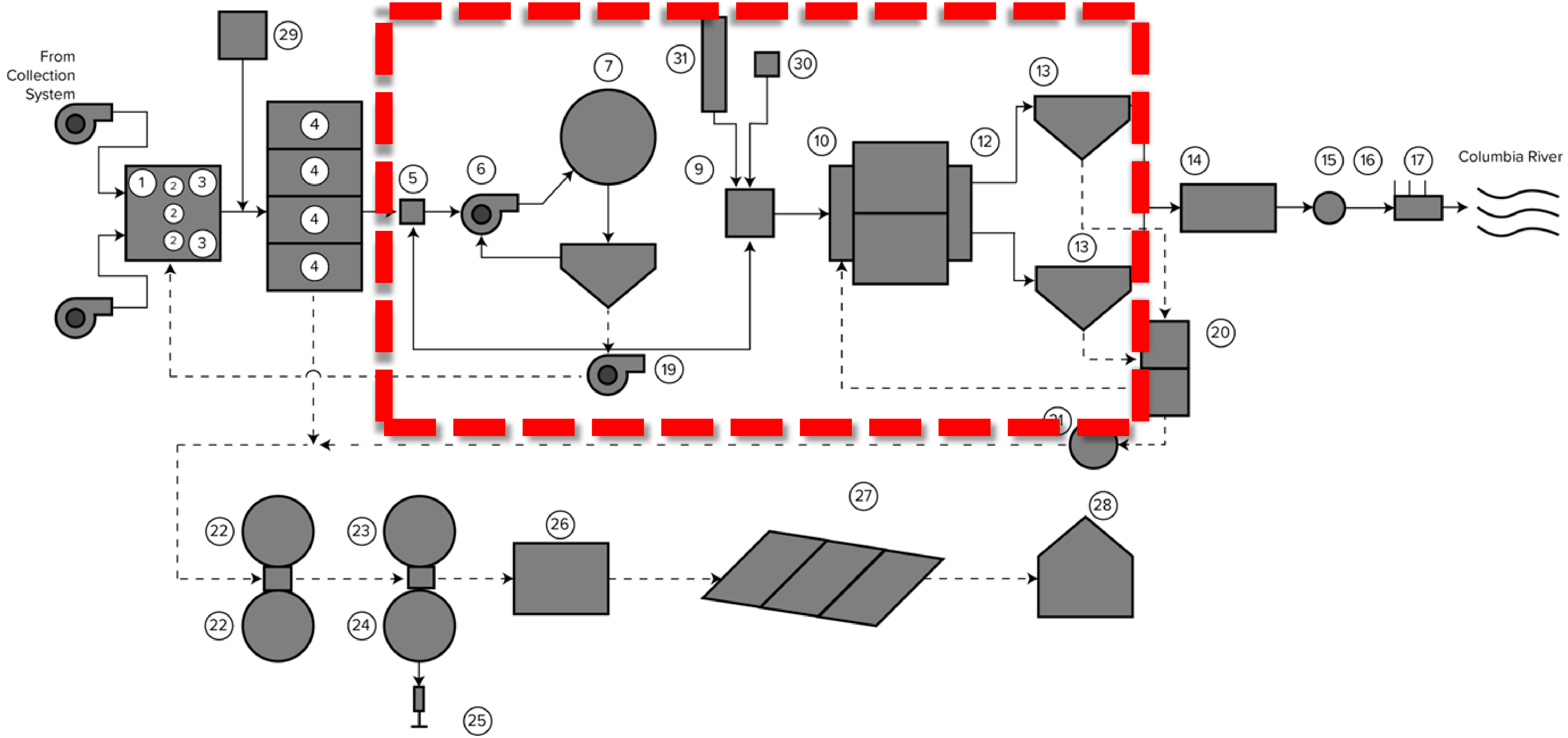
Primary Clarifier

- Number of units = 4 total (2 new + 2 old)
- Max Month Capacity = w/ CEPT 19.7, w/o CEPT 13.8
- Orangebook R/R
  - The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.
- **Pasco Specific R/R Consideration**
  - Orangebook as minimum
  - **Risks**: Short-term O&M and increased secondary load

R/R – Primary Treatment

“Temporary” Chemically Enhanced Primary Treatment (CEPT)

- Orangebook R/R
  - None listed
- **Pasco Specific R/R Consideration**
  - **Risk**: Additional load to the secondary system



Secondary Treatment

R/R – Secondary Treatment

Trickling Filter and Pump Station

- Number of units = 1 trickling filter, 2 pumps
- Max Month Capacity = 2.7 MGD
- Orangebook R/R
  - The units shall be sufficient in number and size so that, with the largest- flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.
  - A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.
- **Pasco Specific R/R Consideration**
  - Orangebook as minimum
  - **Risk**: Additional treatment in the aeration basin

R/R – Secondary Treatment

Intermediate Clarifier and Pump Station

- Number of units = 1clarifier, 2 pumps
- Max Month Capacity = 7.6 MGD
- Orangebook R/R
  - None listed
- **Pasco Specific R/R Consideration**
  - No backup needed
  - **Risk**: Secondary Clarifier Solids Overload

R/R – Secondary Treatment

Aeration Basins

- Number of units = 2
- Max Month Capacity = 4.7 w/o CEPT, 6.8 w/ CEPT
- Orangebook R/R
  - A backup basin will not be required; however, at least two equal-volume basins shall be provided. (For the purpose of this criterion, the two zones of a contact stabilization process are considered as only one basin.)
- **Pasco Specific R/R Consideration**
  - Firm Capacity - with largest unit offline, able to pass/treat MM flow
  - **Risk**: Level of treatment, Permit violation

R/R – Secondary Treatment

Alkalinity Feed System

- Number of units = 2 systems (caustic system , lime system)
- Orangebook R/R
  - None listed
- **Pasco Specific R/R Consideration**
  - Firm capacity in mechanical components with allowance for storage
  - **Risk**: Level of treatment

R/R – Secondary Treatment

Blowers

- Number of units = 4
- Max Month Capacity = 5.7 MGD R&R limit, 7.6 MGD Capacity limit
- Orangebook R/R
  - There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed.
- **Pasco Specific R/R Consideration**
  - Orangebook as minimum as this is a similar to firm capacity
  - **Risk**: Level of treatment, Permit violation

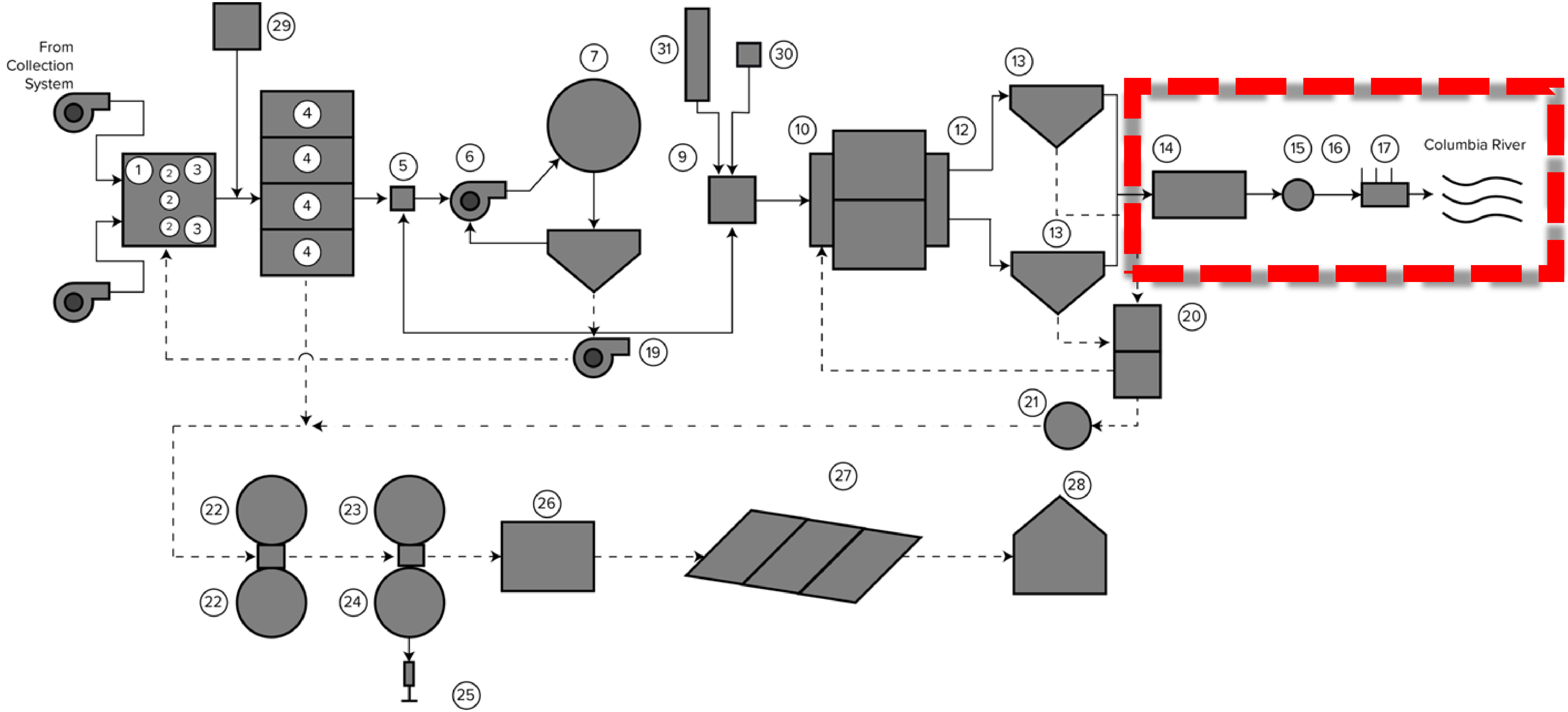
R&R – Secondary Treatment

- Air Diffusers
  - Number of units = Grid layout in multiple sections
  - Max Month Capacity = 7.0 MGD
  - Orangebook R&R
    - The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.
  - **Pasco Specific R/R Consideration**
    - Orangebook as minimum
    - **Risk**: Level of treatment, Permit violation

R/R – Secondary Treatment

Secondary Clarifiers

- Number of units = 2
- Max Month Capacity = 6.5 MGD
- Orangebook R/R
    - The units shall be sufficient in number and size so that, with the largest- flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow.
- **Pasco Specific R/R Consideration**
    - Firm Capacity - with largest unit offline, able to pass/treat MM flow
    - **Risk**: Level of treatment, Permit violation


From Collection System
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Columbia River
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31

End Use

R/R – End Use

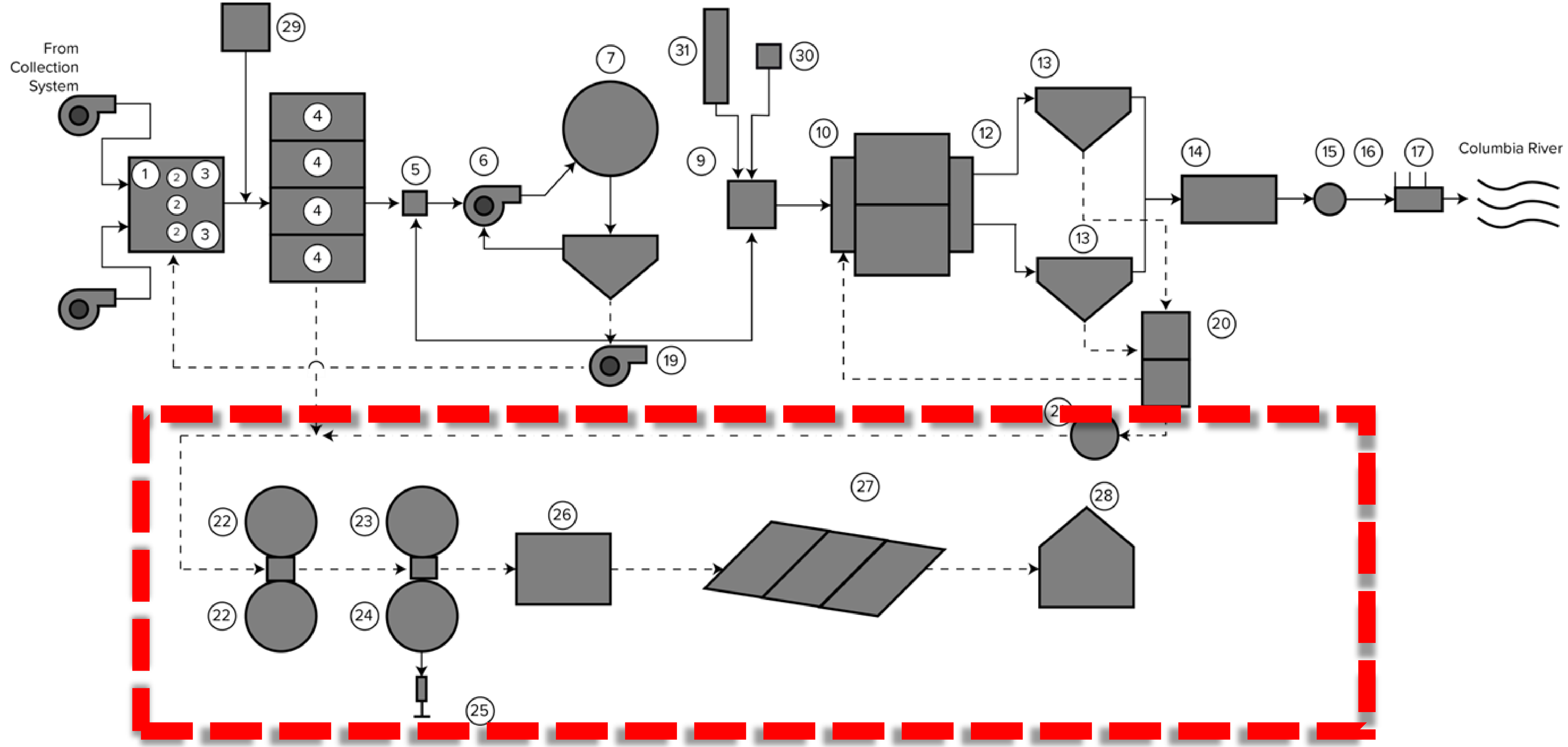
UV Disinfection

- Number of units = 6
- Max Month Capacity = 19.1 MGD
- Orangebook R/R
  - The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the total design flow.
- **Pasco Specific R/R Consideration**
  - With largest bank offline in each channel, able to treat design flow
  - **Risk**: Level of treatment, Permit violation

R/R – End Use

Outfall and diffuser

- Number of units = 1
- Max Month Capacity = 5.9 MGD
- Orangebook R/R
  - None listed
- **Pasco Specific R/R Consideration**
  - Typical for plants to have only one gravity outfall
  - **Risk**: Loss of containment/UV flooding



Solids Treatment

R/R - Solids

Pump Station- Primary Sludge, Intermediate Sludge, RAS/WAS

- Number of units = Multiple
- Orangebook R/R
  - A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.
- **Pasco Specific R/R Consideration**
  - Orangebook
  - **Risks**: Increased O&M

R/R - Solids

Dissolved Air Floatation Thickener (DAFT)

- Number of units = 1
- Max Month Capacity = 6.7 MGD
- Orangebook R/R
  - None listed
- **Pasco Specific R/R Consideration**
  - Redundancy in equipment/process- At least two units or flow back to headworks to capture in the PC.
  - **Risk**: Increased O&M

R/R - Solids

Anaerobic Digester

- Number of units = 2
- Max Month Capacity
  - 6.4 w/o recuperative thickening
  - 7.2 w/ recouperative thickening
- Orangebook R/R
  - None Listed
- **Pasco Specific R/R Consideration**
  - Firm Capacity - with largest unit offline, able to maintain 15 day SRT
  - **Risk**: Economics to handle solids of lower quality

R/R - Solids

Sludge Storage

- Number of units = 1
- Max Month Capacity = dependent on operations
- Orangebook R/R
  - None Listed
- **Pasco Specific R/R Consideration**
  - **Risk**: Increased O&M

Gas Storage

- Number of units = 1
- Max Month Capacity = dependent on operations
- Orangebook R/R
  - None Listed
- **Pasco Specific R/R Consideration**
  - **Risk**: excess biogas disposal

R/R - Solids

Rotary Screen Thickener (RST)

- Number of units = 1
- Max Month Capacity = 8.0 MGD
- Orangebook R/R
  - None Listed
- **Pasco Specific R/R Consideration**
  - Redundancy in equipment/process - at least two units or another methods to handle solids.
  - **Risk**: Increased O&M

R/R - Solids

Drying Beds

- Number of units = Multiple
- Max Month Capacity = 9.2 MGD
- Orangebook R/R
  - None Listed
- **Pasco Specific R/R Consideration**
  - Firm Capacity - with largest unit offline, able to pass/treat MM flow
  - Biosolids Storage Building provides some flexibility
  - **Risk**: Increased O&M

R/R – Other Systems

Power/Electrical

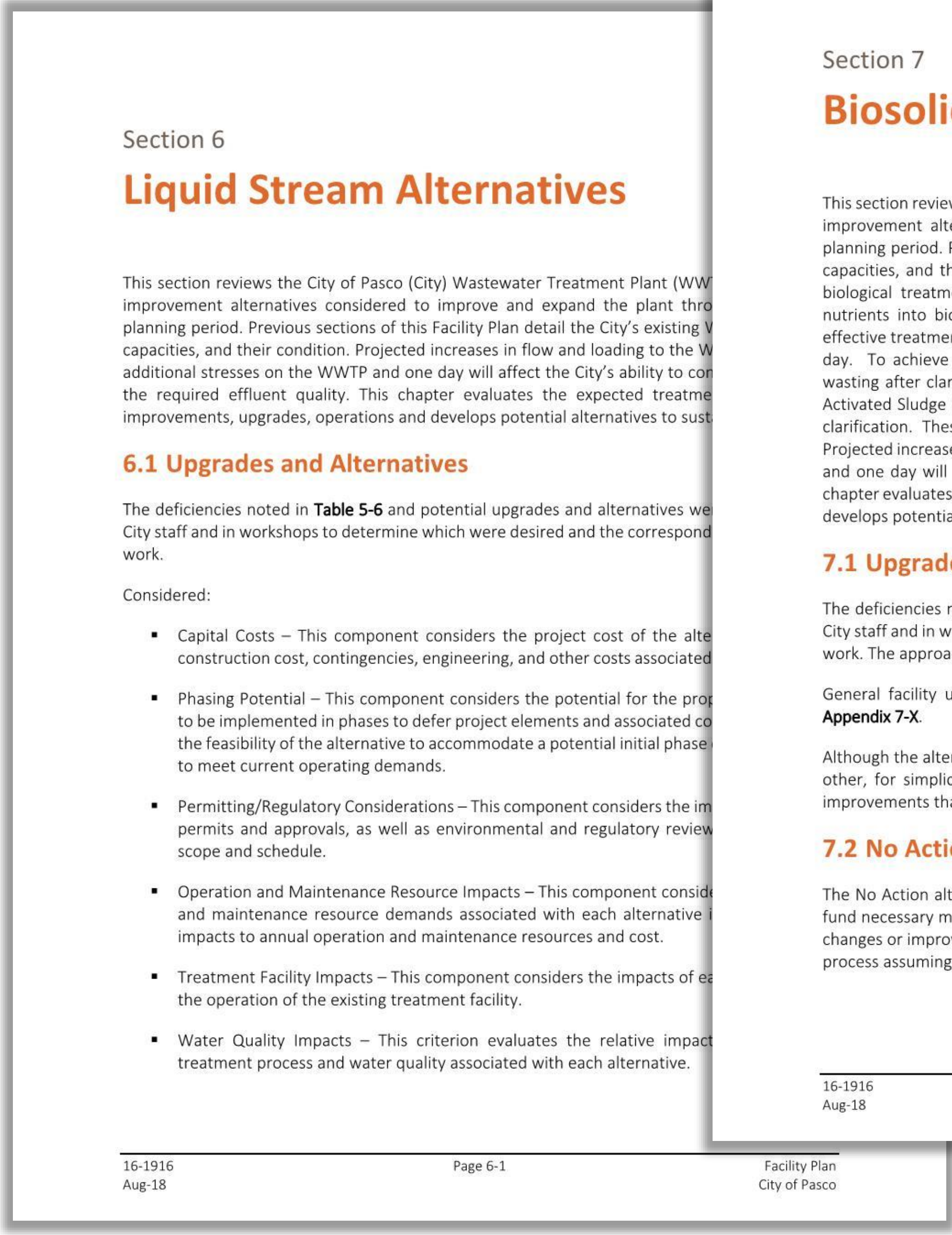
- Orangebook R/R - Two separate sources or works-based generators
- **Pasco Specific R/R Consideration**

Instrumentation and Control (I&C)

- Orangebook R/R – nothing listed
- **Pasco Specific R/R Consideration**

Deficiency Alternatives Overview

SECTION 6 & 7



Section 6

Liquid Stream Alternatives

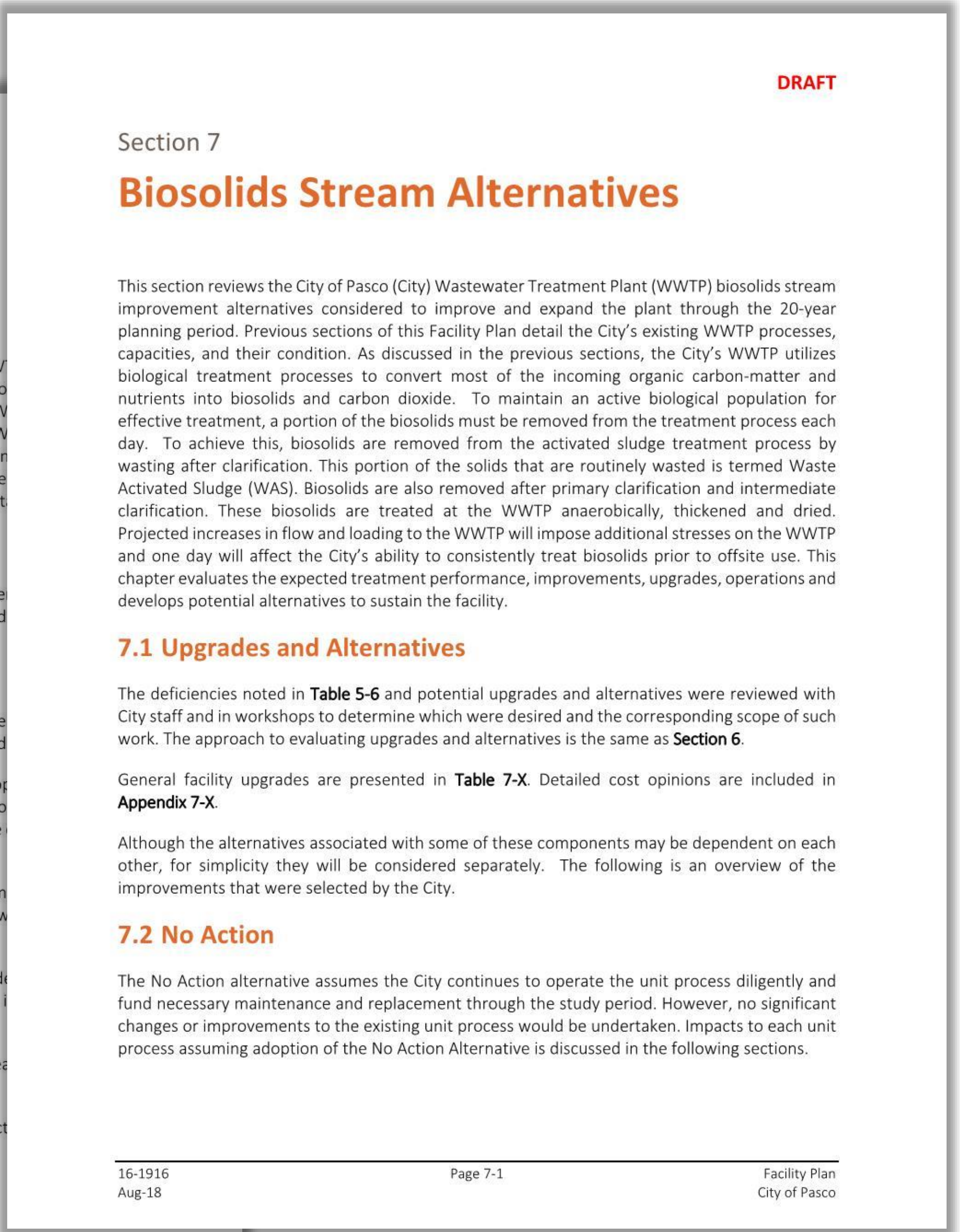
This section reviews the City of Pasco (City) Wastewater Treatment Plant (WW
improvement alternatives considered to improve and expand the plant thro
planning period. Previous sections of this Facility Plan detail the City's existing W
capacities, and their condition. Projected increases in flow and loading to the W
additional stresses on the WWTP and one day will affect the City's ability to co
the required effluent quality. This chapter evaluates the expected treatme
improvements, upgrades, operations and develops potential alternatives to sust

6.1 Upgrades and Alternatives

The deficiencies noted in **Table 5-6** and potential upgrades and alternatives we
City staff and in workshops to determine which were desired and the correspond
work.

Considered:

- Capital Costs – This component considers the project cost of the alte construction cost, contingencies, engineering, and other costs associated
- Phasing Potential – This component considers the potential for the prop to be implemented in phases to defer project elements and associated co the feasibility of the alternative to accommodate a potential initial phase to meet current operating demands.
- Permitting/Regulatory Considerations – This component considers the im permits and approvals, as well as environmental and regulatory review scope and schedule.
- Operation and Maintenance Resource Impacts – This component conside and maintenance resource demands associated with each alternative i impacts to annual operation and maintenance resources and cost.
- Treatment Facility Impacts – This component considers the impacts of ea the operation of the existing treatment facility.
- Water Quality Impacts – This criterion evaluates the relative impact treatment process and water quality associated with each alternative.



Section 7

Biosolids Stream Alternatives

This section reviews the City of Pasco (City) Wastewater Treatment Plant (WWTP) biosolids stream improvement alternatives considered to improve and expand the plant through the 20-year planning period. Previous sections of this Facility Plan detail the City's existing WWTP processes, capacities, and their condition. As discussed in the previous sections, the City's WWTP utilizes biological treatment processes to convert most of the incoming organic carbon-matter and nutrients into biosolids and carbon dioxide. To maintain an active biological population for effective treatment, a portion of the biosolids must be removed from the treatment process each day. To achieve this, biosolids are removed from the activated sludge treatment process by wasting after clarification. This portion of the solids that are routinely wasted is termed Waste Activated Sludge (WAS). Biosolids are also removed after primary clarification and intermediate clarification. These biosolids are treated at the WWTP anaerobically, thickened and dried. Projected increases in flow and loading to the WWTP will impose additional stresses on the WWTP and one day will affect the City's ability to consistently treat biosolids prior to offsite use. This chapter evaluates the expected treatment performance, improvements, upgrades, operations and develops potential alternatives to sustain the facility.

7.1 Upgrades and Alternatives

The deficiencies noted in **Table 5-6** and potential upgrades and alternatives were reviewed with City staff and in workshops to determine which were desired and the corresponding scope of such work. The approach to evaluating upgrades and alternatives is the same as **Section 6**.

General facility upgrades are presented in **Table 7-X**. Detailed cost opinions are included in **Appendix 7-X**.

Although the alternatives associated with some of these components may be dependent on each other, for simplicity they will be considered separately. The following is an overview of the improvements that were selected by the City.

7.2 No Action

The No Action alternative assumes the City continues to operate the unit process diligently and fund necessary maintenance and replacement through the study period. However, no significant changes or improvements to the existing unit process would be undertaken. Impacts to each unit process assuming adoption of the No Action Alternative is discussed in the following sections.

Alternatives Discussion

Common No Action Alternative

- The No Action alternative assumes the City continues to operate the unit process diligently and fund necessary maintenance and replacement through the study period. However, no significant changes or improvements to the existing unit process would be undertaken.

Focus Today

- Deficient Liquids and Biosolids Train Unit Processes (*handouts*)
- Alternative Screening (*consultant perspective*)

Focus Later

- Composite solutions, staging and costs
- Other Improvements (Admin/Lab, Electrical, & I/C)

- *Power recovery/generation, CNG, water reuse, biosolids farm, etc. EXCLUDED*

City Objectives Survey Results

- City WWTP Improvement goals/objectives/preferences
- **Criteria and Weighting Results**
  - Future Uncertainty/Flexibility 42.0%
  - Functional/Operational 29.4%
  - Economic 21.3%
  - Societal 3.7%
  - Environmental 3.5%

Rating Scale

Very Strongly Disfavor	Strongly Disfavors	Disfavor	Slightly Disfavor	Equal	Slightly Favor	Favor	Strongly Favor	Very Strongly Favor
-4	-3	-2	-1	0	1	2	3	4

PART 2

TREATMENT TECHNOLOGIES OR PROCESSES

Completed by:

Date: 4-9-18

Under each unit process area below, please list any treatment technologies or processes that you would like to have considered as a WWTP improvement alternative. To give context, examples are provided for each unit process area listed based on past conversations with the City and our work with other similar municipalities.

Primary Treatment

Influent Screening

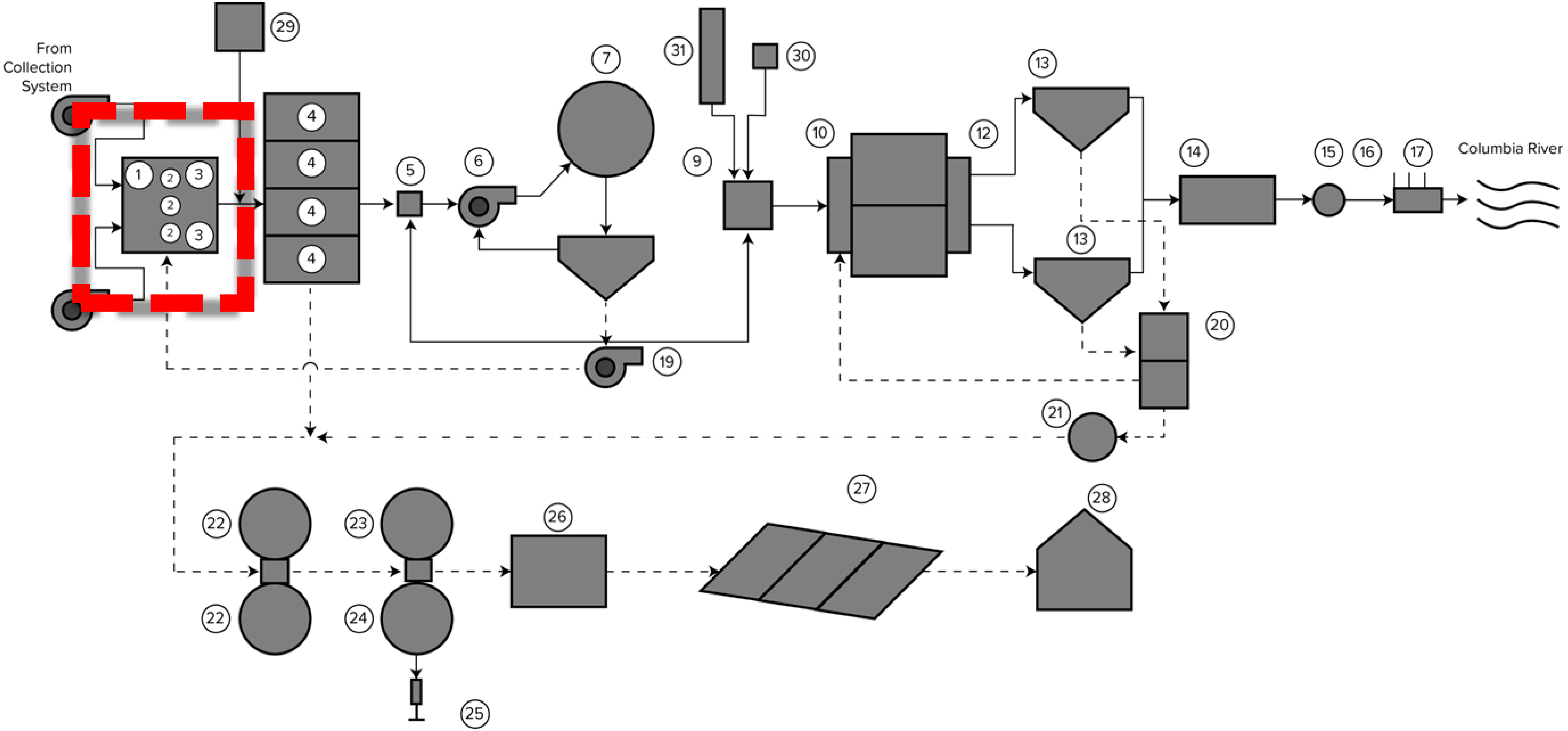
EXAMPLE – New mechanical screen for 3rd/redundant screen channel

1. New Mechanical Screen For Channel #2 (replace Bar Screen)
2.
3.
4.

Grit Removal

EXAMPLE – HeadCell® stacked tray grit / sand separator

1. Replace existing Grit Removal w/more efficient separation
2. Replace Piping (primarily 90° elbows)
3.
4.



Preliminary Treatment

Preliminary Treatment Alternatives

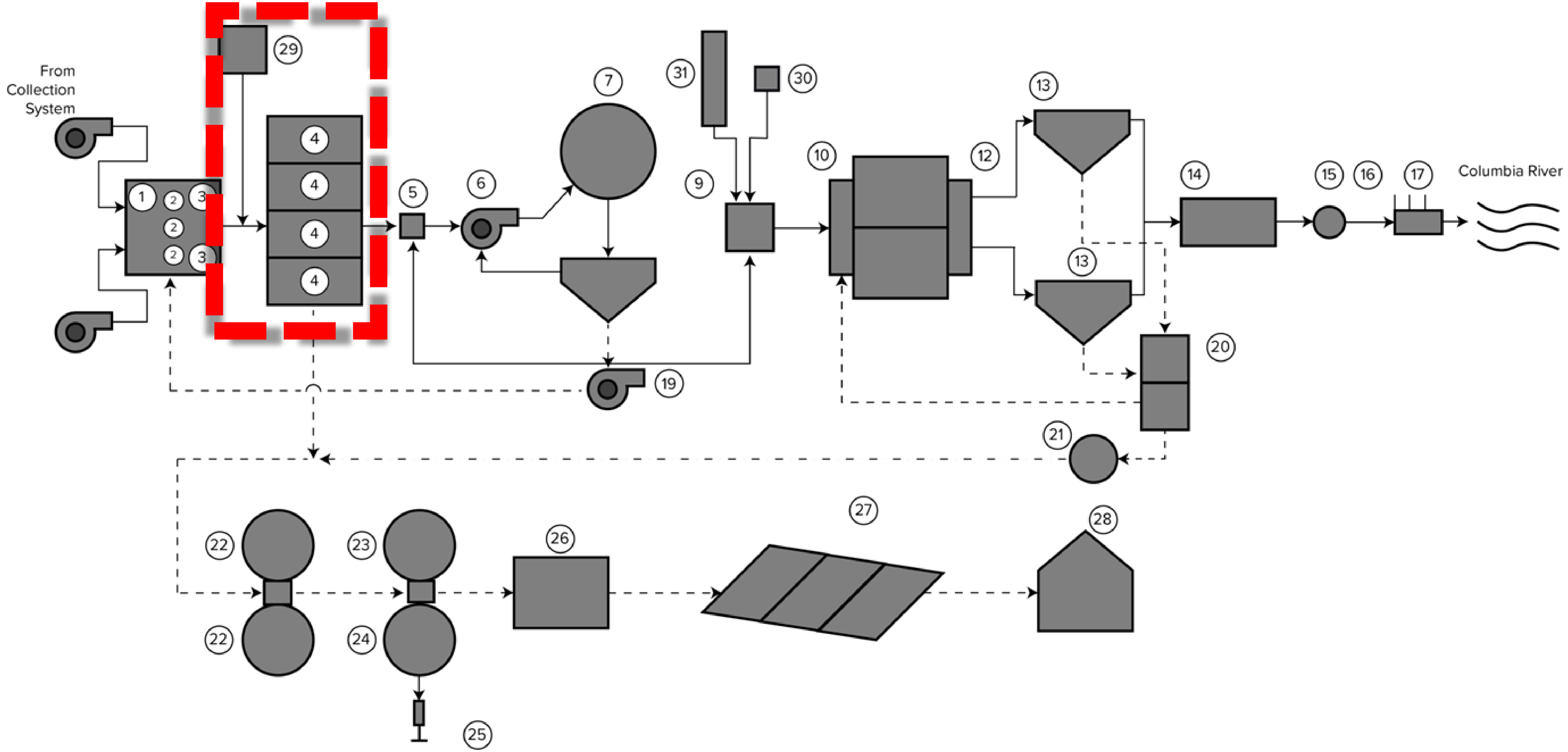
Screens

- At end of planning Horizon, so no alternatives, just allowance

- Replace reciprocating screen with perforated plate screen
- Expand headworks south to increase number of screening units beyond three

Grit

- Not deficient
- Expand headworks south to increase number of grit units



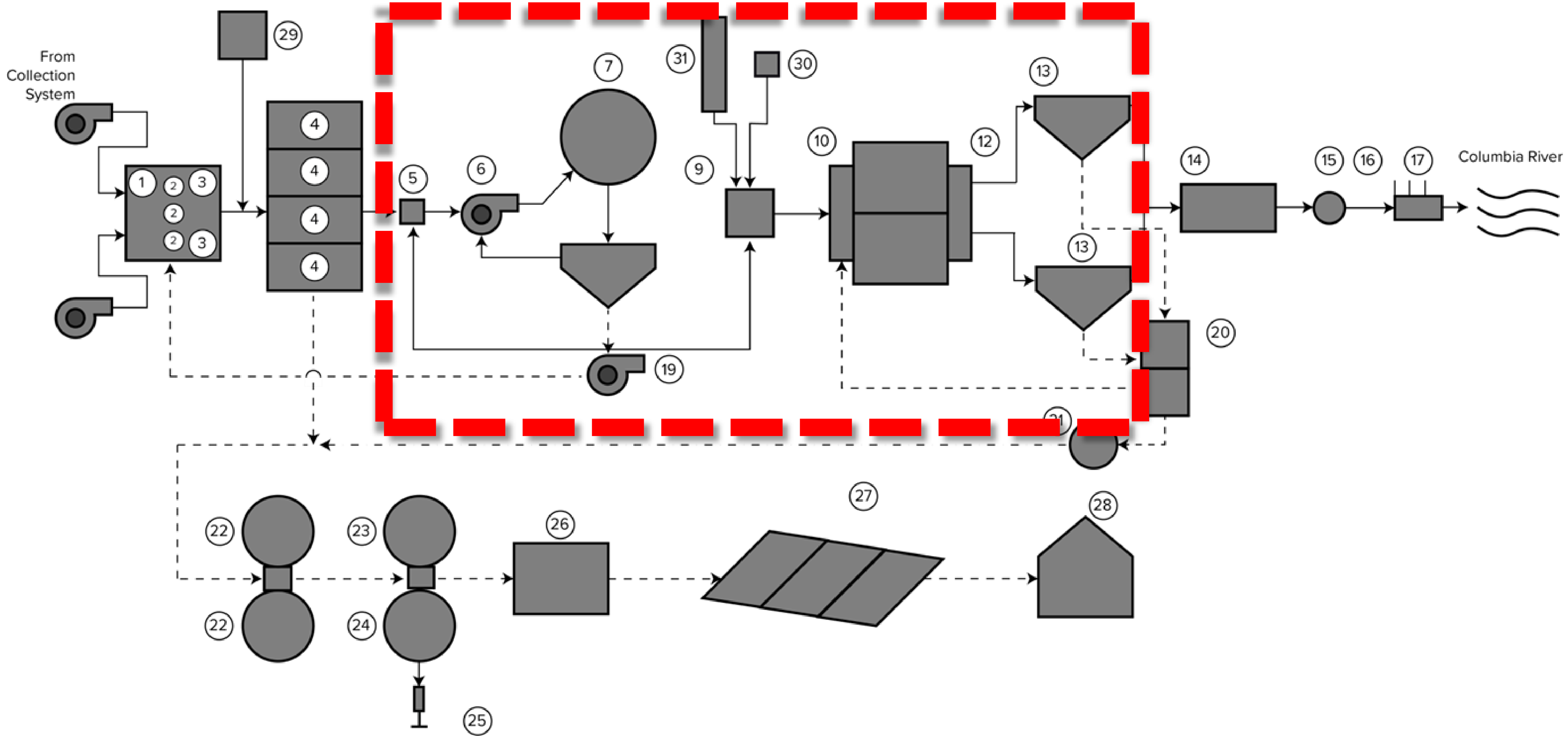
Primary Treatment

Primary Treatment Alternatives

No improvements needed

Discussion Items:

- Cosettling Grit/Gravity Thickener
- CEPT Future
  - Use near term
  - Keep for phasing and long term safety factor



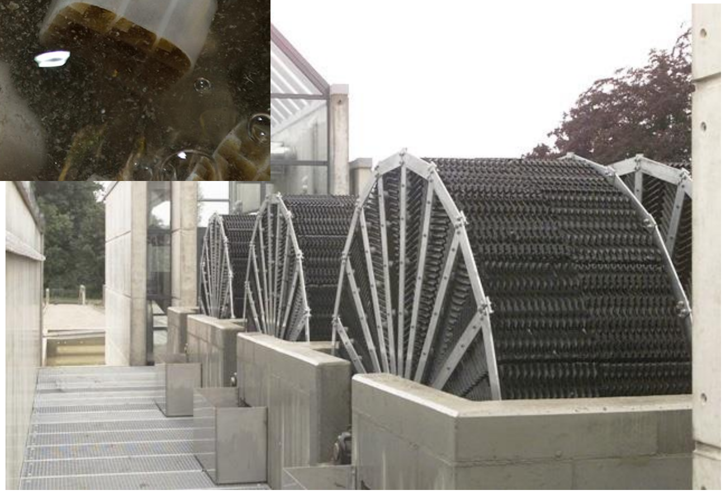
Secondary Treatment

Secondary Treatment Alternatives

~~**BOD only treatment**~~

Attached Growth (fixed film) Biological Treatment

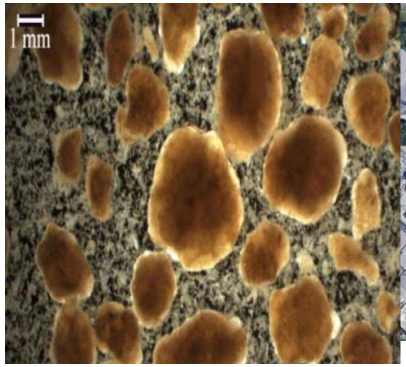
- ~~Trickling Filters Only~~
- ~~Moving Bed Biological Reactor~~
- ~~Rotating Biological Contactor~~

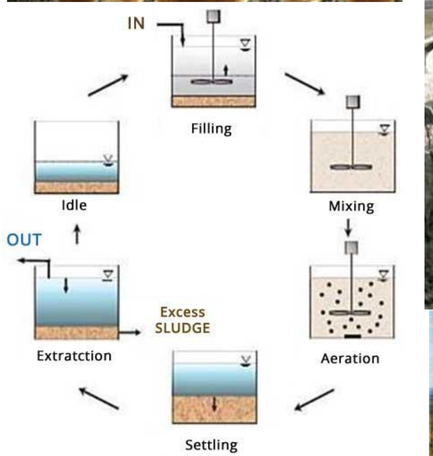


Secondary Treatment Alternatives

Suspended Growth Biological Treatment

- ~~Activated Sludge (AS) – Complete Mix~~
- AS – Plug Flow
- ~~AS – Step Feed~~
- ~~AS – with Granular Sludge~~
- ~~Oxidation Ditch~~
- ~~Deep Shaft Aeration Basin~~
- Membrane Bioreactor
- ~~Sequencing Batch Reactor – Conventional~~
- ~~Sequencing Batch Reactor – Granular Sludge~~
- ~~Lagoons~~

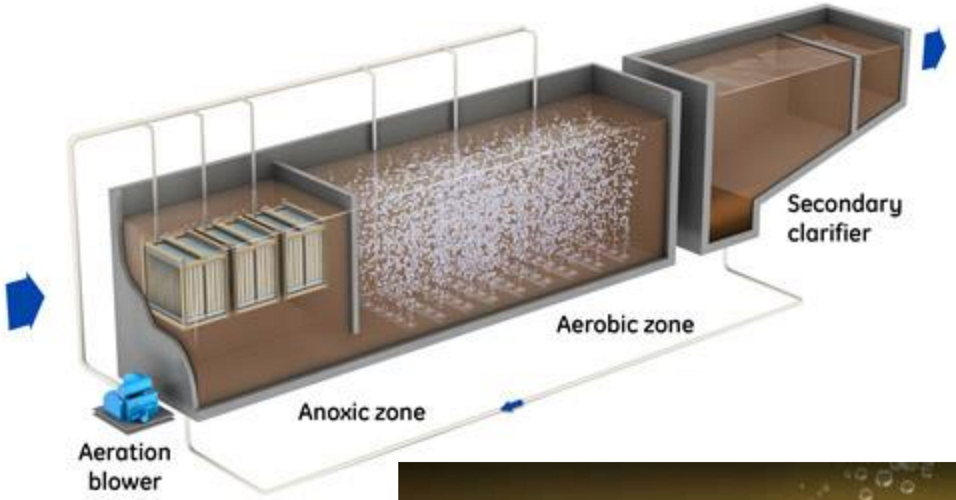




Secondary Treatment Alternatives

Combined Suspended and Fixed Growth Biological Treatment

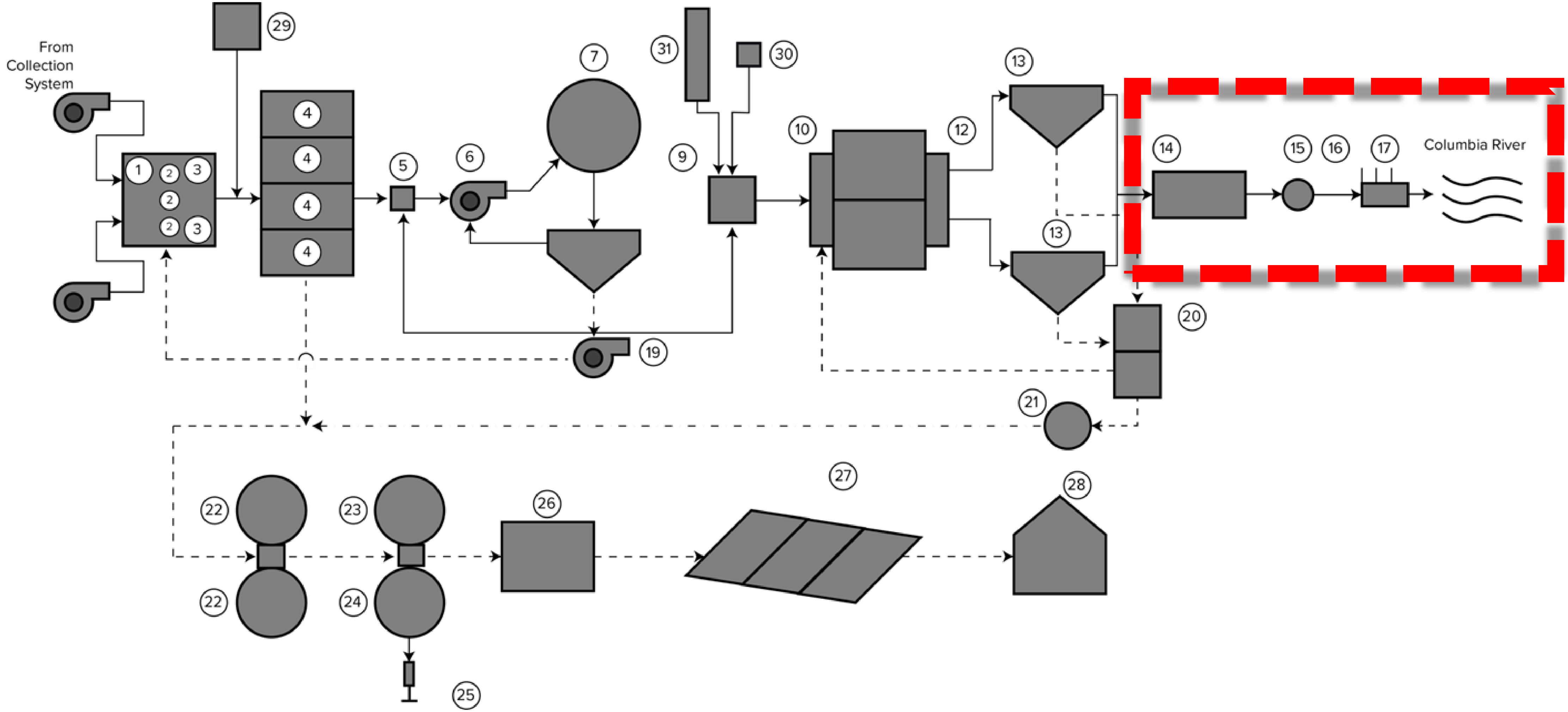
- Internal Fixed Film Activated Sludge
- Zeelung Membrane
- Trickling Filter/Activated Sludge



Secondary Treatment Alternatives

Secondary Solids Separation

- Secondary Clarifier
- ~~Dissolved Air Flotation~~
- ~~Tertiary Filtration~~
- ~~Ballasted Settling~~



From Collection System
1
2
2
2
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4
4
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29
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Columbia River
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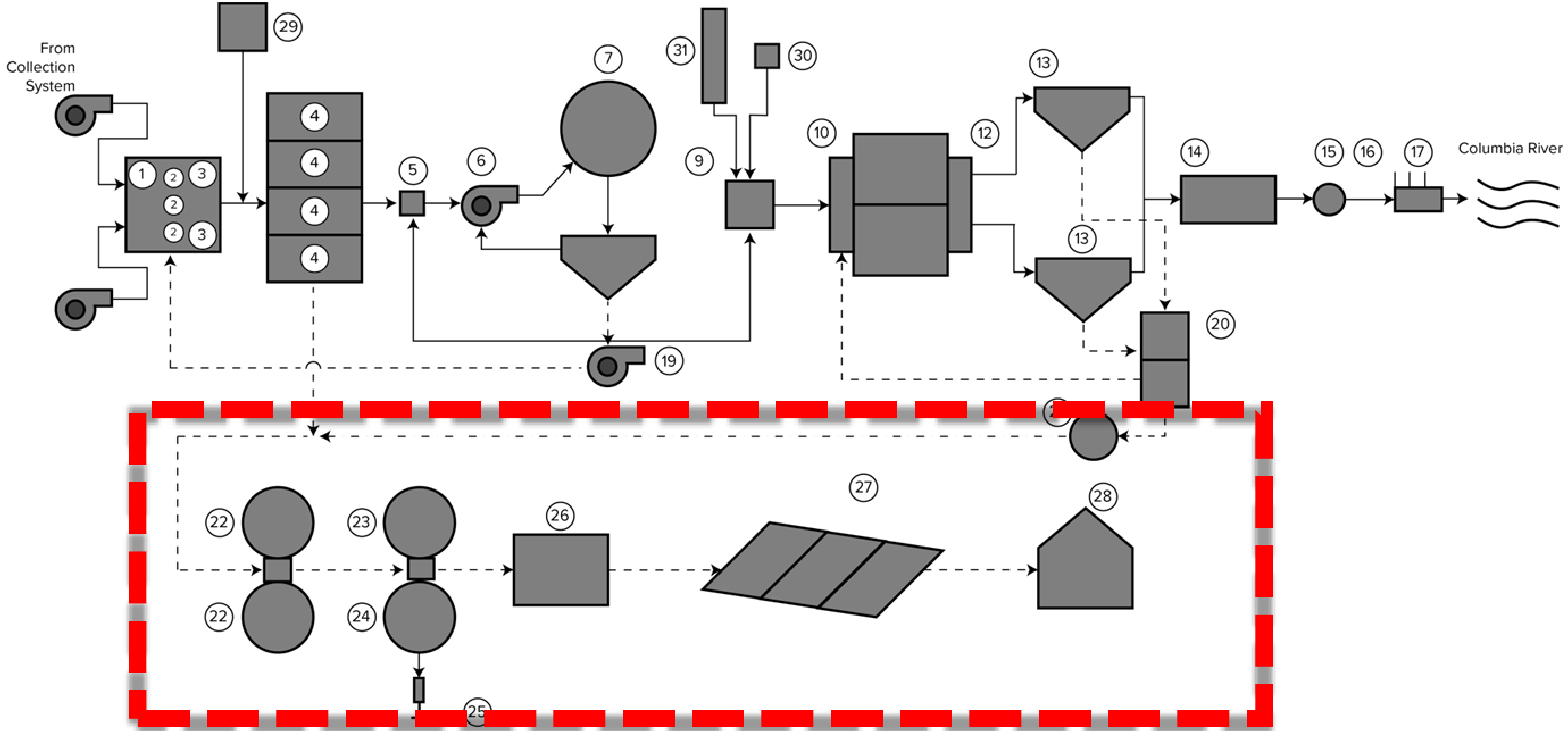
21
22
22
23
24
25
26
27
28

End Use

End-Use Alternatives

Treated WW Reuse/End-Use

- Gravity Pipeline and in river diffuser
- Effluent lift station, pressure pipeline, and diffuser
- ~~Reuse System (urban)~~
- ~~Rapid Infiltration~~
- ~~Land Application (agricultutral)~~



Solids Treatment

Solids Treatment Alternatives

WAS Thickening

- ~~No Thickening~~
- Co-settling
- Mechanical Thickening
- Dissolved Air Flotation

Solids Treatment Alternatives

Solids Stabilization

- Anaerobic Digestion
- Anaerobic Digestion with Recuperative Thickening
- Chemical/Thermal Hydrolysis
- ~~Aerobic Digestion~~
- ~~Cannibal Process™~~
- ~~Lime Stabilization~~
- ~~No Stabilization – Landfill~~
- ~~Incineration~~
- ~~Thermal Drying~~

Solids Treatment Alternatives

Solids Finishing

- Mechanical Thicken prior to Drying Beds
- Mechanically Dewater only
- Mechanical Dewater prior to Drying Beds
- Drying Beds with Greenhouse
- Dewater prior to Drying Beds with Greenhouse
- ~~Vacuum assisted Drying Beds~~
- Composting
- ~~Lagoon~~
- ~~Thermal Drying~~

Secondary Treatment

1. MBR
2. AS – Plug Flow
3. IFAS
4. TF/AS

Secondary Separation

1. Secondary Clarifiers (if needed)

Effluent End-Use

1. Gravity
2. Lift Station

WAS Thickening

1. Mechanical Thickening
2. DAFT
3. Co-settle

Solids Stabilization

1. Anaerobic Digestion
2. AD w/ Recup. Thickening
3. Chemical/Thermal Hydrolysis

Solids Finishing

1. Mechanical Dewater/Drying Beds
2. Mechanical Thicken/Drying Beds
3. Mechanical Dewater/Greenhouse
4. Composting

Consultant Scoring

Project Next Steps

Next Steps Continued…

- Workshop 3 – Deficiency Alternative Refinement & Selection
- WWTP Visits *(# and timing TBD)*
- Council/Public presentations *(# and timing TBD)*
- Draft CIP Development
- City Financial Analysis/Final CIP
- Finalize Facility Plan Section 6, 7, and 8 Documentation
- City Document Review
- Ecology/Federal Cross-Cutter Document Review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APPENDIX 6-4

City of Pasco

WWTP Facility Plan

Workshop 3: WWTP Improvement Alternatives

Presented by: Craig Anderson, Mark Cummings, Dale Richwine & Tracy Cork

November 28, 2018

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WELCOME & INTRODUCTIONS

1. **Looking Back**: Project Review & Update
2. **Improvement Alternative Comparisons**
3. **Project Next Steps** – Capital Improvement Plan

AGENDA

LOOKING BACK:
Project Review & Update

Facility Plan Sections

01 Introduction

02 Existing Conditions — General

03 Existing Conditions — WWTP

04 Capacity Analysis

05 Future Conditions

Draft Document Developed (previous workshops)

06 Liquids Stream Alternatives

07 Solids Stream Alternatives

Today

08 Project Implementation

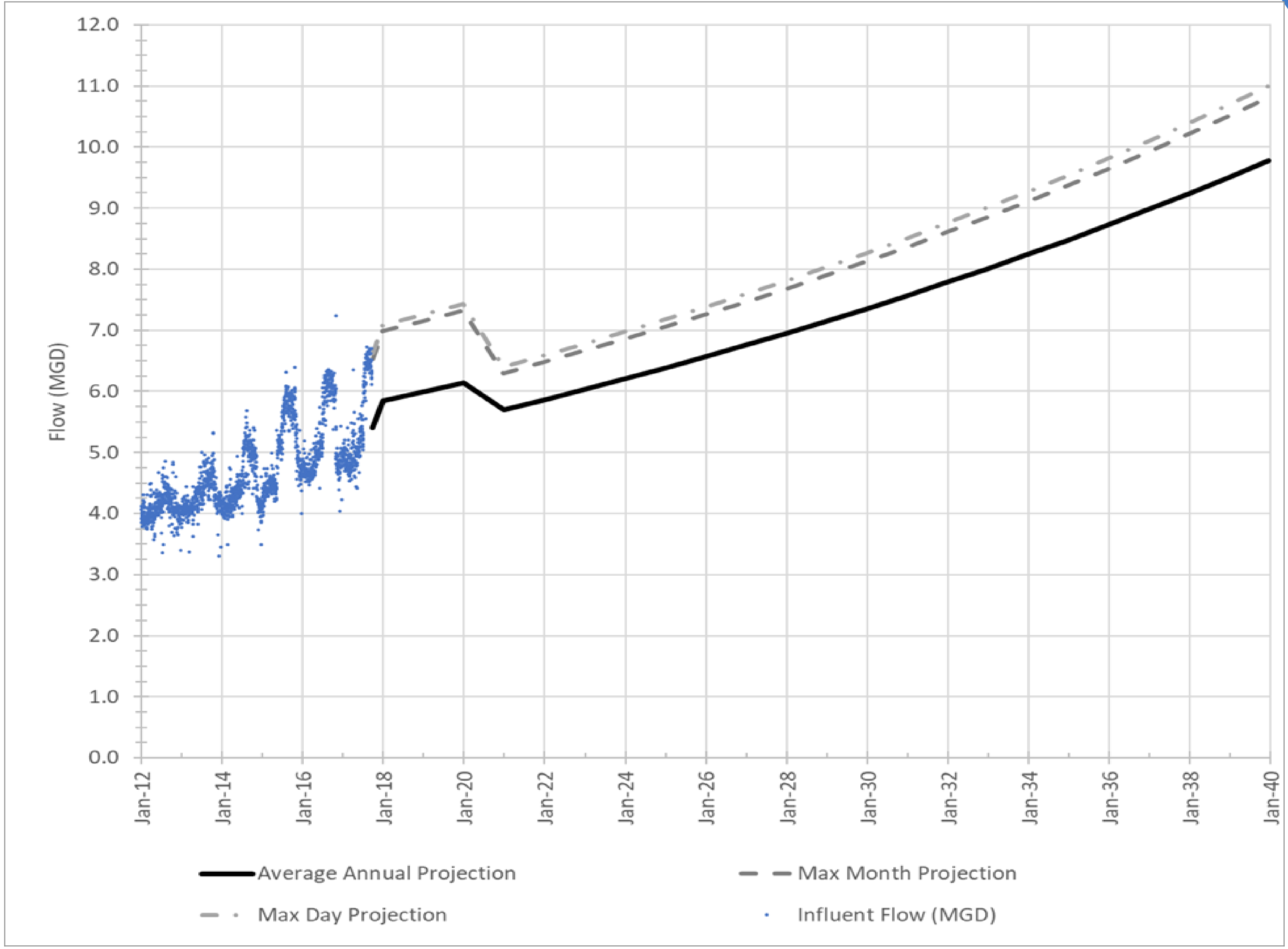
Future Work

Future Flow and Loads (2040)

- Municipal Component
- Industrial Component
- Commitments

- Overall Average Annual
  - 5.9 MGD now
  - 9.8 MGD 2040

- **Overall Max Month**
  - 6.5 MGD now
  - **10.9 MGD 2040**



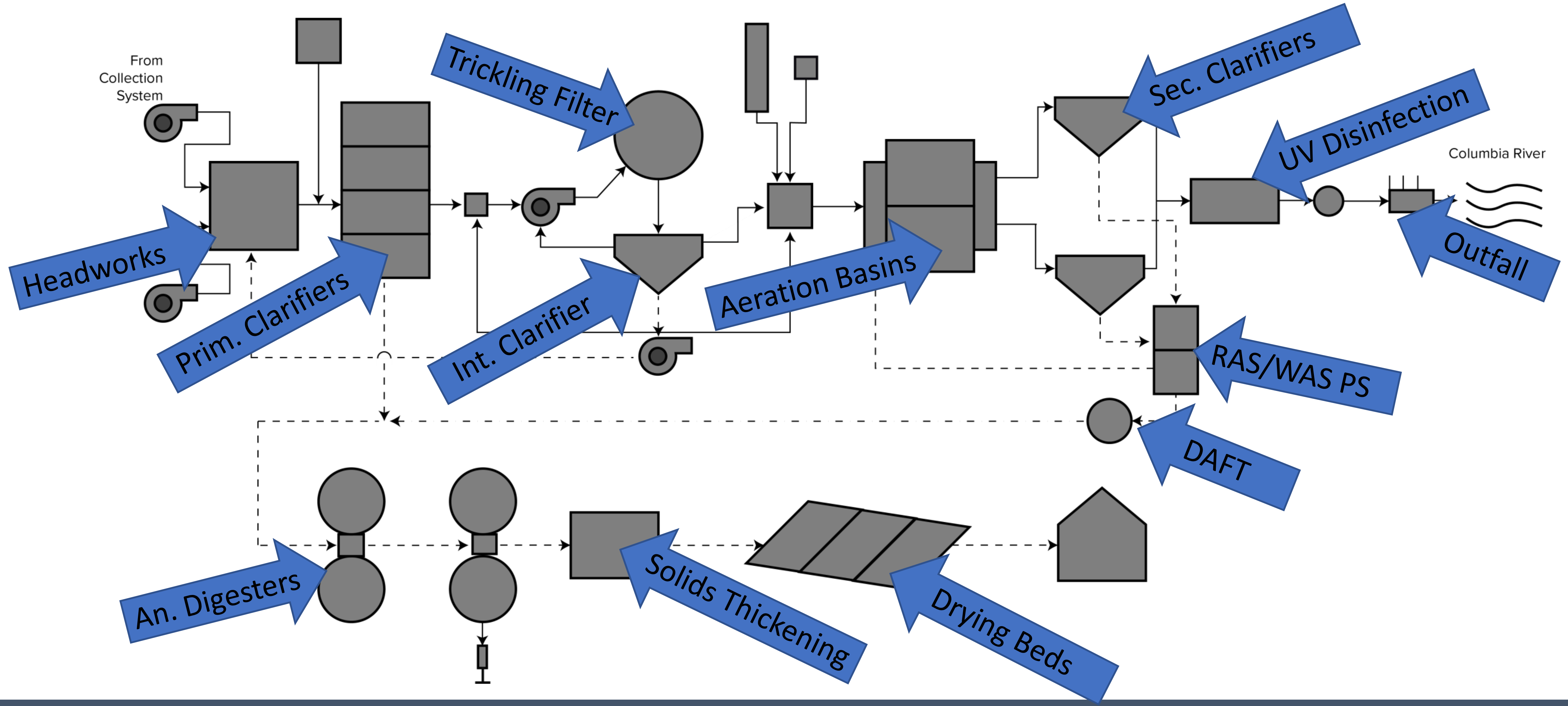
WWTP Aerial

Item	Description
1	Headworks
2	Screen
3	Grit Removal
4	Primary Clarifier
5	PC Effluent Box
6	Trickling Filter Recirculation Pump Station
7	Trickling Filter
8	Intermediate Clarifier
9	ICE Box

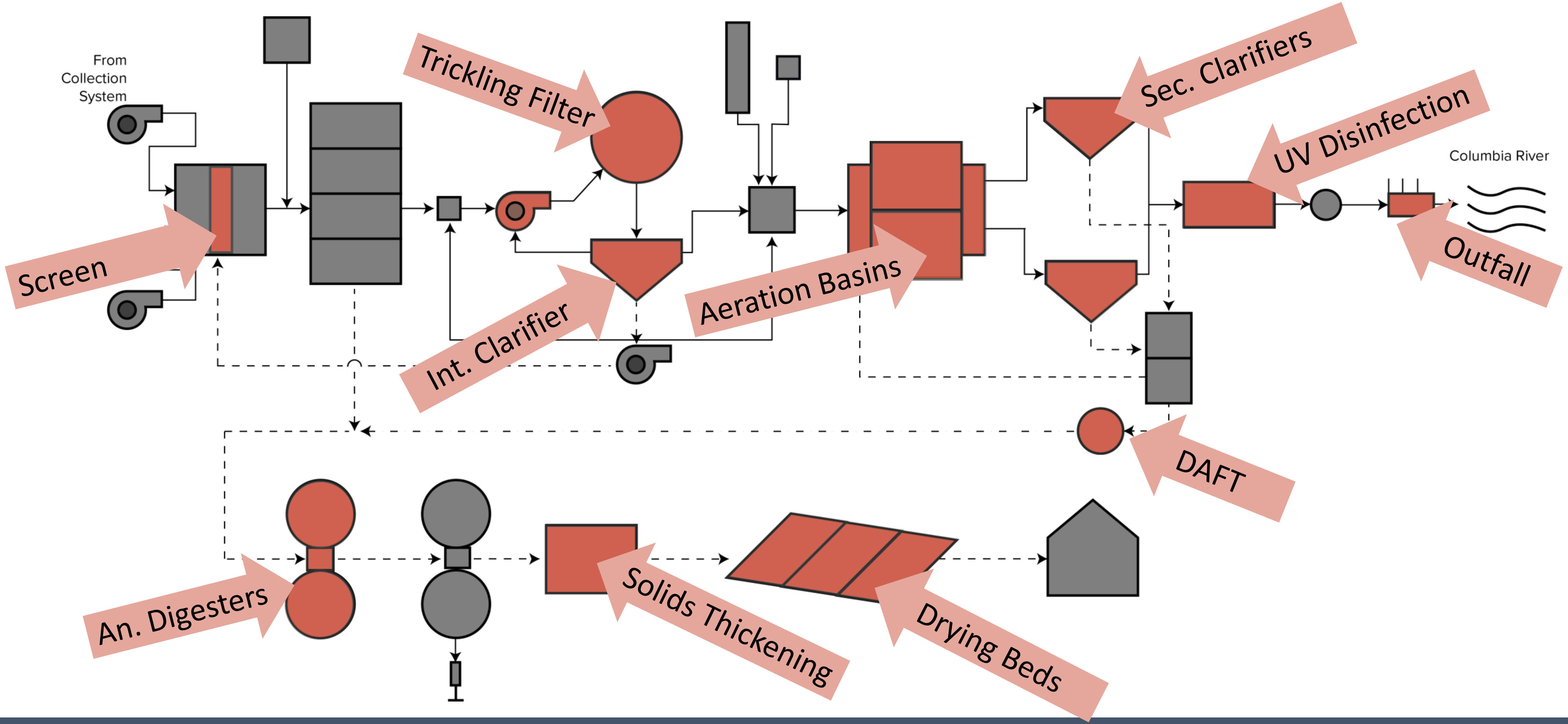
Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River (not pictured)
17	Columbia River Diffuser (not pictured)
18	Primary Sludge Pump Station

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
23	Sludge Storage
24	Gas Storage
25	Flare
26	Solids Thickening
27	Drying Bed

Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building
33	Laboratory
34	Blower Building
35	Machine Shop (not pictured)
36	Equipent Building



Existing Facility Schematic



Identified Deficiency

Reliability and Redundancy Review

- **Firm Capacity**
  - Secondary Treatment
  - Secondary Clarifiers
  - UV Disinfection
  - Alkalinity Feed System
  - Anaerobic Digestion
  - WAS Thickening
  - Biosolids Dewatering
- **Orangebook as Minimum**
  - Screening
  - Primary Clarifier
  - Blowers
  - Air diffusers
  - Pump Stations
- **Single Unit Operation Allowable**
  - Effluent Flow Meter
  - Outfall
  - Sludge Storage
  - Gas Storage
  - Biosolids Storage Building
- **Other Requirement**
  - Grit Removal – Minimum of Two Units

IMPROVEMENT ALTERNATIVE COMPARISONS

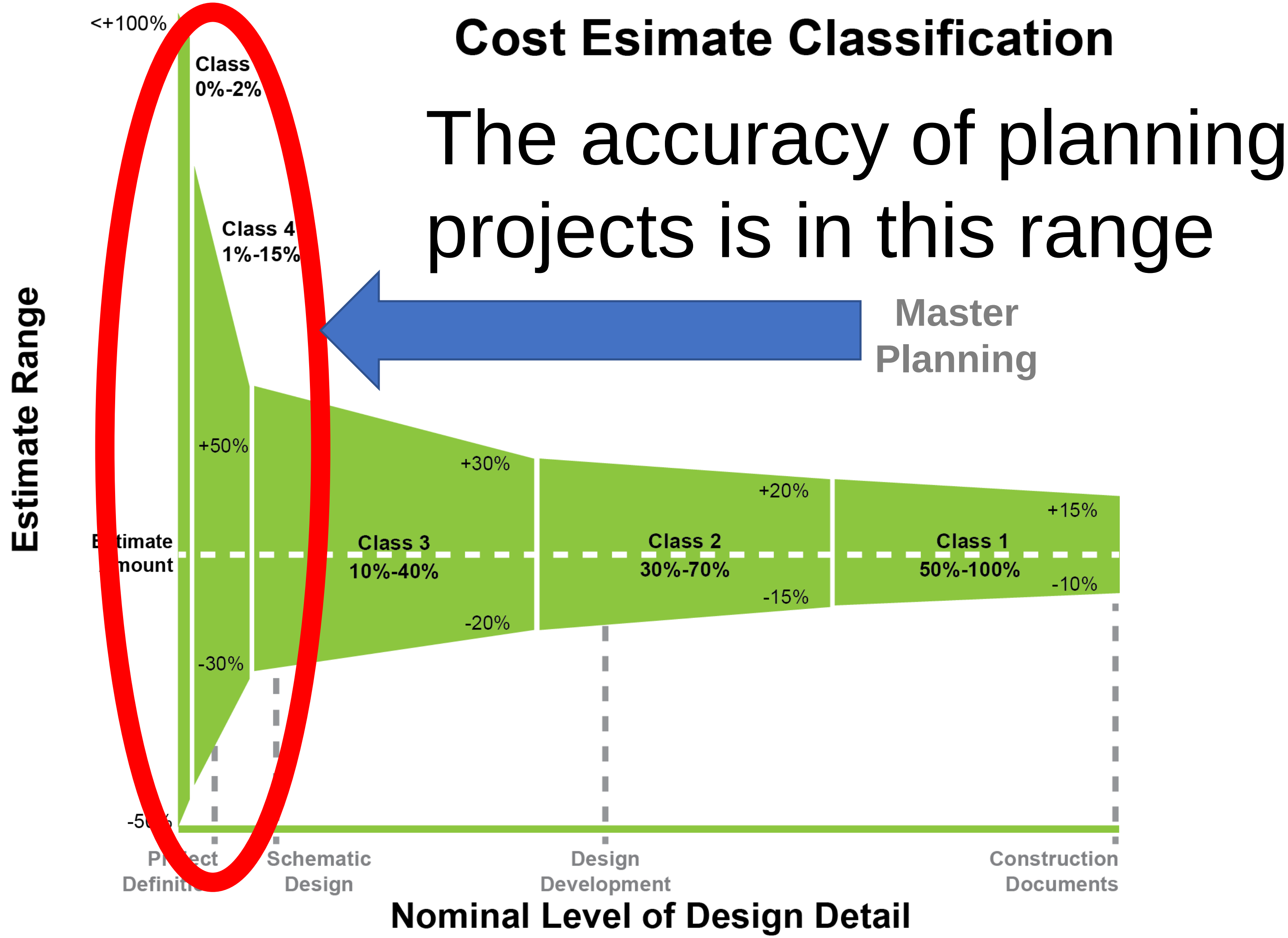
Cost Estimating Overview

General Process	General Description	Alternative	Description	Pasco Feasible	WWTP Size/ Type Typical	Future Uncertainty/ Flexibility (Regs)	Future Uncertainty/ Flexibility (Growth)	Functional/ Operational	Economics (Capital)	Economics (O&M)	Societal	Environment	Additional Factors			Pasco Alternative Preference
Attached Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth on media (fixed film).	Trickling Filters Only	Biological growth covered media filled tower with natural or force ventilated pore space that is dosed with wastewater on regular basis.	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Medium footprint	Well Established Technology	$$$	$	Odors if not force ventilated. Potential for flies	Treatment level not consistent with permit				No. Alternative will not satisfy City's needs.
		Moving Bed Biological Reactor (MBBR)	Single pass aeration basins with suspended plastic media based biological growth. Like a submerged trickling filter	No	No		Medium footprint	Newer, but proven technology	$$$	$$$						No. Alternative will not satisfy City's needs.
		Rotating Biological Contactor (RBC)	Rotating partially submerged discs that support biological growth	No	No		Large footprint	Antiquated technology	$$$	$$$						No. Alternative will not satisfy City's needs.
Suspended Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth floating in water suspension. Denitrification and biological phosphorous removal possible with addition of anoxic and anaerobic selectors/zones.	Activated Sludge - Complete Mix	SIMILAR TO EXISTING PASCO WWTP - Aeration basins with less than 4:1 aspect ratio. Typical of early versions of aeration basin technology	No	Yes	Compatible with biological nutrient removal, but not efficient nitrification	Medium footprint	Antiquated technology	$$	$$			short-circuiting	filament growth		No. Alternative will not satisfy City's needs.
		Activated Sludge - Plug Flow	Aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages	Yes	Yes	Compatible with biological nutrient removal	Medium footprint	Well Established Technology	$$$	$$						YES
		Activated Sludge - Step Feed	Aeration basins with staged wastewater feed and RAS to increase overall basin mixed liquor mass.	No	Yes		Small Footprint	Well Established Technology	$$$	$$						No. Alternative not considered feasible
		Activated Sludge - with granular sludge	aeration basin with mixed liquor that is predominantly in a granular form which allows for higher mixed liquor concentration and rapid solids separation	No	Yes	Very compatible with biological nutrient removal	Small Footprint	Emerging Technology	$$$	$$						No. Alternative not considered feasible
		Oxidation Ditch	Circular or oval aeration basin with mixed liquor rotating in a continuous loop.	No	Yes	Compatible with biological nutrient removal	Large footprint	Well Established Technology	$$$	$						No. Alternative not considered feasible
		Deep Shaft Aeration Basin	A deep vertical orientated aeration basin that has a low footprint and high oxygen transfer rate.	No	No		Small Footprint	Novel Technology	$$$	$$$						No. Alternative not considered feasible
		Membrane Bioreactor (MBR)	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent	Yes	Yes		Small Footprint	Established technology	$$$$	$$$$		Higher level treatment	Potentially installed in existing basins/infrastruc ture.	Requires headworks expansion to increase screening removal system capacity and capabilities.	Potential to maintain existing capacity during construction	YES
		Sequencing Batch Reactor - Conventional	Standard mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes		Medium footprint	Well Established Technology	$$$$	$$$				Requires multiple trains to continue treatment process		No. Alternative not considered feasible
		Sequencing Batch Reactor - Granular (Nerada)	Granular Sludge based mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes	Very compatible with biological nutrient removal	Small footprint	Newer technology	$$$$	$$$			Potential patent issues			No. Alternative not considered feasible
		Facultative/partially aerated lagoons	Typically large lined one-pass earthen diked basins that utilize algae and other naturally occurring microbiology to treat wastewater	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Very large footprint	Well Established Technology	$$$$$	$	Attractive Nuisance Odors and Vectors	Waterfowl habitat				No. Alternative will not satisfy City's needs.

Facility Plan Cost Estimating

- **AACEi** (Association for the Advancement of Cost Engineering International)
- **Class of Estimate** – Class 4/5
- **Project Definition** – 0 to 2 %
- **Maturity Level of Project** – Planning
- **Estimating Methodology** – Combination of multiple methods
- **Accuracy Range** – Plus 50% to minus 30%

Facility Plan Cost Estimating



Facility Plan Cost Estimating

Cost Sources

- Vendor Quotes
- Project Experience
- Recent Project Schedule of Values
- RSMeans

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Probable Cost of Construction
Activated Sludge Plug Flow - WWTP Facility Plan

Project: Activated Sludge Plug Flow
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
Anoxic Basin 1							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
Anoxic Basin 2							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
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				SubTotal:			**$585,795**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364

Facility Plan Cost Estimating

Construction Cost Elements

- Major Materials, Labor, & Equipment
- Allowances
  - Power, Electrical, & IC
  - Mechanical
  - Yard Piping
- Tax (8.6%)
- Mobilization/Demobilization/GC (10%)
- Prevailing Wage (factor)
- Contractor's Overhead and Profit (15%)
- Contingency (30%)

Total Project Cost

- Engineering (25% - design and construction)
- Legal and Administrative (5%)

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Probable Cost of Construction
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A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364

Operation & Maintenance Comparison

Estimating Operation and Maintenance Cost Methodology

- Liquid – Baseline comparison against Activated Sludge
- Solids – Baseline comparison against Anaerobic Digestion

Operation

- Power
  - Pumps
  - Blowers
  - Mixers
  - Dryers
- Chemical
  - Polymer
  - Lime, Caustic, Ferric Chloride, Sodium Hypochlorite, Citric Acid

Maintenance

- Similar manhours for all alternatives except Drying
- Staff numbers grows with plant flow

Alternative Comparisons

General Process	General Description	Alternative	Description	Pasco Feasible	WWTP Size/ Type Typical	Future Uncertainty/ Flexibility (Regs)	Future Uncertainty/ Flexibility (Growth)	Functional/ Operational	Economics (Capital)	Economics (O&M)	Societal	Environment	Additional Factors			Pasco Alternative Preference
Attached Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth on media (fixed film).	Trickling Filters Only	Biological growth covered media filled tower with natural or force ventilated pore space that is dosed with wastewater on regular basis.	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Medium footprint	Well Established Technology	$$$	$	Odors if not force ventilated. Potential for flies	Treatment level not consistent with permit				No. Alternative will not satisfy City's needs.
		Moving Bed Biological Reactor (MBBR)	Single pass aeration basins with suspended plastic media based biological growth. Like a submerged trickling filter	No	No		Medium footprint	Newer, but proven technology	$$$	$$$						No. Alternative will not satisfy City's needs.
		Rotating Biological Contactor (RBC)	Rotating partially submerged discs that support biological growth	No	No		Large footprint	Antiquated technology	$$$	$$$						No. Alternative will not satisfy City's needs.
Suspended Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth floating in water suspension. Denitrification and biological phosphorous removal possible with addition of anoxic and anaerobic selectors/zones.	Activated Sludge - Complete Mix	SIMILAR TO EXISTING PASCO WWTP - Aeration basins with less than 4:1 aspect ratio. Typical of early versions of aeration basin technology	No	Yes	Compatible with biological nutrient removal, but not efficient nitrification	Medium footprint	Antiquated technology	$$	$$			short-circuiting	filament growth		No. Alternative will not satisfy City's needs.
		Activated Sludge - Plug Flow	Aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages	Yes	Yes	Compatible with biological nutrient removal	Medium footprint	Well Established Technology	$$$	$$						YES
		Activated Sludge - Step Feed	Aeration basins with staged wastewater feed and RAS to increase overall basin mixed liquor mass.	No	Yes		Small Footprint	Well Established Technology	$$$	$$						No. Alternative not considered feasible
		Activated Sludge - with granular sludge	aeration basin with mixed liquor that is predominantly in a granular form which allows for higher mixed liquor concentration and rapid solids separation	No	Yes	Very compatible with biological nutrient removal	Small Footprint	Emerging Technology	$$$	$$						No. Alternative not considered feasible
		Oxidation Ditch	Circular or oval aeration basin with mixed liquor rotating in a continuous loop.	No	Yes	Compatible with biological nutrient removal	Large footprint	Well Established Technology	$$$	$						No. Alternative not considered feasible
		Deep Shaft Aeration Basin	A deep vertical orientated aeration basin that has a low footprint and high oxygen transfer rate.	No	No		Small Footprint	Novel Technology	$$$	$$$						No. Alternative not considered feasible
		Membrane Bioreactor (MBR)	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent	Yes	Yes		Small Footprint	Established technology	$$$$	$$$$		Higher level treatment	Potentially installed in existing basins/infrastructure.	Requires headworks expansion to increase screening removal system capacity and capabilities.	Potential to maintain existing capacity during construction	YES
		Sequencing Batch Reactor - Conventional	Standard mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes		Medium footprint	Well Established Technology	$$$$	$$$				Requires multiple trains to continue treatment process		No. Alternative not considered feasible
		Sequencing Batch Reactor - Granular (Nerada)	Granular Sludge based mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes	Very compatible with biological nutrient removal	Small footprint	Newer technology	$$$$	$$$			Potential patent issues			No. Alternative not considered feasible
		Facultative/partially aerated lagoons	Typically large lined one-pass earthen diked basins that utilize algae and other naturally occurring microbiology to treat wastewater	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Very large footprint	Well Established Technology	$$$$$	$	Attractive Nuisance Odors and Vectors	Waterfowl habitat				No. Alternative will not satisfy City's needs.

Headworks Expansion

Secondary Treatment

1. TF/AS
2. AS – Plug Flow
3. IFAS **
4. ~~MABR ZeeLung **~~
5. Ballasted AS Biomag
6. MBR

Effluent End-Use

1. Gravity

WAS Thickening

1. Mechanical Thickening

Solids Stabilization

1. Anaerobic Digestion
2. ~~Thermal/Chemical Hydrolysis**~~

Solids Finishing

1. Mechanical Dewater
2. Thermal Drying **

**Consider only one

Alternatives

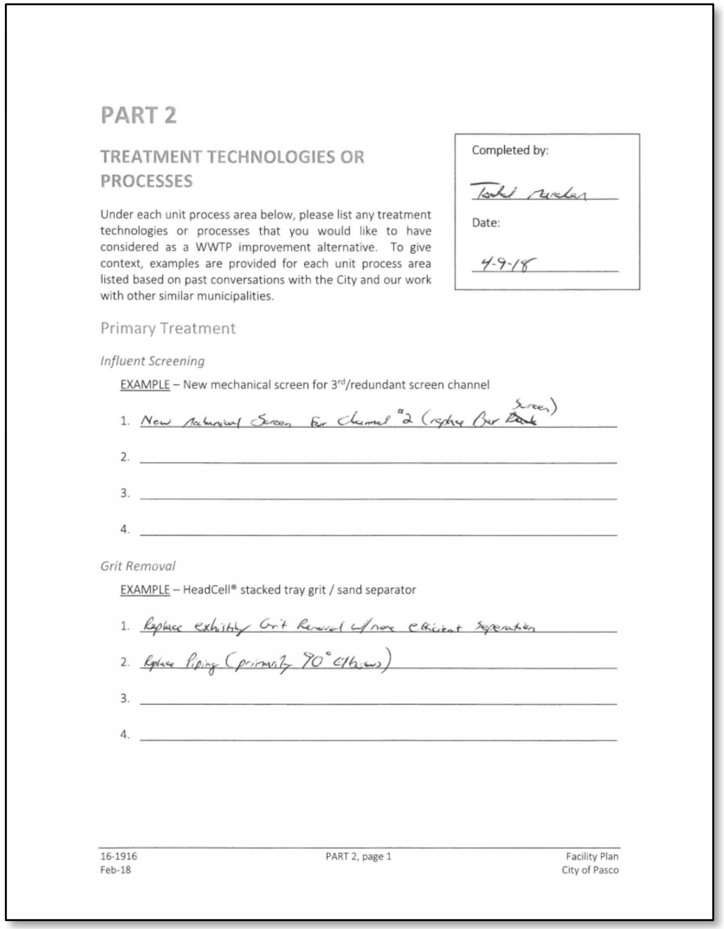
City WWTP Objectives Survey Results

Criteria and Weighting Results

1) Future Uncertainty/Flexibility - 42.0%
2) Functional/Operational - 29.4%
3) Economic - 21.3%
4) Societal - 3.7%
5) Environmental - 3.5%

Rating Scale

Very Strongly Disfavor	Strongly Disfavors	Disfavor	Slightly Disfavor	Equal	Slightly Favor	Favor	Strongly Favor	Very Strongly Favor
-4	-3	-2	-1	0	1	2	3	4



PART 2

TREATMENT TECHNOLOGIES OR PROCESSES

Completed by: [illegible]

Date: 4-9-18

Under each unit process area below, please list any treatment technologies or processes that you would like to have considered as a WWTP improvement alternative. To give context, examples are provided for each unit process area listed based on past conversations with the City and our work with other similar municipalities.

Primary Treatment

Influent Screening

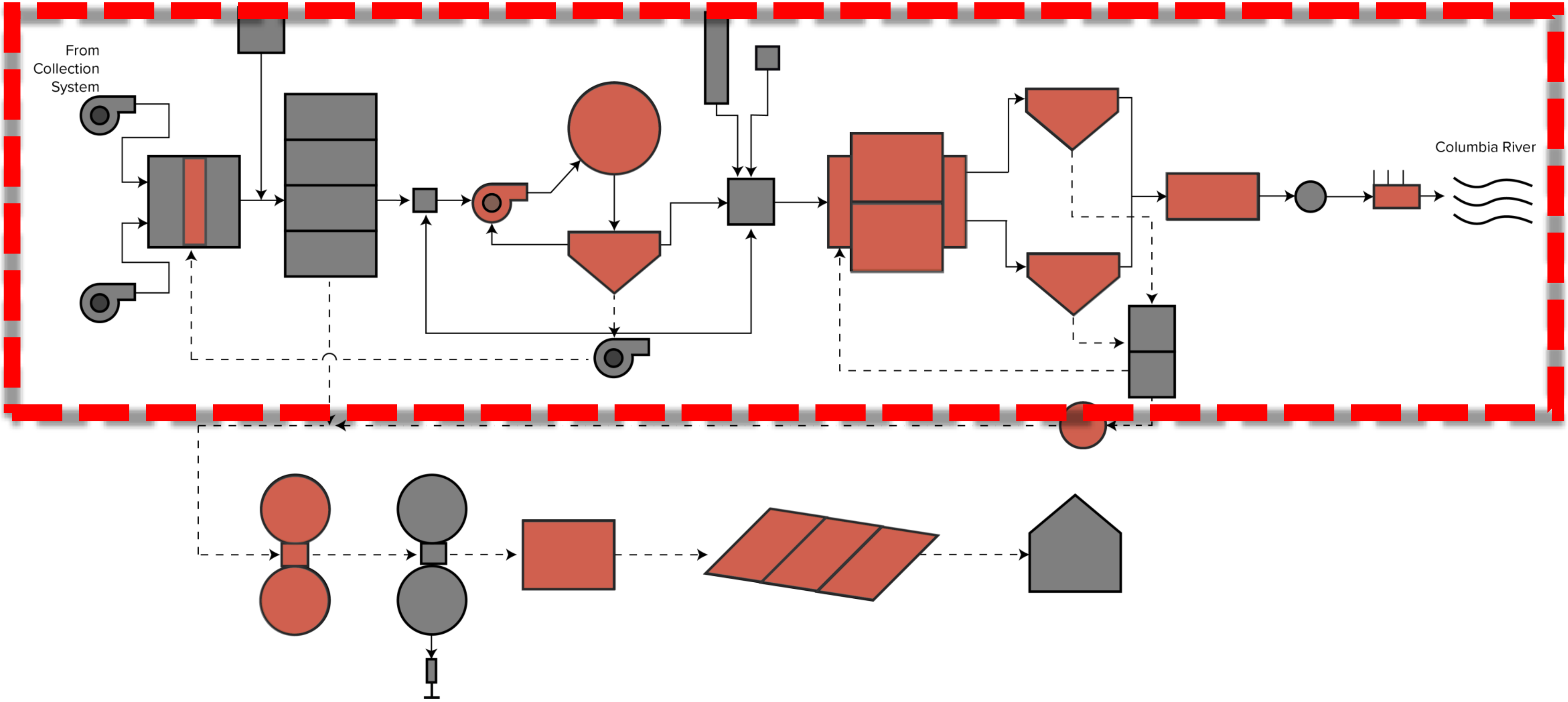
EXAMPLE – New mechanical screen for 3rd/redundant screen channel

1. New Mechanical Screen For Channel #2 (replace Bar ~~Rack~~ Screen)
2.
3.
4.

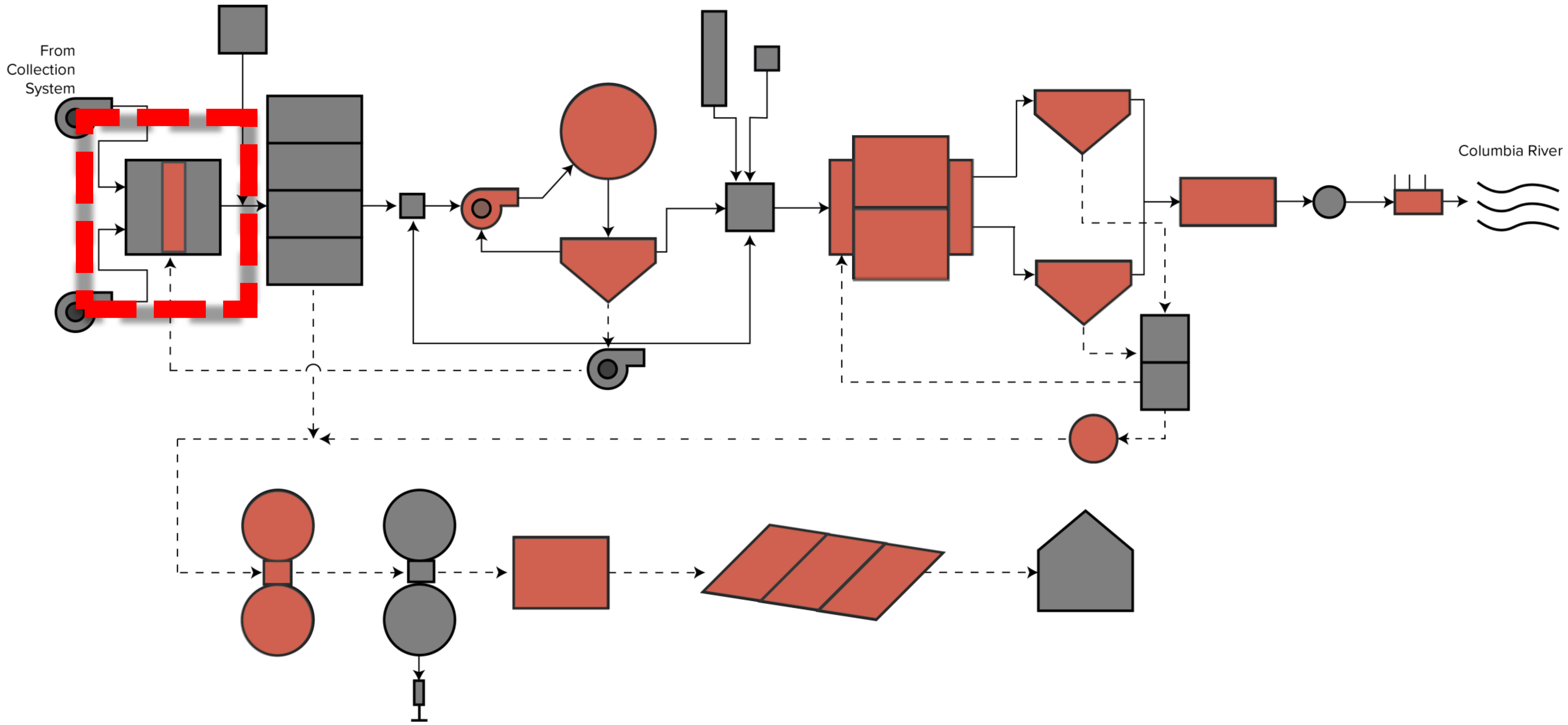
Grit Removal

EXAMPLE – HeadCell® stacked tray grit / sand separator

1. Replace existing Grit Removal w/ more efficient separation
2. Replace Piping (primarily 90° elbows)
3.
4.



Liquid Treatment

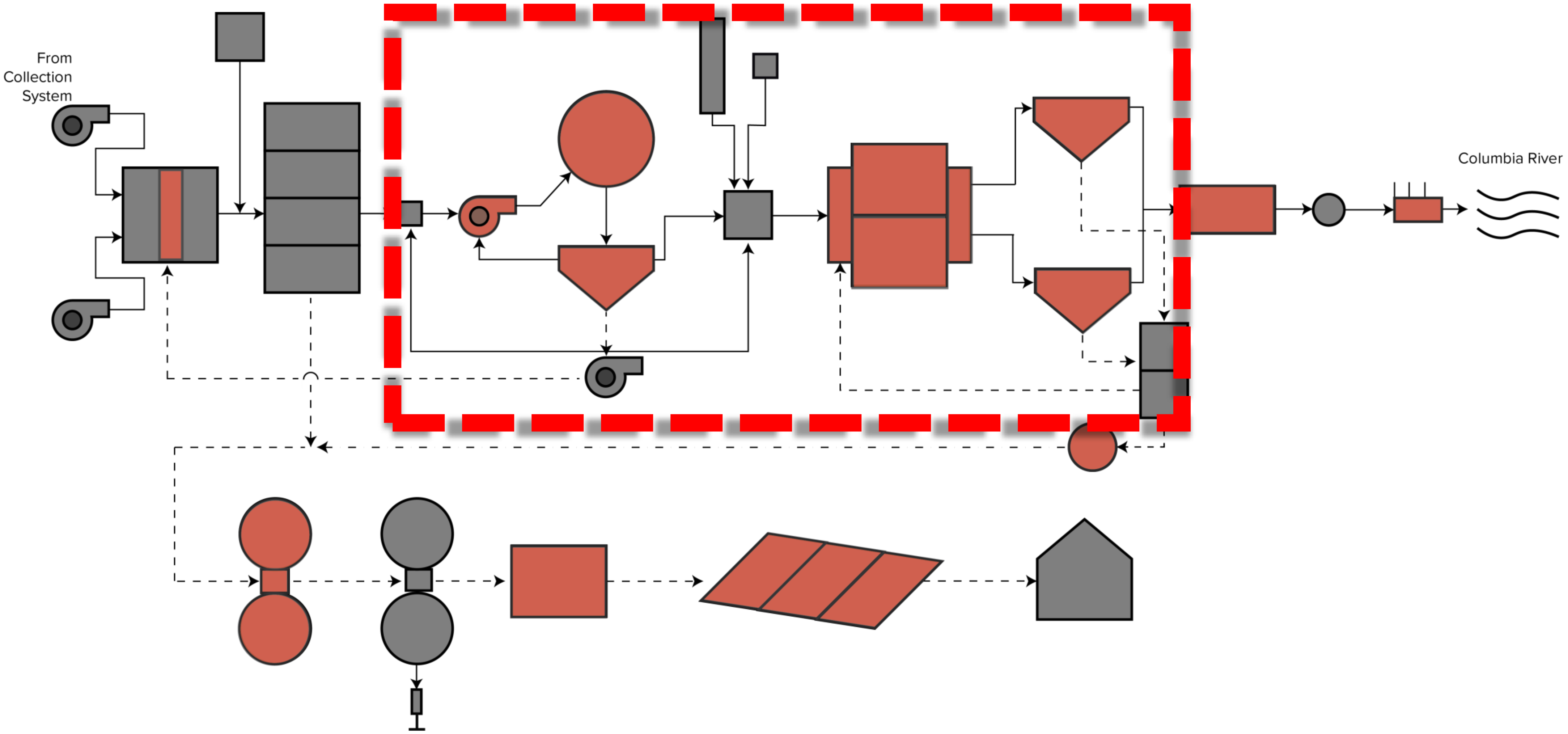


Headworks Expansion

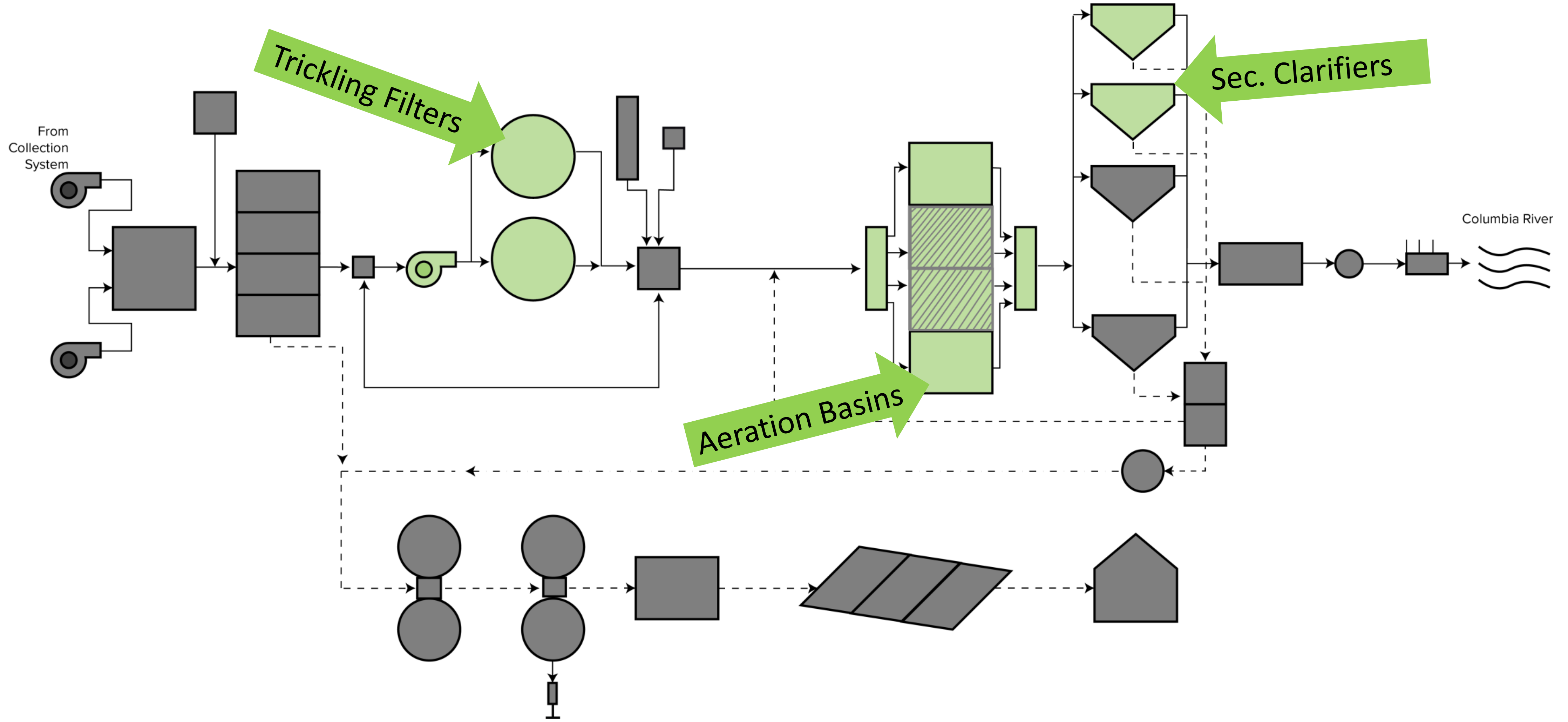
Headworks Expansion Alternative

Overview

- Description
  - Expansion of Headworks Facility with 4th Redundant Screen Channel
- Major Components and Functionality
  - Screen #4
  - Headworks building expansion
- Pro
  - Expanded capacity of screenings
- Con
  - Space limitations
  - Not presently configured well for expansion



Secondary Treatment



Trickling Filter/Activated Sludge Schematic

Trickling Filter/Activated Sludge Expansion

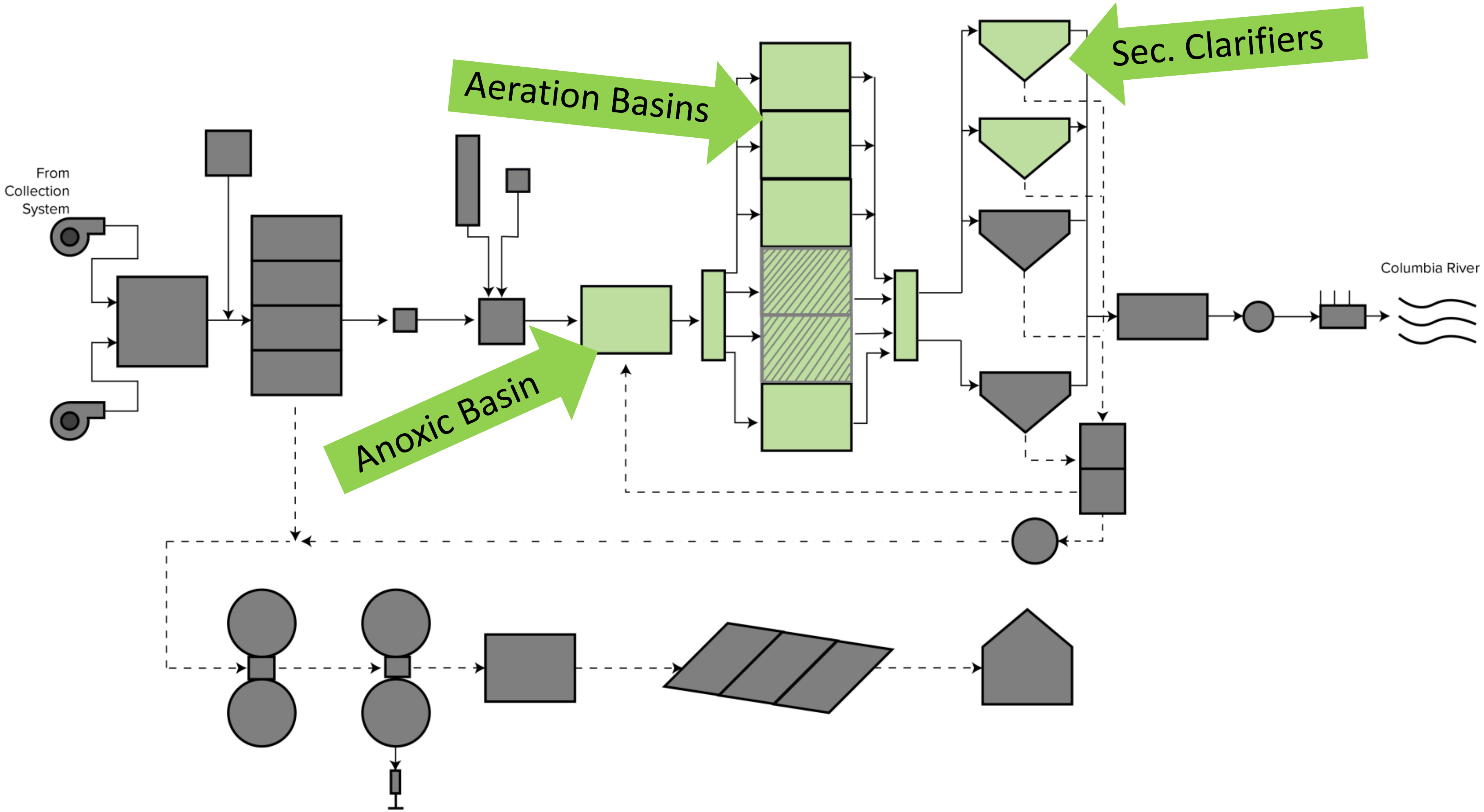
Overview

- Description
  - Similar to existing WWTP – all of plant flow treated over fixed film based trickling filter followed by conventional activated sludge
- Major Components
  - Demo existing Trickling Filter
  - Trickling Filter 1 and 2
  - Trickling Filter Recirculation Pump Station
  - Aeration Basin 3
  - Blower Facility Expansion
  - Secondary Clarifier 3 and 4
- Pro
  - Familiarity with process, well established process
  - Phasing of expansion
- Con
  - Process not as easily upgraded for nutrient removal
    - Denitrification is severely limited to not feasible
    - Option for any future phosphorus is limited to chemical treatment

Trickling Filter/Activated Sludge Expansion (Option 2)

Overview

- Description
  - Similar to existing WWTP – portion of plant flow treated over fixed film based trickling filter followed by conventional activated sludge
- Major Components
  - Demo existing Trickling Filter
  - Trickling Filter 1
  - Trickling Filter Recirculation Pump Station
  - Anoxic Selector
  - Aeration Basin 3, 4 & 5
  - Blower Facility Expansion
  - Secondary Clarifier 3 and 4
- Pro
  - Familiarity with process, well established process
  - Phasing of expansion
- Con
  - Process not as easily upgraded for nutrient removal
    - Denitrification is somewhat limited
    - Option for any future phosphorus is limited to chemical treatment

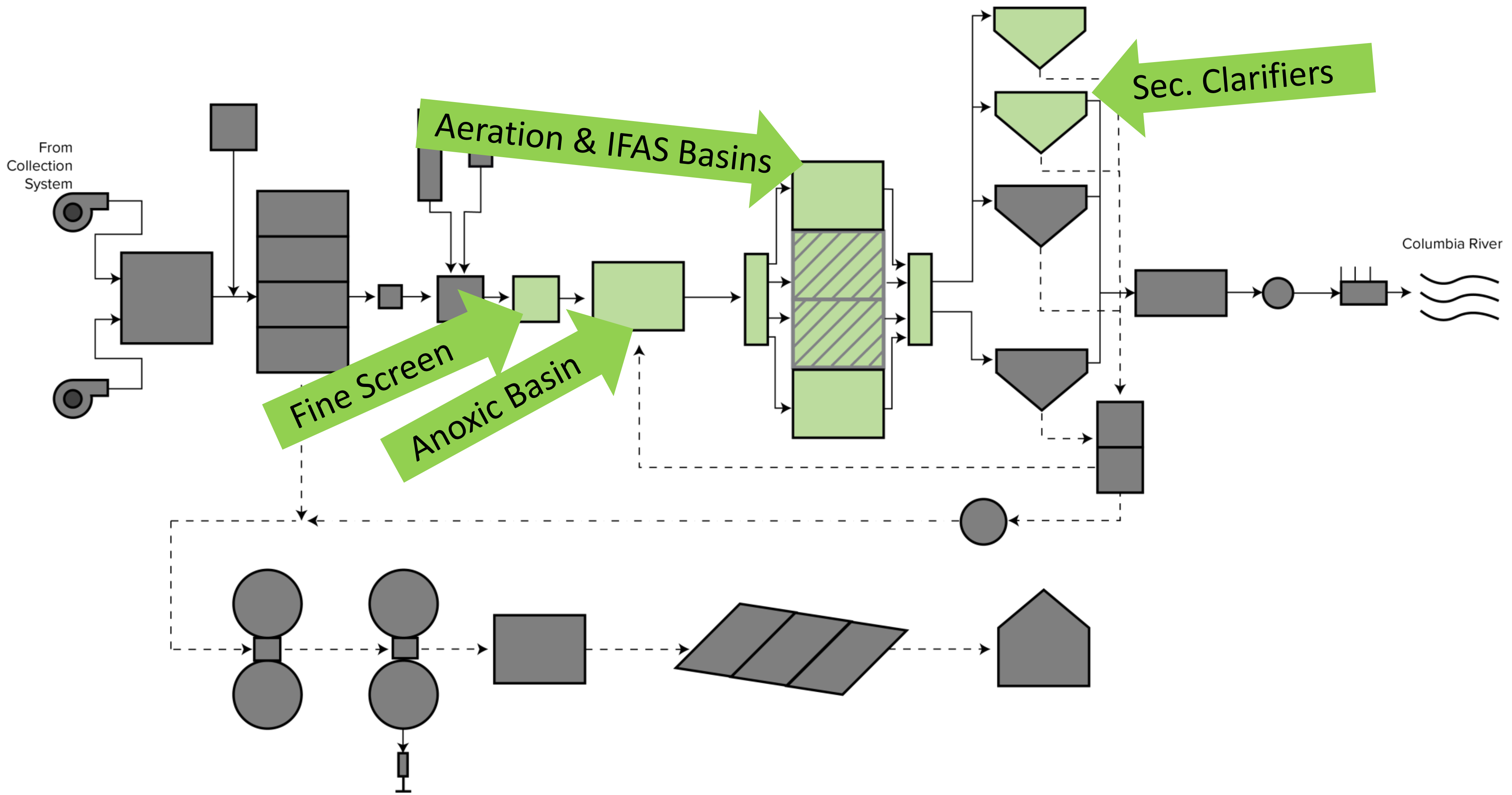


Plug Flow Activated Sludge Schematic

Plug Flow Activated Sludge

Overview

- Description
  - Construct baffling in existing aeration basins and build new aeration basins
- Major Components
  - Demo Existing Trickling Filter
  - Anoxic Basin 1 and 2
  - Modify Existing Aeration Basins 1 and 2
  - Aeration Basins 3-6
  - Blower Facility Expansion
  - Secondary Clarifier 3 and 4
- Pro
  - Robust, tried and true, well established process
  - Ease of Phasing
- Con
  - Many new basins

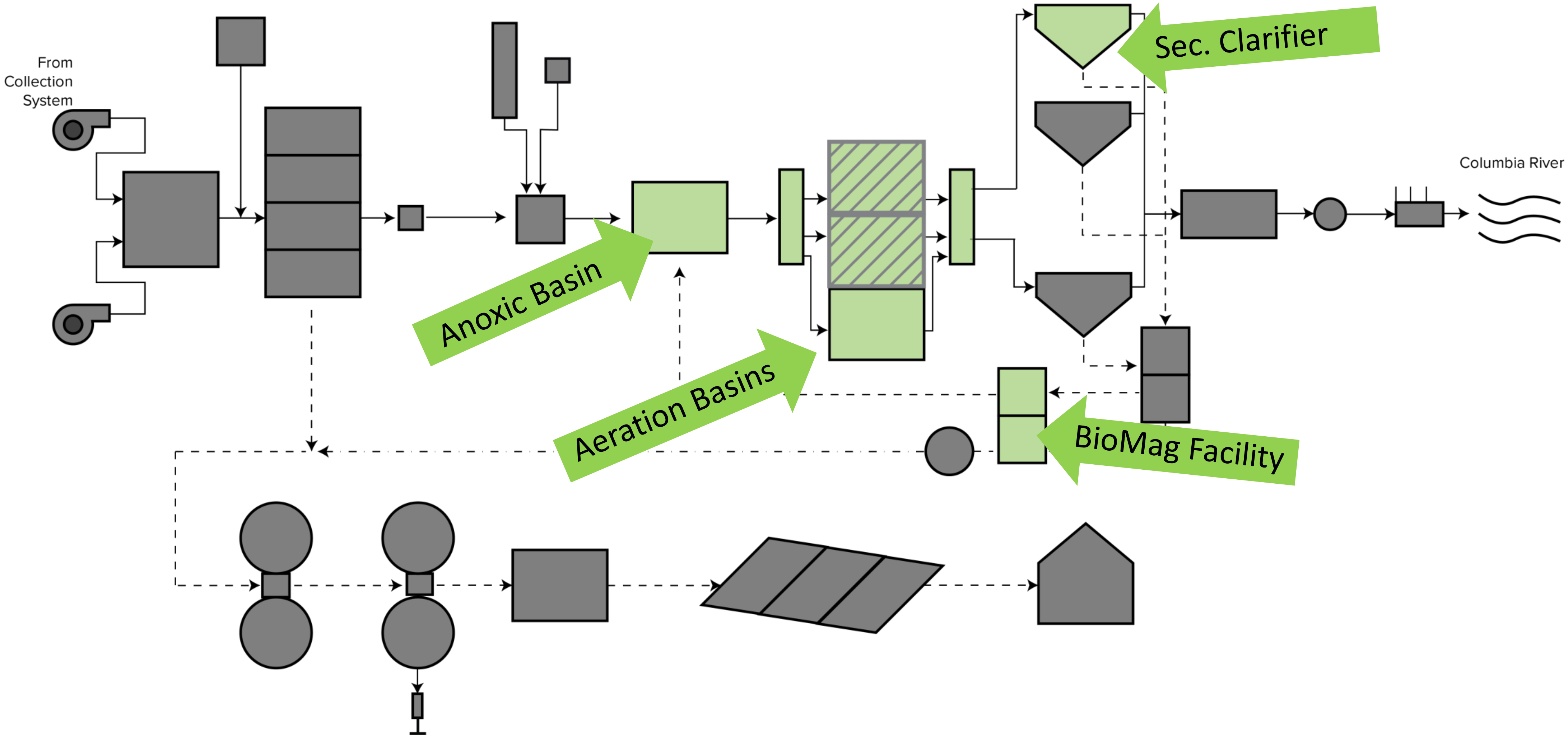


Internal Fixed Film Activated Sludge Schematic

Internal Fixed Film Activated Sludge

Overview

- Description
  - Conventional activated sludge type basin with addition of suspended plastic media with biological growth to generate a higher total microbiological mass.
- Major Components
  - Demo existing trickling filter
  - Fine Screen Facility
  - Primary Effluent Lift Station
  - Anoxic Basin 1 and 2
  - Aeration Basin 1 and 2 retrofit IFAS and aeration system
  - Aeration Basin 3 and 4
  - Blower Facility Expansion
  - Secondary Clarifier 3 and 4 ?AND 5?
- Pro
  - Fewer new basins
- Con
  - High upfront near-term capital cost

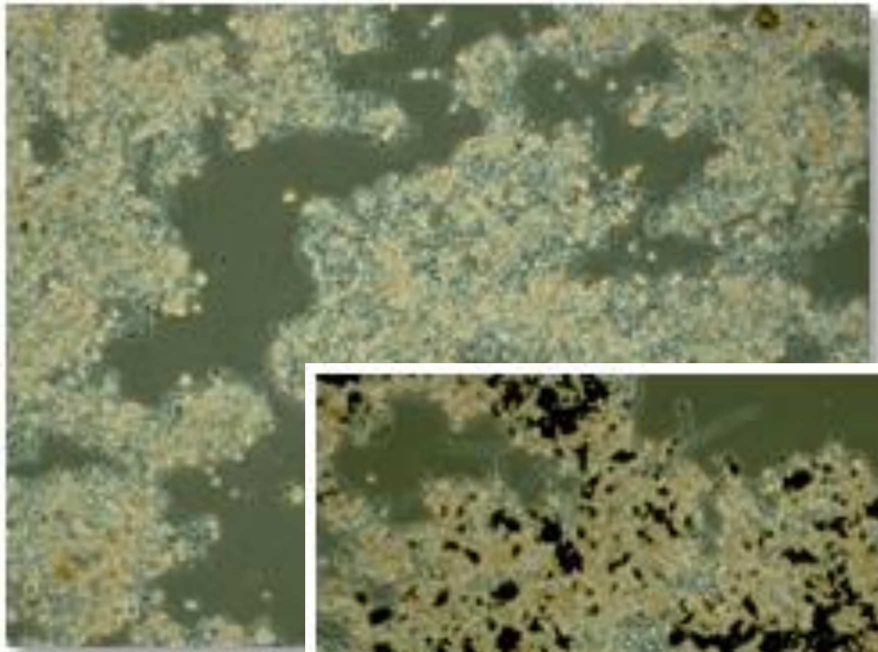


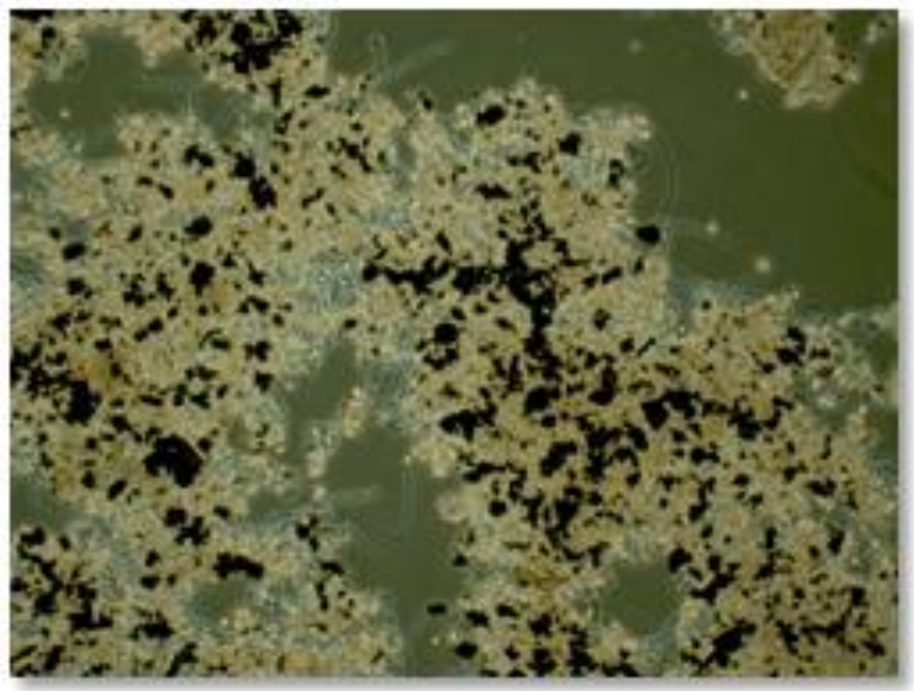
BioMag Activated Sludge Schematic

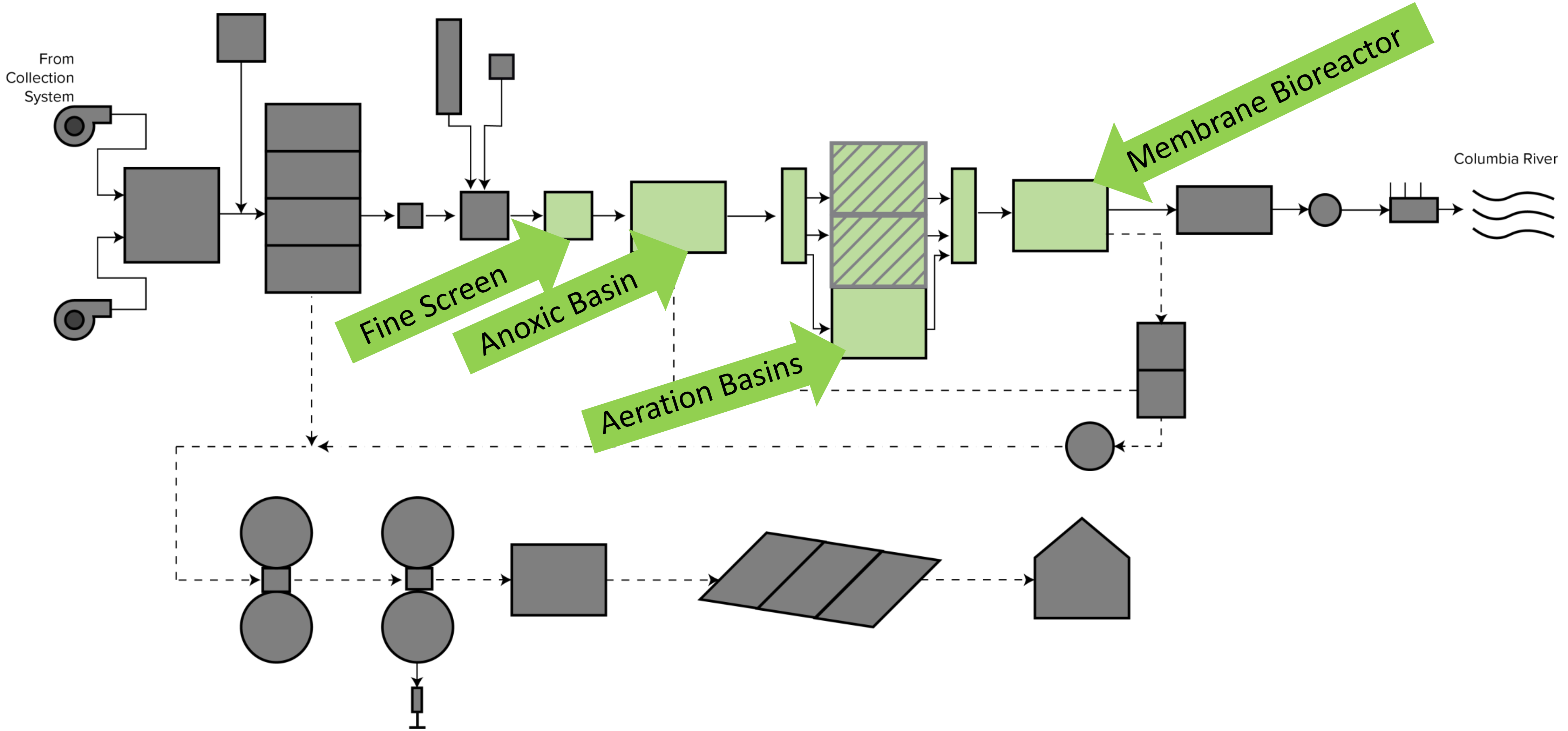
BioMag Activated Sludge

Overview

- Description
  - Ballasted activated sludge
- Major Components
  - Demo Existing Trickling Filter
  - Anoxic Basin 1 and 2
  - Aeration Basin 1 and 2 Retrofit Aeration System
  - Aeration Basin 3
  - Blower Facility Expansion
  - Secondary Clarifier 3
  - BioMag Ballast System
- Pro
  - Differed timing of expansion(s)
  - Likely faster implementation
  - Fewer new basins
- Con
  - Ongoing ballast supply cost
  - High upfront near-term capital cost





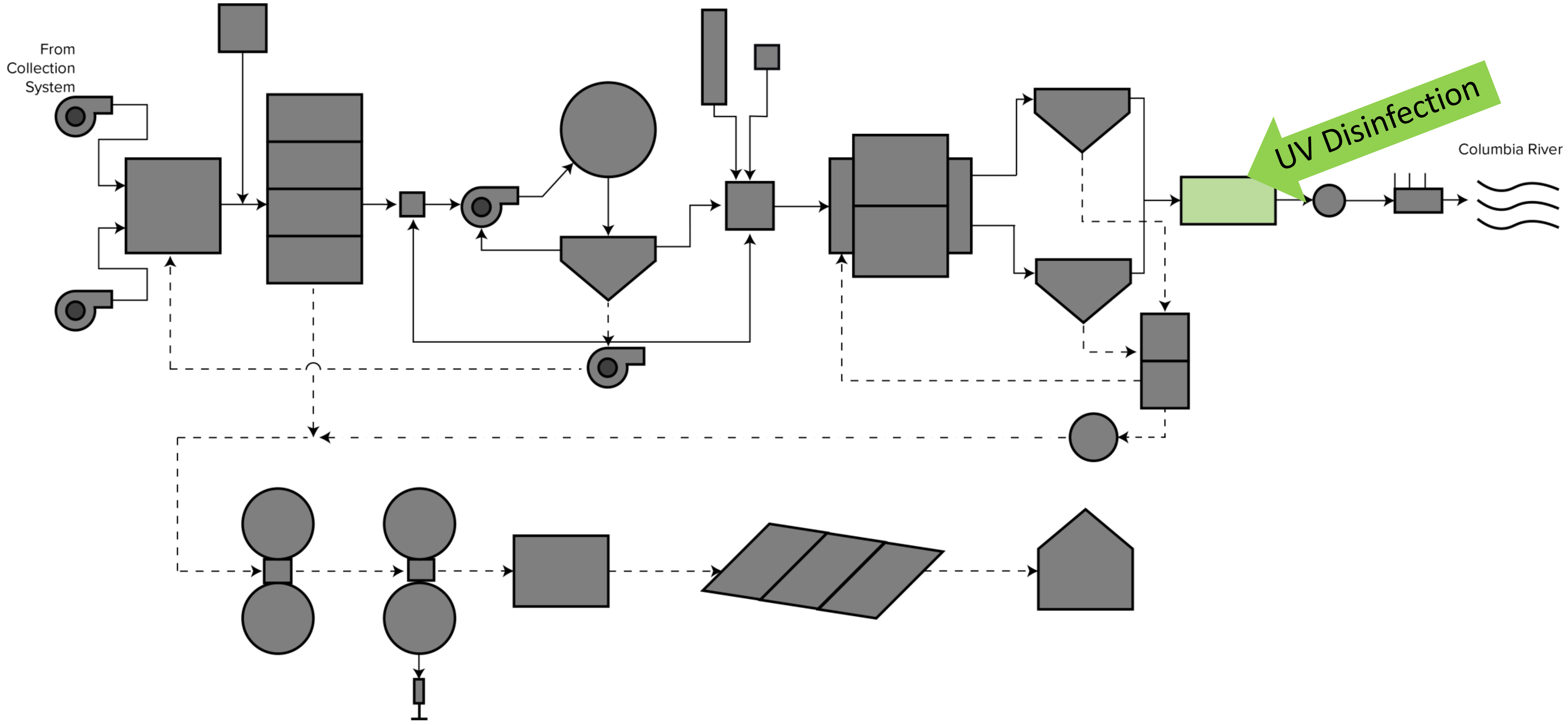


Membrane Bioreactor Schematic

Membrane Bioreactor

Overview

- Description
  - Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent
- Major Components
  - Demo Existing Trickling Filter
  - Fine Screen Facility
  - Primary Effluent Lift Station
  - Anoxic Basin 1 and 2
  - Aeration Basin 1 and 2 Retrofit Aeration System
  - Aeration Basin 3
  - Membrane Basin
  - Blower Facility Expansion
- Pro
  - Consistent high-quality effluent
  - Small footprint
  - Phasing flexibility
- Con
  - High upfront near-term capital cost

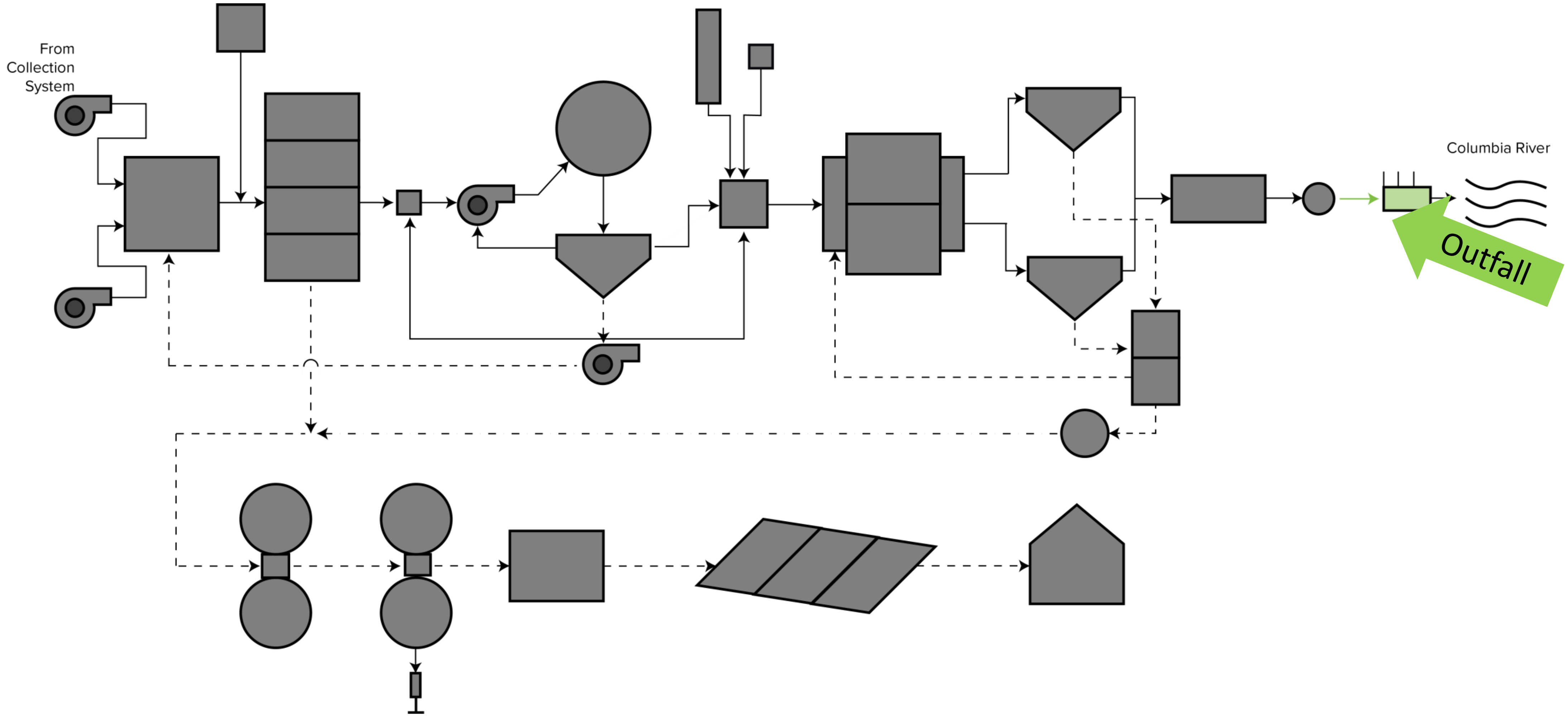


UV Replacement

Ultraviolet Disinfection

Overview

- Description
  - Replace UV Components due to end of life
- Major Components and Functionality
  - UV Modules X12
- Pro
  - Maintain current level of performance
- Con
  - Limited hydraulic capacity for additional modules



End Use

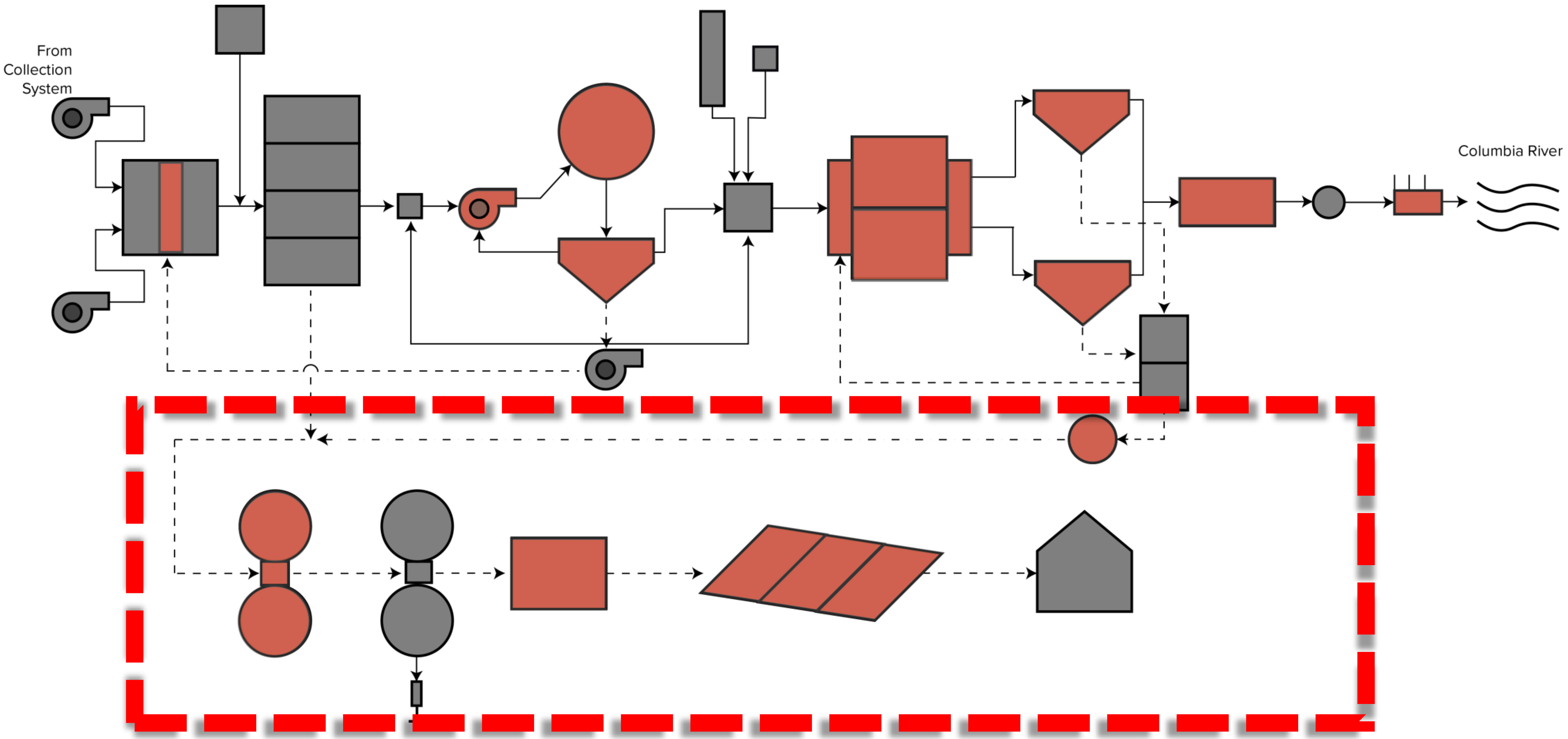
Gravity Pipeline and in River Diffuser

Overview

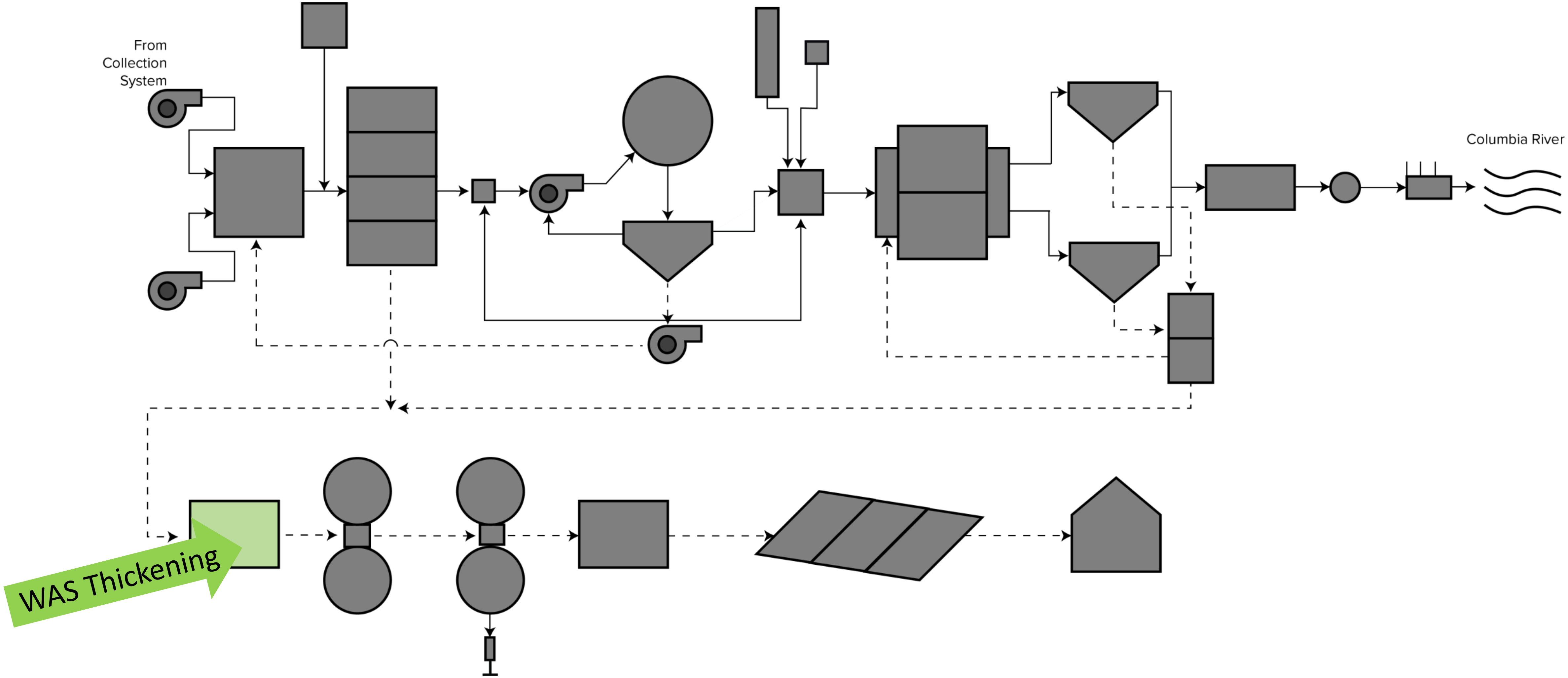
- Description
  - Effluent flow to Columbia River through gravity pipeline and in-river diffuser
- Major Components
  - Gravity Pipeline
  - Diffuser
- Pro
  - Reliable (GRAVITY)
  - UV System Protection
  - No mechanical components
  - Negligilbe O&M Costs
- Con
  - Capital Cost Expensive

Alternative	Total Project Cost	O&M DELTA *(20 yr PW)*
Headworks Expansion	$3,270,000	-
Trickling Filter Activated Sludge (Nit only)	$26,570,000	$6,500,000
Trickling Filter Activated Sludge (Nit/Denit)	$28,240,000	$885,000
Activated Sludge Plug Flow	$33,720,000	$0 (baseline)
Internal Fixed Film Activate Sludge (IFAS)	$43,380,000	$2,100,000
Ballasted Activated Sludge (BioMag)	$33,740,000	$5,400,000
Membrane Bioreactor (MBR)	$45,830,000	$2,200,000*
UV	$2,170,000	-
Outfall	$6,464,000	-

Liquids Alternative Cost Review



Solids Treatment

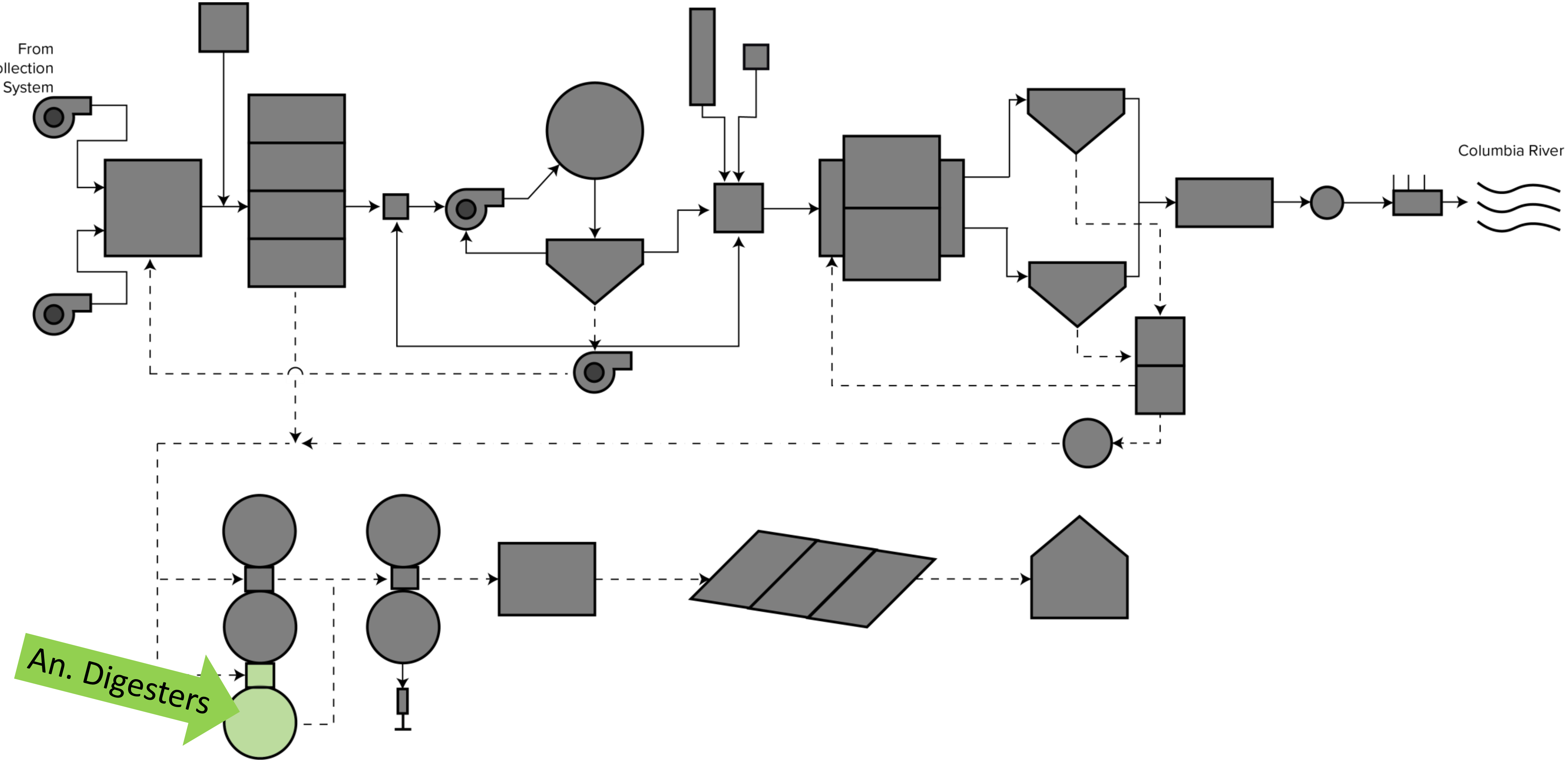


Mechanical WAS Thickening Schematic

Solids WAS Thickening: Mechanical WAS Thickening

Overview

- Description
  - Thickening of waste activated sludge through mechanical process prior to stabilization
- Major Components
  - Thickening Unit 1 and 2
  - Polymer System
  - Thickening Building
- Pro
  - Reliable, easy thickening
  - Adds redundancy
  - Increase digester capacity
  - Redundant unit can be used for recuperative thickening
- Con
  - Capital and O&M expense

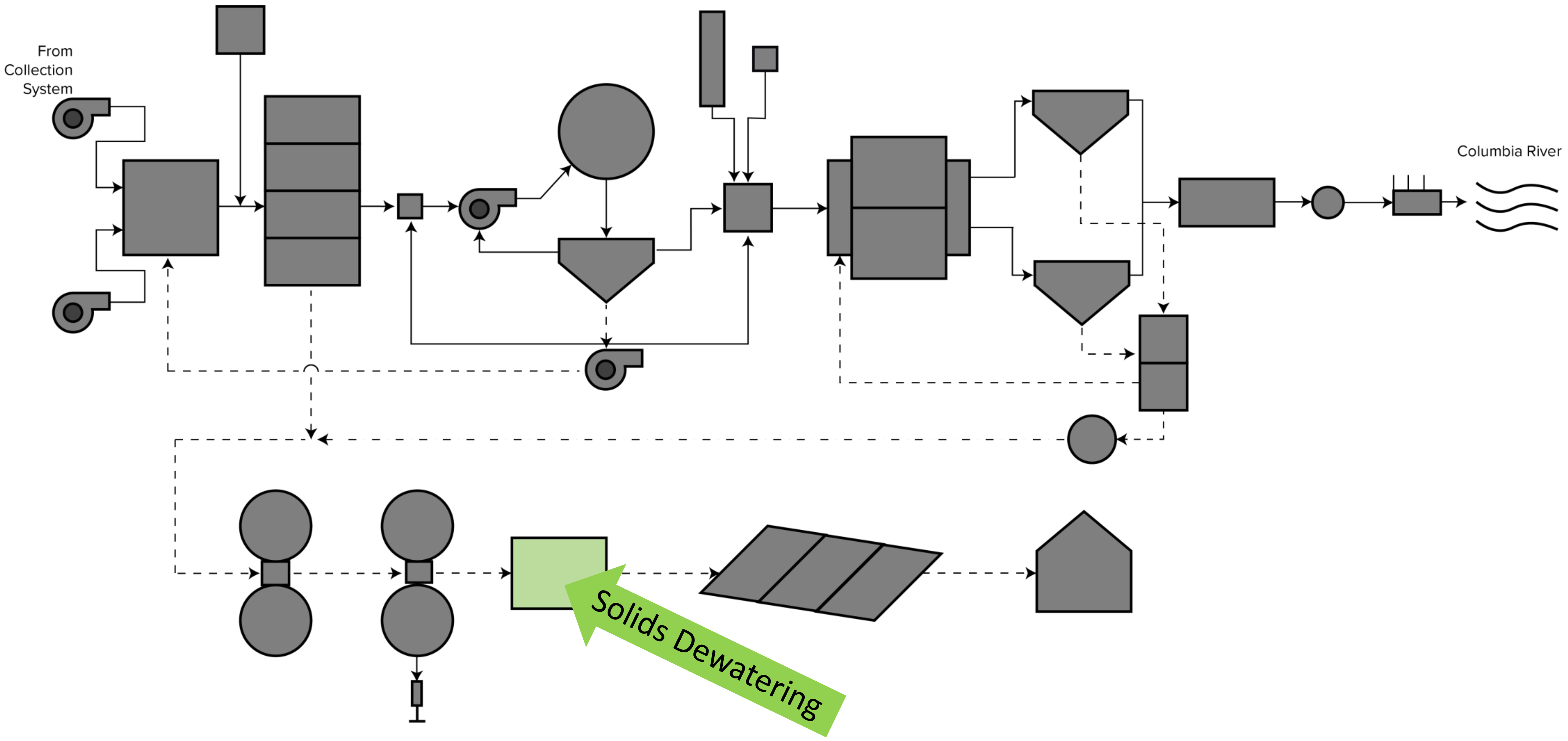


Anaerobic Digestion Expansion Schematic

Anaerobic Digestion Expansion

Overview

- Description
  - Anaerobic digestion system to stabilize biosolids and meet Class B requirements
- Major Components
  - Anaerobic Digester 3
  - Expansion of Solids Handling Building
- Pro
  - Similar treatment to existing units
  - Continued generation of Class B Biosolids for land application program
- Con
  - Space limited for 4th digester

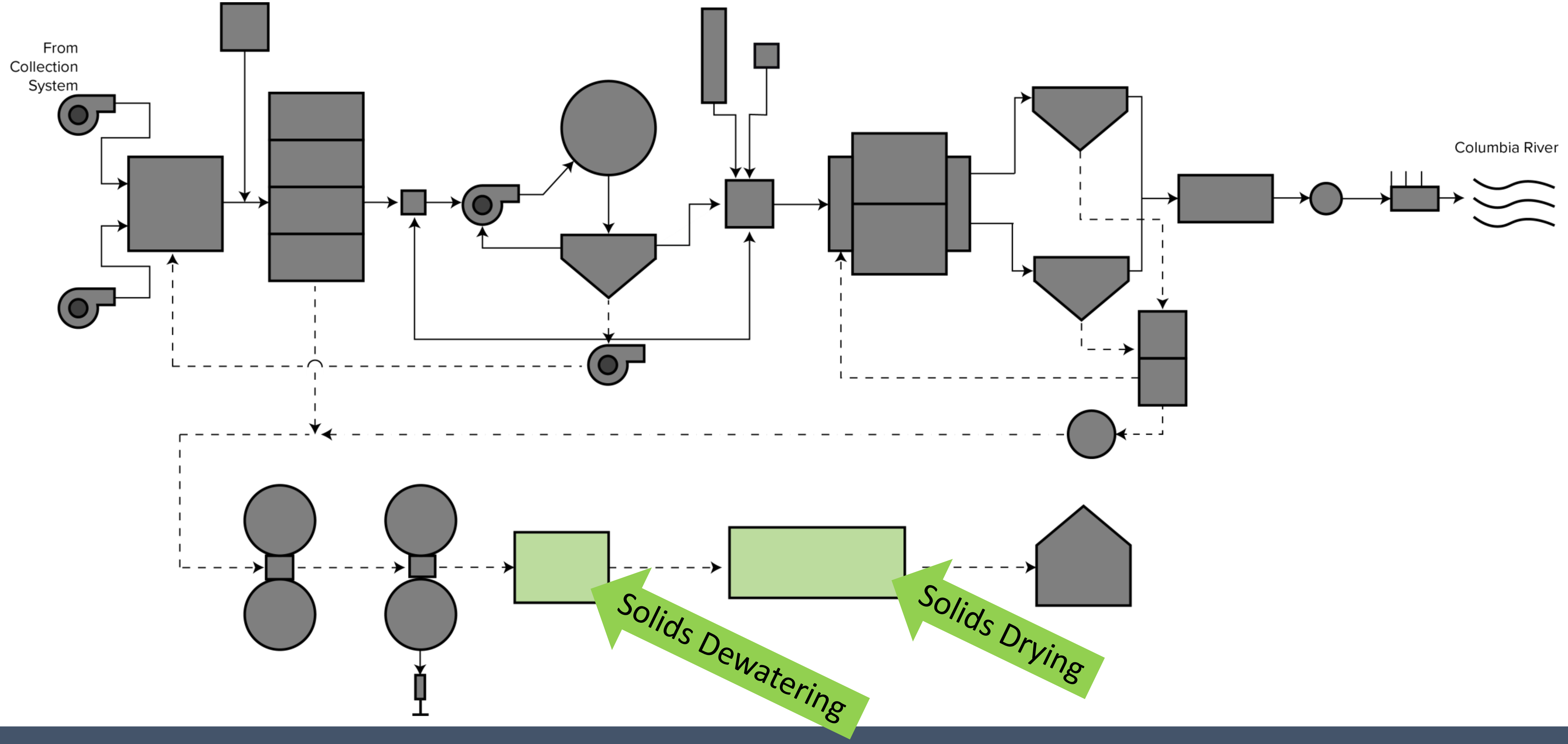


Mechanical Dewater Schematic

Mechanical Dewatering

Overview

- Description
  - Mechanically dewater stabilized sludge to remove water and produce a "cake".
- Major Components
  - Dewatering Unit 1 and 2
  - Polymer System
  - Dewatering Building
- Pro
  - Easy, reliable dewatering
  - Extend the life of the existing drying beds
  - Non-drying bed operation possible
- Con
  - Additional recycle stream
  - Capital and O&M expense



Biosolids Thermal Drying Schematic

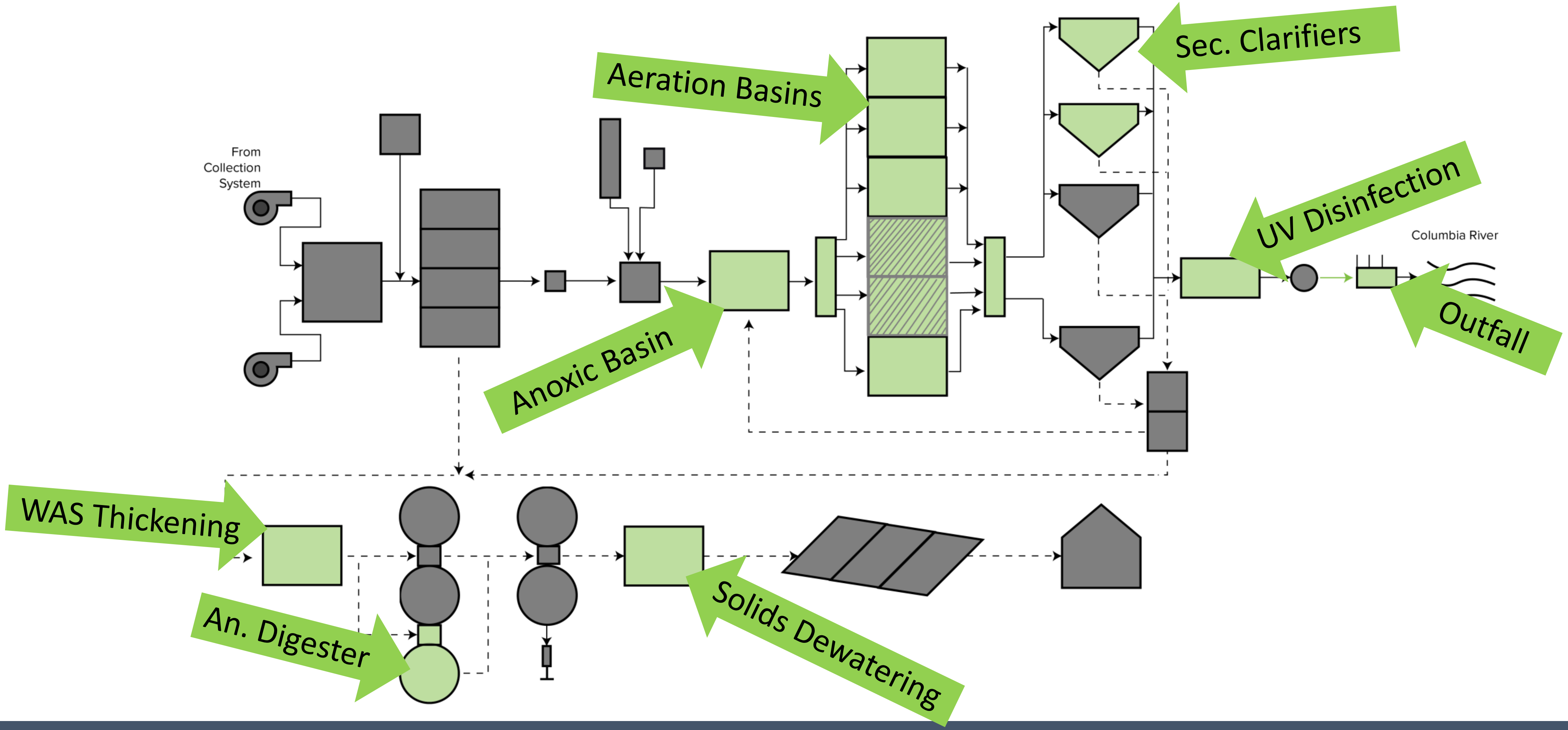
Biosolids Thermal Drying

Overview

- Description
    - Drying biosolids through application of heat to dry through evaporation of water
- Major Components
    - Biosolids Dewatering Facility (required)
    - Biosolids Thermal Drying
- Pro
    - Class A Biosolids
    - Drying beds no longer needed
    - Fewer anaerobic digesters needed
- Con
    - Expensive: Capital & Operation and Maintenance
    - Significant fuel required and added labor
    - Increase in number of processes

Alternative	Total Project Cost	O&M DELTA
Mechanical WAS Thickening	$4,350,000	-
Mechanical Dewater	$8,650,000	-
Anaerobic Digestion Expansion	$8,140,000	$0 (baseline)
Biosolids Thermal Drying	$13,490,000	$3,500,000

Solids Alternative Cost Review



Consultant Draft CIP

Preliminary Phasing of Improvements

1. AB 3, AX 1
2. SC 3

Secondary Improvements Project

3. Gravity Pipeline and Diffuser

Outfall Improvement Project

4. Mechanical WAS Thickening
5. Mechanical Dewatering

Solids Handling Improvements Project

6. Anaerobic digestion

Anaerobic Digestion Expansion Project

7. AB 4-6, AX 2
8. SC 4

Phase 2 Secondary Improvements Project

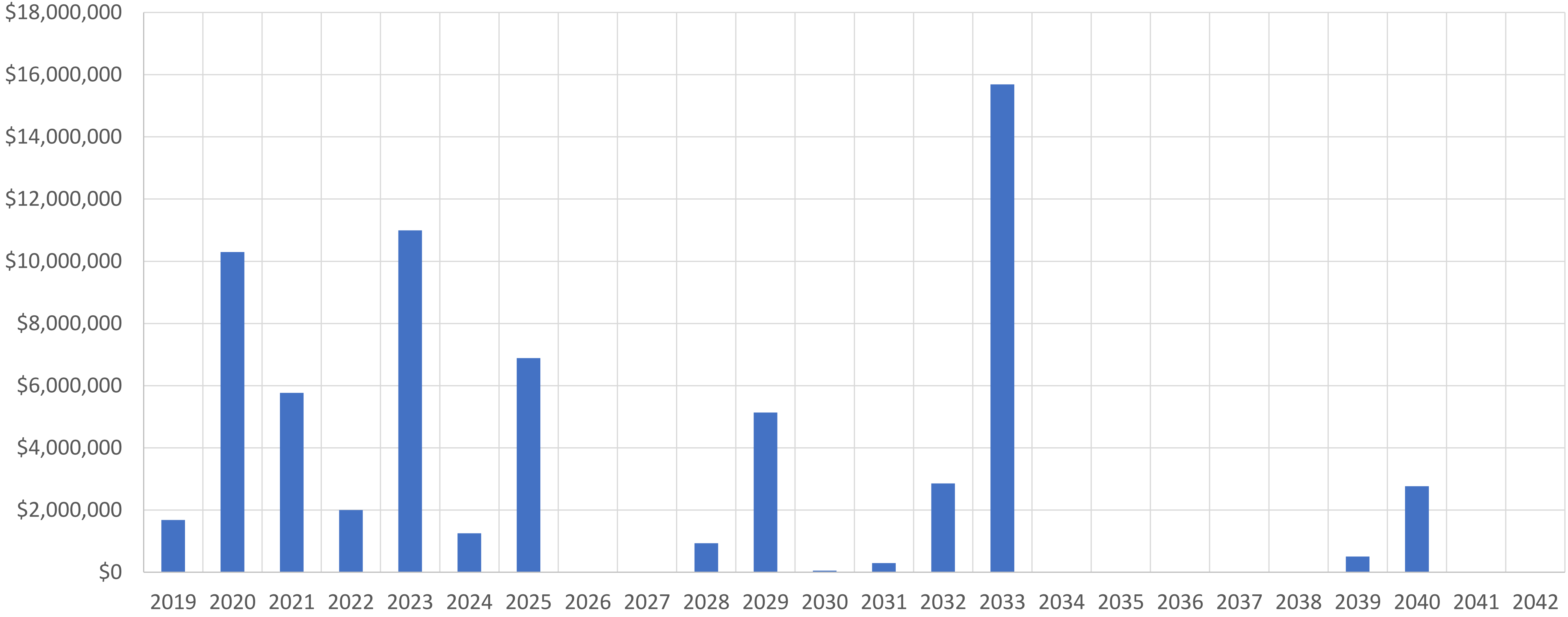
9. UV

Replacement

10. Headworks Expansion

Headworks Expansion Project

Consultant DRAFT CIP



Consultant DRAFT Cash Flow

Project Next Steps

Next Steps Continued…

- WWTP Visits *(# and timing TBD)?*
- Alternative Refinement & Selection?
- Draft Implementation Plan
- City Financial Analysis/Final CIP
- Council/Public presentations *(# and timing TBD)*
- Finalize Facility Plan Section 6, 7, and 8 Documentation
- City Document Review
- Ecology/Federal Cross-Cutter Document Review


murraysmith

murraysmith

APPENDIX 6-5

Probable Cost of Construction
Headworks Expansion - WWTP Facility Plan

Project: Headworks Expansion
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: October 29, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Screen #4 Expansion							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	1,000	SF			$250.00	$250,000
A2	Screen #3 Replacement	1	EA	$199,000.00	$49,750.00	$248,750.00	$248,750
A3	Screen #4	1	EA	$199,000.00	$49,750.00	$248,750.00	$248,750
A4	Inlet Channel Modification and Expansion	1	LS			$200,000.00	$200,000
A5							
A6							
A7	Architectural Finish - 2%	1	LS			$18,950.00	$18,950
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$189,500.00	$189,500
A9	Mechanical Allowance - 20%	1	LS			$189,500.00	$189,500
A10	Yard Piping Allowance - 15%	1	LS			$142,125.00	$142,125
				SubTotal:			**$1,487,575**
	Material & Labor Total:						**$1,487,575.00**
	Mobilization:	10%					$148,758
	Prevailing Wage Rate:	5%					$74,379
	Contractor's Overhead & Profit:	15%					$223,136
	Tax:	8.6%					$166,311
Subtotal							**$1,933,848**
	Owner's Allowance/Contingency:	*30%*					*$580,154*
	Environmental Mitigation:	*Not included*					
	Right of Way Acquisition:	*Not included*					
Estimated Construction Cost							***$2,514,000***
	Engineering (Design and Construction):	25%					$628,500
	Legal and Administrative:	5%					$125,700
Estimated Project Cost							***$3,268,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)							**$1,760,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)							**$3,771,000**

Probable Cost of Construction
Activated Sludge Plug Flow - WWTP Facility Plan

Project: Activated Sludge Plug Flow
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
Anoxic Basin 1							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
Anoxic Basin 2							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**

Aeration Basin 1 Retrofit							
A1	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A2	Aeration Piping	1	LS			$62,500.00	$62,500
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5							
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$10,046.30	$10,046
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$100,462.96	$100,463
A10	Mechanical Allowance - 20%	1	LS			$100,462.96	$100,463
A11	Yard Piping Allowance - 0%	1	LS			$0.00	$0
				SubTotal:			**$713,287**
Aeration Basin 2 Retrofit							
A1	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A2	Aeration Piping	1	LS			$62,500.00	$62,500
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5							
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$10,046.30	$10,046
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$100,462.96	$100,463
A10	Mechanical Allowance - 20%	1	LS			$100,462.96	$100,463
A11	Yard Piping Allowance - 0%	1	LS			$0.00	$0
				SubTotal:			**$713,287**
Aeration Basin 3							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5	Aeration Piping	1	LS			$62,500.00	$62,500
A6	Excavation	3,796	CY			$15.00	$56,944
A7	Haul	3,796	CY			$5.50	$20,880
A8	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A9	Blowers	2	EA	$160,000.00	$40,000.00	$200,000.00	$400,000
A10	Architectural Finish - 2%	1	LS			$18,244.75	$18,245
A11	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$182,447.53	$182,448
A12	Mechanical Allowance - 20%	1	LS			$182,447.53	$182,448
A13	Yard Piping Allowance - 30%	1	LS			$273,671.30	$273,671
				SubTotal:			**$1,969,049**
Aeration Basin 4							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Blowers	1	EA	$160,000.00	$40,000.00	$200,000.00	$200,000
A5	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A6	Aeration Piping	1	LS			$62,500.00	$62,500
A7	Excavation	3,796	CY			$15.00	$56,944
A8	Haul	3,796	CY			$5.50	$20,880
A9	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A10	Architectural Finish - 2%	1	LS			$22,244.75	$22,245
A11	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$222,447.53	$222,448
A12	Mechanical Allowance - 20%	1	LS			$222,447.53	$222,448
A13	Yard Piping Allowance - 30%	1	LS			$333,671.30	$333,671
				SubTotal:			**$1,913,049**

Aeration Basin 5							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Blowers	1	EA	$160,000.00	$40,000.00	$200,000.00	$200,000
A5	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A6	Aeration Piping	1	LS			$62,500.00	$62,500
A7	Excavation	3,796	CY			$15.00	$56,944
A8	Haul	3,796	CY			$5.50	$20,880
A9	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A10	Architectural Finish - 2%	1	LS			$22,244.75	$22,245
A11	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$222,447.53	$222,448
A12	Mechanical Allowance - 20%	1	LS			$222,447.53	$222,448
A13	Yard Piping Allowance - 30%	1	LS			$333,671.30	$333,671
				SubTotal:			**$1,913,049**
Aeration Basin 6							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Blowers	1	EA	$160,000.00	$40,000.00	$200,000.00	$200,000
A5	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A6	Aeration Piping	1	LS			$62,500.00	$62,500
A7	Excavation	3,796	CY			$15.00	$56,944
A8	Haul	3,796	CY			$5.50	$20,880
A9	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A10	Architectural Finish - 2%	1	LS			$22,244.75	$22,245
A11	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$222,447.53	$222,448
A12	Mechanical Allowance - 20%	1	LS			$222,447.53	$222,448
A13	Yard Piping Allowance - 30%	1	LS			$333,671.30	$333,671
				SubTotal:			**$1,913,049**
AB Effluent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Blower Building							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,400	SF			$250.00	$600,000
B2	Blowers	5	EA	$160,000.00	$40,000.00	$200,000.00	$1,000,000
B3							
B4	Architectural Finish - 2%	1	LS			$32,000.00	$32,000
B5	Power, Electrical, Instrumentation and Control Allowance - 5%	1	LS			$80,000.00	$80,000
B6	Mechanical Allowance - 5%	1	LS			$80,000.00	$80,000
B7	Yard Piping Allowance - 5%	1	LS			$80,000.00	$80,000
				SubTotal:			**$1,872,000**
Secondary Clarifier 3							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B10	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**

Secondary Clarifier 4							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B10	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**
RAS/WAS Pump Station							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	3,750	SF			$250.00	$937,500
B2	RAS Pumps	3	EA	$75,000.00	$15,000.00	$90,000.00	$270,000
B3	WAS Pumps	3	EA	$35,000.00	$7,000.00	$42,000.00	$126,000
B4	Flow Meter	2	EA	$25,000.00	$5,000.00	$30,000.00	$60,000
B5							
B6	Architectural Finish - 2%	1	LS			$27,870.00	$27,870
B7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$278,700.00	$278,700
B8	Mechanical Allowance - 20%	1	LS			$278,700.00	$278,700
B9	Yard Piping Allowance - 30%	1	LS			$418,050.00	$418,050
				SubTotal:			**$1,189,320**

Material & Labor Total:		**$16,076,094.99**
Mobilization:	10%	$1,607,609
Prevailing Wage Rate:	5%	$803,805
Contractor's Overhead & Profit:	15%	$2,411,414
Tax:	8.6%	$1,797,307
Subtotal		**$20,898,923**
Owner's Allowance/Contingency:	*30%*	*$6,269,677*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$27,169,000***
Engineering (Design and Construction):	25%	$6,792,250
Legal and Administrative:	5%	$1,358,450
Estimated Project Cost		***$35,320,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$19,018,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$40,754,000**

Probable Cost of Construction
Membrane BioReactor - WWTP Facility Plan

Project: Membrane BioReactor
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
Fine Screen Facility							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	1,200	SF			$250.00	$300,000
A2	2mm Fine Screen	3	EA	$300,000.00	$75,000.00	$375,000.00	$1,125,000
A3	Screw Conveyor	1	EA	$50,400.00	$12,600.00	$63,000.00	$63,000
A4							
A5							
A6	Architectural Finish - 2%	1	LS			$29,760.00	$29,760
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$297,600.00	$297,600
A8	Mechanical Allowance - 10%	1	LS			$148,800.00	$148,800
A9	Yard Piping Allowance - 10%	1	LS			$148,800.00	$148,800
				SubTotal:			**$2,112,960**
Anoxic Basin 1							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**

Anoxic Basin 2							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Aeration Basin 1 Retrofit Aeration System							
A1	Aeration Diffuser System	1	LS	$150,000.00	$37,500.00	$187,500.00	$187,500
A2	Aeration Piping	1	LS			$93,750.00	$93,750
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Cover	123	CY			$1,200.00	$148,148
A5							
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$12,384.26	$12,384
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$123,842.59	$123,843
A10	Mechanical Allowance - 20%	1	LS			$123,842.59	$123,843
A11	Yard Piping Allowance - 5%	1	LS			$30,960.65	$30,961
				SubTotal:			**$910,243**
Aeration Basin 2 Retrofit Aeration System							
A1	Aeration Diffuser System	1	LS	$150,000.00	$37,500.00	$187,500.00	$187,500
A2	Aeration Piping	1	LS			$93,750.00	$93,750
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Cover	123	CY			$1,200.00	$148,148
A5							
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$12,384.26	$12,384
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$123,842.59	$123,843
A10	Mechanical Allowance - 20%	1	LS			$123,842.59	$123,843
A11	Yard Piping Allowance - 5%	1	LS			$30,960.65	$30,961
				SubTotal:			**$910,243**
Aeration Basin 3							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$150,000.00	$37,500.00	$187,500.00	$187,500
A4	Aeration Piping	1	LS			$93,750.00	$93,750
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7	Cover	123	CY			$1,200.00	$148,148
A8	Architectural Finish - 2%	1	LS			$16,786.42	$16,786
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$167,864.20	$167,864
A10	Mechanical Allowance - 20%	1	LS			$167,864.20	$167,864
A11	Yard Piping Allowance - 30%	1	LS			$251,796.30	$251,796
				SubTotal:			**$1,443,632**

AB Effluent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Membrane BioReactor							
A1	RAS and Permeate PS Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	1,200	SF			$250.00	$300,000
A2	Chem Treat Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	1,200	SF			$250.00	$300,000
A3	Wall Structural Concrete	132	CY			$800.00	$105,778
A4	Slab Structural Concrete	224	CY			$700.00	$156,800
A5	Membrane Bioreactor Package	1	LS	$4,300,000.00	$1,075,000.00	###########	$5,375,000
A6	Cover	100	CY			$1,200.00	$119,467
A7							
A8	Architectural Finish - 2%	1	LS			$127,140.89	$127,141
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			###########	$1,271,409
A10	Mechanical Allowance - 20%	1	LS			###########	$1,271,409
A11	Yard Piping Allowance - 10%	1	LS			$635,704.44	$635,704
				SubTotal:			**$9,662,708**
Blower Building							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,400	SF			$250.00	$600,000
B2	Blowers	8	EA	$160,000.00	$40,000.00	$200,000.00	$1,600,000
B3							
B4	Architectural Finish - 2%	1	LS			$44,000.00	$44,000
B5	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$440,000.00	$440,000
B6	Mechanical Allowance - 10%	1	LS			$220,000.00	$220,000
B7	Yard Piping Allowance - 10%	1	LS			$220,000.00	$220,000
				SubTotal:			**$3,124,000**
Demo Secondary Clarifiers							
B1	Demo Concrete Clarifier 3 and 4	846	CY			$115.65	$97,853
B2	Misc. Demo	1	LS			$29,356.00	$29,356
B3							
B4							
B5							
B6	Architectural Finish - 2%	1	LS			$2,544.19	$2,544
B7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$25,441.87	$25,442
B8	Mechanical Allowance - 20%	1	LS			$25,441.87	$25,442
B9	Yard Piping Allowance - 30%	1	ls			$38,162.80	$38,163
				SubTotal:			**$218,800**

Material & Labor Total:		**$19,945,955.66**
Mobilization:	10%	$1,994,596
Prevailing Wage Rate:	5%	$997,298
Contractor's Overhead & Profit:	15%	$2,991,893
Tax:	8.6%	$2,229,958
Subtotal		**$25,929,742**
Owner's Allowance/Contingency:	*30%*	*$7,778,923*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$33,709,000***
Engineering (Design and Construction):	25%	$8,427,250
Legal and Administrative:	5%	$1,685,450
Estimated Project Cost		***$43,822,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$23,596,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$50,564,000**

murraysmith

Probable Cost of Construction
Internal Fixed-Film Activated Sludge - WWTP Facility Plan

Project: Internal Fixed-Film Activated Sludge
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
Fine Screen Facility							
A1	Fine Screen	3	EA	$300,000.00	$75,000.00	$375,000.00	$1,125,000
A2	Screw Conveyor	1	EA	$50,400.00	$12,600.00	$63,000.00	$63,000
A3	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	1,200	SF			$250.00	$300,000
A4							
A5	Architectural Finish - 2%	1	LS			$29,760.00	$29,760
A6	Power, Electrical, Instrumentation and Control Allowance - 10%	1	LS			$148,800.00	$148,800
A7	Mechanical Allowance - 10%	1	LS			$148,800.00	$148,800
A8	Yard Piping Allowance - 10%	1	LS			$148,800.00	$148,800
				SubTotal:			**$1,964,160**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
IFAS Package and Modification of AB 1 and AB 2							
A1	IFAS Package	1	CY	$1,450,000.00	$362,500.00	###########	$1,812,500
A2	Baffle System AB 1	1	LS			$379,629.63	$379,630
A3	Baffle System AB 2	1	LS			$379,629.63	$379,630
A4	Mixed Liquor Recycle Pump and Piping AB 1	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5	Mixed Liquor Recycle Pump and Piping AB 2	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$56,435.19	$56,435
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$564,351.85	$564,352
A10	Mechanical Allowance - 10%	1	LS			$282,175.93	$282,176
A11	Yard Piping Allowance - 10%	1	LS			$282,175.93	$282,176
				SubTotal:			**$4,006,898**

IFAS Package and Aeration Basin 3							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	IFAS Package	1	CY	$725,000.00	$181,250.00	$906,250.00	$906,250
A4	Baffle System AB 3	1	LS			$379,629.63	$379,630
A5	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A6	Aeration Diffuser System	1	LS	$150,000.00	$37,500.00	$187,500.00	$187,500
A7	Aeration Piping	1	LS			$93,750.00	$93,750
A8	Excavation	3,796	CY			$15.00	$56,944
A9	Haul	3,796	CY			$5.50	$20,880
A10	Architectural Finish - 2%	1	LS			$42,041.05	$42,041
A11	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$420,410.49	$420,410
A12	Mechanical Allowance - 20%	1	LS			$420,410.49	$420,410
A13	Yard Piping Allowance - 10%	1	LS			$210,205.25	$210,205
				SubTotal:			**$3,195,120**
IFAS Package and Aeration Basin 4							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	IFAS Package	1	CY	$725,000.00	$181,250.00	$906,250.00	$906,250
A4	Baffle System AB 4	1	LS			$379,629.63	$379,630
A5	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A6	Aeration Diffuser System	1	LS	$150,000.00	$37,500.00	$187,500.00	$187,500
A7	Aeration Piping	1	LS			$93,750.00	$93,750
A8	Excavation	3,796	CY			$15.00	$56,944
A9	Haul	3,796	CY			$5.50	$20,880
A10	Architectural Finish - 2%	1	LS			$42,041.05	$42,041
A11	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$420,410.49	$420,410
A12	Mechanical Allowance - 20%	1	LS			$420,410.49	$420,410
A13	Yard Piping Allowance - 10%	1	LS			$210,205.25	$210,205
				SubTotal:			**$3,195,120**
AB Effluent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Blower Building							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,400	SF			$250.00	$600,000
B2	Blowers	8	EA	$160,000.00	$40,000.00	$200,000.00	$1,600,000
B3							
B4	Architectural Finish - 2%	1	LS			$44,000.00	$44,000
B5	Power, Electrical, Instrumentation and Control Allowance - 5%	1	LS			$110,000.00	$110,000
B6	Mechanical Allowance - 5%	1	LS			$110,000.00	$110,000
B7	Yard Piping Allowance - 5%	1	LS			$110,000.00	$110,000
				SubTotal:			**$2,574,000**
Secondary Clarifier 3							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032

				SubTotal:			**$1,158,318**
Secondary Clarifier 4							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**
RAS/WAS Pump Station							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	3,750	SF			$250.00	$937,500
B2	RAS Pumps	3	EA	$75,000.00	$15,000.00	$90,000.00	$270,000
B3	WAS Pumps	3	EA	$35,000.00	$7,000.00	$42,000.00	$126,000
B4	Flow Meter	2	EA	$25,000.00	$5,000.00	$30,000.00	$60,000
B5							
B6	Architectural Finish - 2%	1	LS			$27,870.00	$27,870
B7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$278,700.00	$278,700
B8	Mechanical Allowance - 20%	1	LS			$278,700.00	$278,700
B9	Yard Piping Allowance - 30%	1	LS			$418,050.00	$418,050
				SubTotal:			**$1,189,320**

Material & Labor Total:		**$18,833,032.76**
Mobilization:	10%	$1,883,303
Prevailing Wage Rate:	5%	$941,652
Contractor's Overhead & Profit:	15%	$2,824,955
Tax:	8.6%	$2,105,533
Subtotal		**$24,482,943**
Owner's Allowance/Contingency:	*30%*	*$7,344,883*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$31,828,000***
Engineering (Design and Construction):	25%	$7,957,000
Legal and Administrative:	5%	$1,591,400
Estimated Project Cost		***$41,376,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$22,280,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$47,742,000**

Probable Cost of Construction
Membrane Aerated BioReactor - WWTP Facility Plan

Project: Membrane Aerated BioReactor
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
Fine Screen Facility							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	1,200	SF			$250.00	$300,000
A2	2mm Fine Screen	3	EA	$300,000.00	$75,000.00	$375,000.00	$1,125,000
A3	Screw Conveyor	1	EA	$50,400.00	$12,600.00	$63,000.00	$63,000
A4							
A5							
A6	Architectural Finish - 2%	1	LS			$29,760.00	$29,760
A7	Power, Electrical, Instrumentation and Control Allowance - 10%	1	LS			$148,800.00	$148,800
A8	Mechanical Allowance - 10%	1	LS			$148,800.00	$148,800
A9	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A10	Yard Piping Allowance - 10%	1	LS			$148,800.00	$148,800
				SubTotal:			**$1,964,160**
Anoxic Basin 1							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A11	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
Anoxic Basin 2							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116

A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A11	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
					SubTotal:		**$585,795**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A10	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
					SubTotal:		**$117,329**
Membrane Aerated Bioreactor							
A1	Equipment	1	EA	$2,500,000.00	$1,250,000.00	###########	$3,750,000
A2	Wall Structural Concrete	157	CY			$750.00	$118,056
A3	Slab Structural Concrete	93	CY			$550.00	$50,926
A4	Excavation	1,574	CY			$15.00	$23,611
A5	Haul	1,574	CY			$5.50	$8,657
A6	Baffle System	1	LS			$379,629.63	$379,630
A7	Architectural Finish - 2%	1	LS			$86,617.59	$86,618
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$866,175.93	$866,176
A9	Mechanical Allowance - 20%	1	LS			$866,175.93	$866,176
A10	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A11	Yard Piping Allowance - 30%	1	LS			###########	$1,299,264
					SubTotal:		**$7,449,113**
Aeration Basin 3							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A4	Aeration Piping	1	LS			$125,000.00	$125,000
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7	Baffle System	1	LS			$379,629.63	$379,630
A8	Architectural Finish - 2%	1	LS			$20,791.05	$20,791
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$207,910.49	$207,910
A10	Mechanical Allowance - 20%	1	LS			$207,910.49	$207,910
A11	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A12	Yard Piping Allowance - 30%	1	LS			$311,865.74	$311,866
					SubTotal:		**$1,788,030**
Aeration Basin 4							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A4	Aeration Piping	1	LS			$125,000.00	$125,000
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7							
A8	Architectural Finish - 2%	1	LS			$13,198.46	$13,198
A9	Power allowance - 0%	1	LS			$0.00	
A10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$131,984.57	$131,985
A11	Mechanical Allowance - 20%	1	LS			$131,984.57	$131,985
A12	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A13	Yard Piping Allowance - 30%	1	LS			$197,976.85	$197,977
					SubTotal:		**$1,135,067**
AB Effluent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364

A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A10	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Blower Building							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,400	SF			$250.00	$600,000
B2	Blowers	4	EA	$160,000.00	$40,000.00	$200,000.00	$800,000
B3							
B4	Architectural Finish - 2%	1	LS			$28,000.00	$28,000
B5	Power, Electrical, Instrumentation and Control Allowance - 5%	1	LS			$70,000.00	$70,000
B6	Mechanical Allowance - 5%	1	LS			$70,000.00	$70,000
B7	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
B8	Yard Piping Allowance - 5%	1	LS			$70,000.00	$70,000
				SubTotal:			**$1,638,000**
Secondary Clarifier 3							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
B13	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**
Secondary Clarifier 4							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
B13	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**
RAS/WAS Pump Station							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	3,750	SF			$250.00	$937,500
B2	RAS Pumps	3	EA	$75,000.00	$15,000.00	$90,000.00	$270,000
B3	WAS Pumps	3	EA	$35,000.00	$7,000.00	$42,000.00	$126,000
B4	Flow Meter	2	EA	$25,000.00	$5,000.00	$30,000.00	$60,000
B5							
B6	Architectural Finish - 2%	1	LS			$27,870.00	$27,870
B7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$278,700.00	$278,700
B8	Mechanical Allowance - 20%	1	LS			$278,700.00	$278,700
B9	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
B10	Yard Piping Allowance - 30%	1	LS			$418,050.00	$418,050
				SubTotal:			**$1,189,320**

Material & Labor Total:	**$19,043,696.34**
Mobilization:	$0
Prevailing Wage:	$0

Contractor's Overhead & Profit:	$0
Tax:	$0
Subtotal	**$19,043,696**
Owner's Allowance/Contingency:	*$0*
Environmental Mitigation:	
Right of Way Acquisition:	
Estimated Construction Cost	***$19,044,000***
Engineering (Design and Construction):	$0
Legal and Administrative:	$0
Estimated Project Cost	***$19,044,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)	**$13,331,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)	**$28,566,000**

Probable Cost of Construction
Trickling Filter Activated Sludge 2 - WWTP Facility Plan

Project: Trickling Filter Activated Sludge 2
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
Trickling Filter 1							
A1	Wall Structural Concrete	87	CY			$800.00	$69,417
A2	Slab Structural Concrete	176	CY			$700.00	$123,191
A3	Mechanism	1	LS	$116,000.00	$29,000.00	$145,000.00	$145,000
A4	Media, Support and Biograting	1	LS	$410,550.00	$82,110.00	$492,660.00	$492,660
A5	Excavation	202	CY			$15.00	$3,036
A6	Haul	202	CY			$5.50	$1,113
A7							
A8							
A9	Architectural Finish - 2%	1	LS			$16,688.34	$16,688
A10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$166,883.39	$166,883
A11	Mechanical Allowance - 20%	1	LS			$166,883.39	$166,883
A12	Yard Piping Allowance - 30%	1	LS			$250,325.09	$250,325
				SubTotal:			**$1,435,197**

Trickling Filter Pump Station							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	800	SF			$250.00	$200,000
A2	Pumps	3	EA	$50,000.00	$10,000.00	$60,000.00	$180,000
A3	Flow Meter	1	EA	$25,000.00	$5,000.00	$30,000.00	$30,000
A4							
A5							
A6	Architectural Finish - 2%	1	LS			$8,200.00	$8,200
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$82,000.00	$82,000
A8	Mechanical Allowance - 20%	1	LS			$82,000.00	$82,000
A9	Yard Piping Allowance - 30%	1	LS			$123,000.00	$123,000
				SubTotal:			**$705,200**
Anoxic Basin 1							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
Anoxic Basin 2							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Aeration Basin 1 Retrofit							
A1	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A2	Aeration Piping	1	LS			$62,500.00	$62,500
A3	Baffle System	1	LS			$189,814.81	$189,815
A4							
A5							
A6	Architectural Finish - 2%	1	LS			$7,546.30	$7,546
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$75,462.96	$75,463
A8	Mechanical Allowance - 20%	1	LS			$75,462.96	$75,463
A9	Yard Piping Allowance - 15%	1	LS			$56,597.22	$56,597
				SubTotal:			**$592,384**
Aeration Basin 2 Retrofit							
A1	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A2	Aeration Piping	1	LS			$62,500.00	$62,500
A3	Baffle System	1	LS			$189,814.81	$189,815
A4							
A5							

A6	Architectural Finish - 2%	1	LS			$7,546.30	$7,546
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$75,462.96	$75,463
A8	Mechanical Allowance - 20%	1	LS			$75,462.96	$75,463
A9	Yard Piping Allowance - 15%	1	LS			$56,597.22	$56,597
				SubTotal:			**$592,384**
Aeration Basin 3							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A4	Aeration Piping	1	LS			$62,500.00	$62,500
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7							
A8	Architectural Finish - 2%	1	LS			$11,948.46	$11,948
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$119,484.57	$119,485
A10	Mechanical Allowance - 20%	1	LS			$119,484.57	$119,485
A11	Yard Piping Allowance - 30%	1	LS			$179,226.85	$179,227
				SubTotal:			**$1,027,567**

Aeration Basin 4							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A4	Aeration Piping	1	LS			$62,500.00	$62,500
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7							
A8	Architectural Finish - 2%	1	LS			$11,948.46	$11,948
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$119,484.57	$119,485
A10	Mechanical Allowance - 20%	1	LS			$119,484.57	$119,485
A11	Yard Piping Allowance - 30%	1	LS			$179,226.85	$179,227
				SubTotal:			**$1,027,567**
Aeration Basin 5							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A4	Aeration Piping	1	LS			$62,500.00	$62,500
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7							
A8	Architectural Finish - 2%	1	LS			$11,948.46	$11,948
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$119,484.57	$119,485
A10	Mechanical Allowance - 20%	1	LS			$119,484.57	$119,485
A11	Yard Piping Allowance - 30%	1	LS			$179,226.85	$179,227
				SubTotal:			**$1,027,567**
AB Effluent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 10%	1	LS			$6,821.44	$6,821
A8	Mechanical Allowance - 10%	1	LS			$6,821.44	$6,821
A9	Yard Piping Allowance - 10%	1	LS			$6,821.44	$6,821
				SubTotal:			**$90,043**
Blower Building							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,400	SF			$250.00	$600,000
B2	Blowers	3	EA	$160,000.00	$40,000.00	$200,000.00	$600,000
B3							
B4	Architectural Finish - 2%	1	LS			$24,000.00	$24,000
B5	Power, Electrical, Instrumentation and Control Allowance - 5%	1	LS			$60,000.00	$60,000
B6	Mechanical Allowance - 5%	1	LS			$60,000.00	$60,000
B7	Yard Piping Allowance - 5%	1	LS			$60,000.00	$60,000
				SubTotal:			**$1,404,000**
Secondary Clarifier 3							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**
Secondary Clarifier 4							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397

B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**

RAS/WAS Pump Station							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	3,750	SF			$250.00	$937,500
B2	RAS Pumps	3	EA	$75,000.00	$15,000.00	$90,000.00	$270,000
B3	WAS Pumps	3	EA	$35,000.00	$7,000.00	$42,000.00	$126,000
B4	Flow Meter	2	EA	$25,000.00	$5,000.00	$30,000.00	$60,000
B5							
B6	Architectural Finish - 2%	1	LS			$27,870.00	$27,870
B7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$278,700.00	$278,700
B8	Mechanical Allowance - 20%	1	LS			$278,700.00	$278,700
B9	Yard Piping Allowance - 30%	1	LS			$418,050.00	$418,050
				SubTotal:			**$1,189,320**

Material & Labor Total:		**$12,853,907.64**
Mobilization:	10%	$1,285,391
Prevailing Wage Rate:	5%	$642,695
Contractor's Overhead & Profit:	15%	$1,928,086
Tax:	8.6%	$1,437,067
Subtotal		**$16,710,080**
Owner's Allowance/Contingency:	*30%*	*$5,013,024*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$21,723,000***
Engineering (Design and Construction):	25%	$5,430,750
Legal and Administrative:	5%	$1,086,150
Estimated Project Cost		***$28,240,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$15,206,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$32,585,000**

Probable Cost of Construction
Trickling Filter Activated Sludge - WWTP Facility Plan

Project: Trickling Filter Activated Sludge
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
Trickling Filter 1							
A1	Wall Structural Concrete	87	CY			$800.00	$69,417
A2	Slab Structural Concrete	176	CY			$700.00	$123,191
A3	Mechanism	1	LS	$116,000.00	$29,000.00	$145,000.00	$145,000
A4	Media, Support and Biograting	1	LS	$410,550.00	$82,110.00	$492,660.00	$492,660
A5	Excavation	202	CY			$15.00	$3,036
A6	Haul	202	CY			$5.50	$1,113
A7							
A8							
A9	Architectural Finish - 2%	1	LS			$16,688.34	$16,688
A10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$166,883.39	$166,883
A11	Mechanical Allowance - 20%	1	LS			$166,883.39	$166,883
A12	Yard Piping Allowance - 30%	1	LS			$250,325.09	$250,325
				SubTotal:			**$1,435,197**
Trickling Filter 2							
A1	Wall Structural Concrete	87	CY			$800.00	$69,417
A2	Slab Structural Concrete	176	CY			$700.00	$123,191
A3	Mechanism	1	LS	$116,000.00	$29,000.00	$145,000.00	$145,000
A4	Media, Support and Biograting	1	LS	$410,550.00	$82,110.00	$492,660.00	$492,660
A5	Excavation	202	CY			$15.00	$3,036
A6	Haul	202	CY			$5.50	$1,113
A7							
A8							
A9	Architectural Finish - 2%	1	LS			$16,688.34	$16,688
A10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$166,883.39	$166,883
A11	Mechanical Allowance - 20%	1	LS			$166,883.39	$166,883
A12	Yard Piping Allowance - 30%	1	LS			$250,325.09	$250,325
				SubTotal:			**$1,435,197**

Trickling Filter Pump Station							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	800	SF			$250.00	$200,000
A2	Pumps	3	EA	$50,000.00	$10,000.00	$60,000.00	$180,000
A3	Flow Meter	1	EA	$25,000.00	$5,000.00	$30,000.00	$30,000
A4							
A5							
A6	Architectural Finish - 2%	1	LS			$8,200.00	$8,200
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$82,000.00	$82,000
A8	Mechanical Allowance - 20%	1	LS			$82,000.00	$82,000
A9	Yard Piping Allowance - 30%	1	LS			$123,000.00	$123,000
				SubTotal:			**$705,200**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Aeration Basin 1 Retrofit							
A1	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A2	Aeration Piping	1	LS			$62,500.00	$62,500
A3	Baffle System	1	LS			$189,814.81	$189,815
A4							
A5							
A6	Architectural Finish - 2%	1	LS			$7,546.30	$7,546
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$75,462.96	$75,463
A8	Mechanical Allowance - 20%	1	LS			$75,462.96	$75,463
A9	Yard Piping Allowance - 15%	1	LS			$56,597.22	$56,597
				SubTotal:			**$592,384**
Aeration Basin 2 Retrofit							
A1	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A2	Aeration Piping	1	LS			$62,500.00	$62,500
A3	Baffle System	1	LS			$189,814.81	$189,815
A4							
A5							
A6	Architectural Finish - 2%	1	LS			$7,546.30	$7,546
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$75,462.96	$75,463
A8	Mechanical Allowance - 20%	1	LS			$75,462.96	$75,463
A9	Yard Piping Allowance - 15%	1	LS			$56,597.22	$56,597
				SubTotal:			**$592,384**
Aeration Basin 3							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A4	Aeration Piping	1	LS			$62,500.00	$62,500
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7							
A8	Architectural Finish - 2%	1	LS			$11,948.46	$11,948
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$119,484.57	$119,485
A10	Mechanical Allowance - 20%	1	LS			$119,484.57	$119,485
A11	Yard Piping Allowance - 30%	1	LS			$179,226.85	$179,227
				SubTotal:			**$1,027,567**

Aeration Basin 4							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Aeration Diffuser System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A4	Aeration Piping	1	LS			$62,500.00	$62,500
A5	Excavation	3,796	CY			$15.00	$56,944
A6	Haul	3,796	CY			$5.50	$20,880
A7							
A8	Architectural Finish - 2%	1	LS			$11,948.46	$11,948
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$119,484.57	$119,485
A10	Mechanical Allowance - 20%	1	LS			$119,484.57	$119,485
A11	Yard Piping Allowance - 30%	1	LS			$179,226.85	$179,227
				SubTotal:			**$1,027,567**
AB Effluent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 10%	1	LS			$6,821.44	$6,821
A8	Mechanical Allowance - 10%	1	LS			$6,821.44	$6,821
A9	Yard Piping Allowance - 10%	1	LS			$6,821.44	$6,821
				SubTotal:			**$90,043**
Blower Building							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,400	SF			$250.00	$600,000
B2	Blowers	3	EA	$160,000.00	$40,000.00	$200,000.00	$600,000
B3							
B4	Architectural Finish - 2%	1	LS			$24,000.00	$24,000
B5	Power, Electrical, Instrumentation and Control Allowance - 5%	1	LS			$60,000.00	$60,000
B6	Mechanical Allowance - 5%	1	LS			$60,000.00	$60,000
B7	Yard Piping Allowance - 5%	1	LS			$60,000.00	$60,000
				SubTotal:			**$1,404,000**
Secondary Clarifier 3							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**
Secondary Clarifier 4							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**

RAS/WAS Pump Station							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	3,750	SF			$250.00	$937,500
B2	RAS Pumps	3	EA	$75,000.00	$15,000.00	$90,000.00	$270,000
B3	WAS Pumps	3	EA	$35,000.00	$7,000.00	$42,000.00	$126,000
B4	Flow Meter	2	EA	$25,000.00	$5,000.00	$30,000.00	$60,000
B5							
B6	Architectural Finish - 2%	1	LS			$27,870.00	$27,870
B7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$278,700.00	$278,700
B8	Mechanical Allowance - 20%	1	LS			$278,700.00	$278,700
B9	Yard Piping Allowance - 30%	1	LS			$418,050.00	$418,050
				SubTotal:			**$1,189,320**

Material & Labor Total:		**$12,089,946.81**
Mobilization:	10%	$1,208,995
Prevailing Wage Rate:	5%	$604,497
Contractor's Overhead & Profit:	15%	$1,813,492
Tax:	8.6%	$1,351,656
Subtotal		**$15,716,931**
Owner's Allowance/Contingency:	*30%*	*$4,715,079*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$20,432,000***
Engineering (Design and Construction):	25%	$5,108,000
Legal and Administrative:	5%	$1,021,600
Estimated Project Cost		***$26,562,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$14,302,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$30,648,000**

Probable Cost of Construction
BioMag Activated Sludge - WWTP Facility Plan

Project: BioMag Activated Sludge
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Demo Existing Trickling Filter and Intermediate Clarifier							
A1	Demo Trickling Filter Concrete	247	CY			$115.65	$28,540
A2	Demo Intermediate Clarifier	150	CY			$115.65	$17,323
A3	Demo Trickling Filter Pump Station	1	LS			$25,000.00	$25,000
A4	Demo Intermediate Clarifier Sludge Pump Station	1	LS			$50,000.00	$50,000
A5	Misc. Demo	1	LS			$36,258.78	$36,259
A6							
				SubTotal:			**$157,121**
BioMag							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	1,600	SF			$250.00	$400,000
A2	BioMag Mix Tank	72	CY			$800.00	$57,407
A3	BioMag Package	1	LS	$2,590,000.00	$647,500.00	###########	$3,237,500
A4	BioMag Material	13	Ton	$515.00	$128.75	$643.75	$8,369
A5							
A6							
A7							
A8							
A9	Architectural Finish - 2%	1	LS			$74,065.52	$74,066
A10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$740,655.23	$740,655
A11	Mechanical Allowance - 10%	1	LS			$370,327.62	$370,328
A12	Yard Piping Allowance - 10%	1	LS			$370,327.62	$370,328
				SubTotal:			**$5,258,652**
Anoxic Basin 1							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**

Anoxic Basin 2							
A1	Wall Structural Concrete	190	CY			$800.00	$151,852
A2	Slab Structural Concrete	93	CY			$700.00	$64,815
A3	Mixing System	1	LS	$68,000.00	$17,000.00	$85,000.00	$85,000
A4	Excavation	1,898	CY			$15.00	$28,472
A5	Haul	1,898	CY			$5.50	$10,440
A6							
A7	Architectural Finish - 2%	1	LS			$6,811.57	$6,812
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$68,115.74	$68,116
A9	Mechanical Allowance - 20%	1	LS			$68,115.74	$68,116
A10	Yard Piping Allowance - 30%	1	LS			$102,173.61	$102,174
				SubTotal:			**$585,795**
AB Influent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Aeration Basin 1 Retrofit Aeration System							
A1	Aeration Diffuser System	1	LS	$150,000.00	$37,500.00	$187,500.00	$187,500
A2	Aeration Piping	1	LS			$93,750.00	$93,750
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5							
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$11,921.30	$11,921
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$119,212.96	$119,213
A10	Mechanical Allowance - 20%	1	LS			$119,212.96	$119,213
A11	Yard Piping Allowance - 5%	1	LS			$29,803.24	$29,803
				SubTotal:			**$876,215**
Aeration Basin 2 Retrofit Aeration System							
A1	Aeration Diffuser System	1	LS	$150,000.00	$37,500.00	$187,500.00	$187,500
A2	Aeration Piping	1	LS			$93,750.00	$93,750
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5							
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$11,921.30	$11,921
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$119,212.96	$119,213
A10	Mechanical Allowance - 20%	1	LS			$119,212.96	$119,213
A11	Yard Piping Allowance - 5%	1	LS			$29,803.24	$29,803
				SubTotal:			**$876,215**
Aeration Basin 3							
A1	Wall Structural Concrete	253	CY			$800.00	$202,469
A2	Slab Structural Concrete	185	CY			$700.00	$129,630
A3	Baffle System	1	LS			$189,814.81	$189,815
A4	Mixed Liquor Recycle Pump and Piping	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5	Aeration Diffuser System	1	LS	$200,000.00	$50,000.00	$250,000.00	$250,000
A6	Aeration Piping	1	LS			$125,000.00	$125,000
A7	Excavation	3,796	CY			$15.00	$56,944
A8	Haul	3,796	CY			$5.50	$20,880
A9	Architectural Finish - 2%	1	LS			$21,994.75	$21,995
A10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$219,947.53	$219,948
A11	Mechanical Allowance - 20%	1	LS			$219,947.53	$219,948
A12	Yard Piping Allowance - 30%	1	LS			$329,921.30	$329,921
				SubTotal:			**$1,891,549**

AB Effluent Splitter							
A1	Wall Structural Concrete	42	CY			$800.00	$33,244
A2	Slab Structural Concrete	40	CY			$700.00	$28,000
A3	Excavation	340	CY			$15.00	$5,100
A4	Haul	340	CY			$5.50	$1,870
A5							
A6	Architectural Finish - 2%	1	LS			$1,364.29	$1,364
A7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$13,642.89	$13,643
A8	Mechanical Allowance - 20%	1	LS			$13,642.89	$13,643
A9	Yard Piping Allowance - 30%	1	LS			$20,464.33	$20,464
				SubTotal:			**$117,329**
Blower Building							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,400	SF			$250.00	$600,000
B2	Blowers	8	EA	$160,000.00	$40,000.00	$200,000.00	$1,600,000
B3							
B4	Architectural Finish - 2%	1	LS			$44,000.00	$44,000
B5	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$440,000.00	$440,000
B6	Mechanical Allowance - 5%	1	LS			$110,000.00	$110,000
B7	Yard Piping Allowance - 5%	1	LS			$110,000.00	$110,000
				SubTotal:			**$2,904,000**
Secondary Clarifier 3							
B1	Wall Structural Concrete	117	CY			$800.00	$93,422
B2	Slab Structural Concrete	306	CY			$700.00	$214,397
B3	Mechanism	1	LS	$185,000.00	$46,250.00	$231,250.00	$231,250
B4	Weir and Baffles	1	LS	$30,000.00	$7,500.00	$37,500.00	$37,500
B5	Excavation	4,725	CY			$15.00	$70,882
B6	Haul	4,725	CY			$5.50	$25,990
B7							
B8							
B9	Architectural Finish - 2%	1	LS			$13,468.81	$13,469
B10	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$134,688.14	$134,688
B11	Mechanical Allowance - 20%	1	LS			$134,688.14	$134,688
B12	Yard Piping Allowance - 30%	1	LS			$202,032.21	$202,032
				SubTotal:			**$1,158,318**
RAS/WAS Pump Station							
B1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,501	SF			$250.00	$625,313
B2	RAS Pumps	2	EA	$75,000.00	$15,000.00	$90,000.00	$180,000
B3	WAS Pumps	2	EA	$35,000.00	$7,000.00	$42,000.00	$84,000
B4	Flow Meter	2	EA	$25,000.00	$5,000.00	$30,000.00	$60,000
B5							
B6	Architectural Finish - 2%	1	LS			$18,986.25	$18,986
B7	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$189,862.50	$189,863
B8	Mechanical Allowance - 20%	1	LS			$189,862.50	$189,863
B9	Yard Piping Allowance - 30%	1	LS			$284,793.75	$284,794
				SubTotal:			**$827,505**
	Material & Labor Total:						**$15,355,824.30**
	Mobilization:	10%					$1,535,582
	Prevailing Wage Rate:	5%					$767,791
	Contractor's Overhead & Profit:	15%					$2,303,374
	Tax:	8.6%					$1,716,781
Subtotal							**$19,962,572**
	Owner's Allowance/Contingency:	*30%*					*$5,988,771*
	Environmental Mitigation:	*Not included*					
	Right of Way Acquisition:	*Not included*					
Estimated Construction Cost							***$25,951,000***
	Engineering (Design and Construction):	25%					$6,487,750
	Legal and Administrative:	5%					$1,297,550
Estimated Project Cost							***$33,736,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)							**$18,166,000**

Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)	**$38,927,000**

Probable Cost of Construction
UV Expansion Project - WWTP Facility Plan

Project: UV Expansion Project
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
UV Expansion Project							
A1	UV Modules X 12	0	LS	$480,000.00	$240,000.00	$720,000.00	
A2							
A3	UV Modules X 16	1	LS	$560,000.00	$280,000.00	$840,000.00	$840,000
A4	Channel Modification	1	LS	$10,000.00	$25,000.00	$35,000.00	$35,000
A5	Influent Stilling Plate	1	LS	$5,000.00	$5,000.00	$10,000.00	$10,000
A6	Level Control Gate	1	LS	$25,000.00	$25,000.00	$50,000.00	$50,000
A7							
A8							
A9	Architectural Finish - 2%	1	LS			$18,700.00	$18,700
A10	Power, Electrical, Instrumentation and Control Allowance - 30%	1	LS			$280,500.00	$280,500
A11	Mechanical Allowance - 5%	1	LS			$46,750.00	$46,750
A12	Yard Piping Allowance - 0%	1	LS			$0.00	
				SubTotal:			**$1,280,950**

Material & Labor Total:		**$1,280,950.00**
Mobilization:	10%	$128,095
Prevailing Wage Rate:	5%	$64,048
Contractor's Overhead & Profit:	15%	$192,143
Tax:	8.6%	$143,210
Subtotal		**$1,665,235**
Owner's Allowance/Contingency:	*30%*	*$499,571*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$2,165,000***
Engineering (Design and Construction):	25%	$541,250
Legal and Administrative:	5%	$108,250
Estimated Project Cost		***$2,815,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$1,516,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$3,248,000**

Probable Cost of Construction
Wastewater Treatment Plant Facility Plan - Outfall Project 1

Project: Wastewater Treatment Plant Facility Plan
Submittal: Outfall Project 1
Owner: City of Pasco, WA
Project No.: 16-1916
Date: August, 3, 2018

Item No.	Item	Quantity		Unit Costs: Material	Unit Costs: Labor/Equipment (L/E)	Unit Costs: Total	Total Cost
A1	Abandonment of existing inland outfall piping and manholes	1	LS			$9,000.00	$9,000
A2	Abandonment in place of existing inwater piping	1	LS			$22,500.00	$22,500
A3	Bypass Pumping	1	LS			$25,000.00	$25,000
A4	Inland Pipe - Open Cut Fused HDPE 36" Diameter	1,800	LF			$200.00	$360,000
A5	Manholes - 96" Diameter manhole and appertanances	6	EA			$15,000.00	$90,000
A6	Flow meter & vault	1	EA			$50,000.00	$50,000
A7	Surface Restoration (one lane width) - Asphalt	900	LF			$80.00	$72,000
A8	Surface Restoration - Misc	900	LF			$15.00	$13,500
A9	In-water pipe and multi-port diffuser - Fused HDPE, placed, concrete collars, rip rap protection	50	LF			$2,340.00	$117,000
A10	Wetland Reconstruction	0	LS			$10,000.00	
A11	Erosion and Sediment Control (1% of inland work)	1	LS			$12,840.00	$12,840
A12	Traffic Control (1% of inland work)	1	LS			$12,840.00	$12,840
				SubTotal:			**$784,680**

Material & Labor Total:		**$784,680.00**
Sales Tax	8.6%	$67,482
Mobilization:	10%	$78,468
Contractor's Overhead & Profit:	15%	$117,702
Subtotal		**$1,048,332**
Owner's Allowance/Contingency:	*30%*	*$314,500*
Land or Right of Way Acquisition	*Not included*	
Estimated Construction Cost		***$1,363,000***
Outfall Study	LS	$0
Engineering	15%	$204,450
Construction Eng./Admin.	5%	$68,150
Estimated Project Cost		***$1,636,000***
Project Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$1,145,000**
Project Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$2,454,000**

Probable Cost of Construction
Wastewater Treatment Plant Facility Plan - Outfall

Project: Wastewater Treatment Plant Facility Plan
Submittal: Outfall
Owner: City of Pasco, WA
Project No.: 16-1916
Date: August, 3, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Total	
A1	Abandonment of existing inland outfall piping and manholes	0	LS			$9,000.00	
A2	Abandonment in place of existing inwater piping	0	LS			$22,500.00	
A3	Bypass Pumping	0	LS			$25,000.00	
A4	Inland Pipe - Open Cut Fused HDPE 36" Diameter	0	LF			$200.00	
A5	Manholes - 96" Diameter manhole and appertananes	0	EA			$15,000.00	
A6	Flow meter & vault	0	EA			$50,000.00	
A7	Surface Restoration (one lane width) - Asphalt	0	LF			$80.00	
A8	Surface Restoration - Misc	0	LF			$15.00	
A9	In-water pipe and multi-port diffuser - Fused HDPE, placed, concrete collars, rip rap protection	1,000	LF			$2,340.00	$2,340,000
A10	Wetland Reconstruction	1	LS			$10,000.00	$10,000
A11	Erosion and Sediment Control (1% of inland work)	0	LS			$0.00	
A12	Traffic Control (1% of inland work)	0	LS			$0.00	
				SubTotal:			**$2,350,000**

Material & Labor Total:		**$2,350,000.00**
Sales Tax	8.6%	$202,100
Mobilization:	10%	$235,000
Contractor's Overhead & Profit:	15%	$352,500
Subtotal		**$3,139,600**
Owner's Allowance/Contingency:	*30%*	*$941,880*
Land or Right of Way Acquisition	*Not included*	
Estimated Construction Cost		***$4,081,000***
Outfall Study	LS	$0
Engineering	15%	$612,150
Construction Eng./Admin.	5%	$204,050
Estimated Project Cost		***$4,897,000***
Project Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$3,428,000**
Project Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$7,346,000**

Probable Cost of Construction
Administration Building - WWTP Facility Plan

Project: Administration Building
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Adminstration Building							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	6,600	SF			$350.00	$2,310,000
A2							
A3							
A4							
A5							
A6	Architectural Finish - 0%	1	LS			$0.00	
A7	Power, Electrical, Instrumentation and Control Allowance - 0%	1	LS			$0.00	
A8	Mechanical Allowance - 0%	1	LS			$0.00	
A9	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A10	Yard Piping Allowance - 0%	1	LS			$0.00	
				SubTotal:			**$2,310,000**

Material & Labor Total:		**$2,310,000.00**
Mobilization:	10%	$231,000
Prevailing Wage:	5%	$115,500
Contractor's Overhead & Profit:	15%	$346,500
Tax:	8.6%	$258,258
Subtotal		**$3,003,000**
Owner's Allowance/Contingency:	*30%*	*$900,900*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$3,904,000***
Engineering (Design and Construction):	25%	$976,000
Legal and Administrative:	5%	$195,200
Estimated Project Cost		***$5,075,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$2,733,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$5,856,000**

Probable Cost of Construction
Laboratory Building - WWTP Facility Plan

Project: Laboratory Building
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Laboratory Building							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.	2,000	SF			$350.00	$700,000
A2							
A3							
A4							
A5							
A6	Architectural Finish - 0%	1	LS			$0.00	
A7	Power, Electrical, Instrumentation and Control Allowance - 0%	1	LS			$0.00	
A8	Mechanical Allowance - 0%	1	LS			$0.00	
A9	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A10	Yard Piping Allowance - 0%	1	LS			$0.00	
				SubTotal:			**$700,000**

Material & Labor Total:		**$700,000.00**
Mobilization:	10%	$70,000
Prevailing Wage:	5%	$35,000
Contractor's Overhead & Profit:	15%	$105,000
Tax:	8.6%	$78,260
Subtotal		**$910,000**
Owner's Allowance/Contingency:	*30%*	*$273,000*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$1,183,000***
Engineering (Design and Construction):	25%	$295,750
Legal and Administrative:	5%	$59,150
Estimated Project Cost		***$1,538,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$828,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$1,775,000**

APPENDIX 7-1

Probable Cost of Construction
Waste Activated Sludge Thickening - WWTP Facility Plan

Project: Waste Activated Sludge Thickening
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
WAS Thickening							
A1	Classified Space Building - Includes foundation, envelope, windows, doors, HVAC, Lighting.	1,440	SF			$350.00	$504,000
A2	Thickening Unit	2	EA	$250,000.00	$125,000.00	$375,000.00	$750,000
A3	Polymer Wet	1	LS	$37,130.00	$9,282.50	$46,412.50	$46,413
A4							
A5							
A6							
A7							
A8	Architectural Finish - 2%	1	LS			$26,008.25	$26,008
A9	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$260,082.50	$260,083
A10	Mechanical Allowance - 15%	1	LS			$195,061.88	$195,062
A11	Yard Piping Allowance - 15%	1	LS			$195,061.88	$195,062
				SubTotal:			**$1,976,627**

Material & Labor Total:		**$1,976,627.00**
Mobilization:	10%	$197,663
Prevailing Wage Rate:	5%	$98,831
Contractor's Overhead & Profit:	15%	$296,494
Tax:	8.6%	$220,987
Subtotal		**$2,569,615**
Owner's Allowance/Contingency:	*30%*	*$770,885*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$3,340,000***
Engineering (Design and Construction):	25%	$835,000
Legal and Administrative:	5%	$167,000
Estimated Project Cost		***$4,342,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$2,338,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$5,010,000**

Probable Cost of Construction
Anaerobic Digester - WWTP Facility Plan

Project: Anaerobic Digester
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Anaerobic Digester							
A1	Classified Space Building - Includes foundation, envelope, windows, doors, HVAC, Lighting.	1,664	SF			$350.00	$582,400
A2	Wall Structural Concrete	145	CY			$800.00	$115,693
A3	Slab Structural Concrete	253	CY			$700.00	$177,395
A4							
A5	AD Cover	1	EA	$200,000.00	$50,000.00	$250,000.00	$250,000
A6	Boiler	2	EA	$140,000.00	$35,000.00	$175,000.00	$350,000
A7	Spiral Heat Exchanger	2	EA	$47,000.00	$11,750.00	$58,750.00	$117,500
A8	Recirculation Pump	2	EA	$37,500.00	$9,375.00	$46,875.00	$93,750
A9	Mixer	1	EA	$150,000.00	$37,500.00	$187,500.00	$187,500
A10	Flare	1	EA	$85,000.00	$21,250.00	$106,250.00	$106,250
A11	Architectural Finish - 2%	1	LS			$39,609.77	$39,610
A12	Power, Electrical, Instrumentation and Control Allowance - 30%	1	LS			$594,146.58	$594,147
A13	Mechanical Allowance - 40%	1	LS			$792,195.45	$792,195
A14	Yard Piping Allowance - 15%	1	LS			$297,073.29	$297,073
				SubTotal:			**$3,703,514**

Material & Labor Total:		**$3,703,513.71**
Mobilization:	10%	$370,351
Prevailing Wage Rate:	5%	$185,176
Contractor's Overhead & Profit:	15%	$555,527
Tax:	8.6%	$414,053
Subtotal		**$4,814,568**
Owner's Allowance/Contingency:	*30%*	*$1,444,370*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$6,259,000***
Engineering (Design and Construction):	25%	$1,564,750
Legal and Administrative:	5%	$312,950
Estimated Project Cost		***$8,137,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$4,381,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$9,389,000**

Probable Cost of Construction
Thermal Chemical Hydrolysis - WWTP Facility Plan

Project: Thermal Chemical Hydrolysis
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Thermal Chemical Hydrolysis							
A1	Building - Includes foundation, envelope, windows, doors, basic HVAC, Lighting.		SF			$250.00	
A2	Equipment		EA	$1.00	$0.25	$1.25	
A3							
A4							
A5							
A6							
A7							
A8							
A9							
A10							
A11							
A12	Architectural Finish - 2%	1	LS			$0.00	
A13	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$0.00	
A14	Mechanical Allowance - 20%	1	LS			$0.00	
A15	Undeveloped Mechanical Allowance - 0%	1	LS			$0.00	
A16	Yard Piping Allowance - 30%	1	LS			$0.00	
				SubTotal:			**$0**

Material & Labor Total:	**$0.00**
Mobilization:	$0
Prevailing Wage:	$0
Contractor's Overhead & Profit:	$0
Tax:	$0
Subtotal	**$0**
Owner's Allowance/Contingency:	*$0*
Environmental Mitigation:	
Right of Way Acquisition:	
Estimated Construction Cost	***$0***
Engineering (Design and Construction):	$0
Legal and Administrative:	$0
Estimated Project Cost	***$0***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)	**$0**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)	**$0**

Probable Cost of Construction
Biosolids Drying - WWTP Facility Plan

Project: Biosolids Drying
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs: Material	Unit Costs: Labor/Equipment (L/E)	Unit Costs: Subtotal	Total Cost
Biosolids Drying							
A1	Classified Space Building - Includes foundation, envelope, windows, doors, HVAC, Lighting.	2,400	SF			$350.00	$840,000
A2	Dryer Package	1	LS	$2,900,000.00	$435,000.00	###########	$3,335,000
A3							
A4							
A5	Architectural Finish - 2%	1	LS			$83,500.00	$83,500
A6	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$835,000.00	$835,000
A7	Mechanical Allowance - 15%	1	LS			$626,250.00	$626,250
A8	Yard Piping Allowance - 10%	1	LS			$417,500.00	$417,500
				SubTotal:			**$6,137,250**

Material & Labor Total:		**$6,137,250.00**
Mobilization:	10%	$613,725
Prevailing Wage Rate:	5%	$306,863
Contractor's Overhead & Profit:	15%	$920,588
Tax:	8.6%	$686,145
Subtotal		**$7,978,425**
Owner's Allowance/Contingency:	*30%*	*$2,393,528*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$10,372,000***
Engineering (Design and Construction):	25%	$2,593,000
Legal and Administrative:	5%	$518,600
Estimated Project Cost		***$13,484,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$7,260,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$15,558,000**

Probable Cost of Construction
Biosolids Dewatering - WWTP Facility Plan

Project: Biosolids Dewatering
Submittal: WWTP Facility Plan
Owner: City of Pasco, WA
Project No.: 16-1916
Date: November 20, 2018

Item No.	Item	Quantity		Unit Costs			Total Cost
				Material	Labor/Equipment (L/E)	Subtotal	
Biosolids Dewatering							
A1	Classified Space Building - Includes foundation, envelope, windows, doors, HVAC, Lighting.	1,440	SF			$350.00	$504,000
A2	Dewatering Unit	2	EA	$750,000.00	$187,500.00	$937,500.00	$1,875,000
A3	Polymer Wet	1	LS	$65,000.00	$16,250.00	$81,250.00	$81,250
A4	Centrate Storage and Return System	1	LS	$100,000.00	$25,000.00	$125,000.00	$125,000
A5	Conveyor	2	EA	$75,000.00	$18,750.00	$93,750.00	$187,500
A6							
A7	Architectural Finish - 2%	1	LS			$55,455.00	$55,455
A8	Power, Electrical, Instrumentation and Control Allowance - 20%	1	LS			$554,550.00	$554,550
A9	Mechanical Allowance - 15%	1	LS			$415,912.50	$415,913
A10	Yard Piping Allowance - 5%	1	LS			$138,637.50	$138,638
				SubTotal:			**$3,937,305**

Material & Labor Total:		**$3,937,305.00**
Mobilization:	10%	$393,731
Prevailing Wage Rate:	5%	$196,865
Contractor's Overhead & Profit:	15%	$590,596
Tax:	8.6%	$440,191
Subtotal		**$5,118,497**
Owner's Allowance/Contingency:	*30%*	*$1,535,549*
Environmental Mitigation:	*Not included*	
Right of Way Acquisition:	*Not included*	
Estimated Construction Cost		***$6,654,000***
Engineering (Design and Construction):	25%	$1,663,500
Legal and Administrative:	5%	$332,700
Estimated Project Cost		***$8,650,000***
Construction Cost w/ sales Tax and Owner's Allowance (minimum range: -30%)		**$4,658,000**
Construction Cost w/ sales Tax and Owner's Allowance (maximum range: +50%)		**$9,981,000**

APPENDIX 8-1

Appendix 8-1

WWTP Goals, Objectives and Evaluation Criteria

8-1.1 Introduction

This section of the Wastewater Facility Plan documents the City of Pasco's (City) wastewater treatment plant (WWTP) goals, objectives and evaluation criteria for comparing and assessing the existing WWTP and expansion alternatives.

The development of the City's WWTP Facility Plan (Plan) must include addressing anticipated future growth, technology, finances, the environment and regulatory requirements associated with operating the wastewater treatment system. However, more than this can be incorporated into the plan.

City staff were surveyed to determine City goals, values, and objectives for consideration when identifying and evaluating future expansion and improvement alternatives for the wastewater treatment plant. The survey included comparing the five criteria areas as well as describing any treatment processes or technologies that were of interest to the City. A copy of the survey is included in **Attachment 8-1.1.**

The five criteria areas considered in determining the objectives and alternatives for the WWTP alternatives included:

Economic – Captures the relative economic costs and benefits of each alternative and focusses on the affordability, budget priorities, capital cost, and operational costs. A preference for this criterion means that factors such as capital costs, annual operational costs, cash flow requirements, etc are an important evaluation criterion for you.

Environmental – A preference for this criterion emphasizes a desire to provide low impact to, protection of, or enhancement of the environment. Environmentally favorable alternative traits include, but are not limited to: reducing greenhouse gases, providing better effluent quality than required, reusing or conserving water, reducing energy use, improving air quality, constructing LEED certified facilities, generating/recovering energy or resources, etc.

Social – A preference for this criterion shows a desire to protect and enhance public health and safety; enhance cultural, educational, and recreational assets; and maintain/enhance good public relations. For example, socially preferred alternatives would provide or compliment a City amenity (park, wetland, etc...), include public education features, or minimize off-site impacts (traffic, noise, odors), etc.

Functional/Operational – Preferring this criterion shows a City's desire that alternatives demonstrate through a longstanding history an ability to meet treatment objectives, be easily implemented, and be easy to operate and maintain. New, emerging, or cutting-edge treatment technologies would not rank highly under these criteria.

Future Uncertainty/Flexibility – The major unit process of a WWTP are routinely used beyond their 20-year planning horizon and future growth and regulatory requirements in the planning horizon are never truly known and can only be estimated based on existing information and trends. Favoring these criteria shows a desire for alternatives that not only meet the anticipated future growth and regulatory conditions but also can meet (or easily be adapted to meet) faster or slower growth and/or more stringent regulatory conditions such as nutrient removal versus just Biochemical Oxygen Demand removal.

8-1.1.1 Survey Results

Survey results were collected from City Staff during a workshop on April 11, 2018. At this workshop, the individual criterion results were reviewed and a collective group pairwise comparison was performed. The resulting rank and weight of the group pairwise comparison is summarized in **Table 8-1.1**.

Table 8-1.1
Survey Result

Goal	Rank	Weighting
Future Uncertainty/Flexibility	1	42%
Functional/Operational	2	29%
Economic	3	21%
Societal	4	4%
Environmental	5	4%

Using the relative scale of -4 to 4 shown below, rate the criteria on the left side against each other criteria in the upper right side of the provided matrix. Use whole numbers and fill out the white boxes only.

For example, when comparing the first pairing presented below, if you "Slightly Disfavor" the "Economics" criteria over "Functional/Operational", then enter "-1" in the associated matrix box as shown below.

As another example, if you "Strongly Favor" the "Environmental" criteria over the "Societal", then enter "3" in its associated matrix box as shown below.

A definition for each of the criteria is provided for your reference next to the blank matrix on the following page.

Example Rating Matrix

Rating Scale

Very Strongly Disfavor	Strongly Disfavors	Disfavor	Slightly Disfavor	Equal	Slightly Favor	Favor	Strongly Favor	Very Strongly Favor
-4	-3	-2	-1	0	1	2	3	4

WWTP Goal	Economic	Functional/ Operational	Environmental	Societal	Future Uncertainty/ Flexibility
Economic	0	-1			
Functional/Operational		0			
Environmental			0	3	
Societal				0	
Future Uncertainty/Flexibility					0

PART 1 - Criteria Preferences

WWTP Goals, Values, and Objectives	Economic	Functional/Operational	Environmental	Societal	Future Uncertainty/Flexibility
Economic	0				
Functional/Operational		0			
Environmental			0		
Societal				0	
Future Uncertainty/Flexibility					0

Criteria Descriptions:

Economic – Captures the relative economic costs and benefits of each alternative and focusses on the affordability, budget priorities, capital cost, and operational costs. A preference for this criteria means that factors such as capital costs, annual operational costs, cash flow requirements, etc are an important evaluation criteria for you.

Functional/Operational – Preferring this criteria shows a City's desire that alternatives demonstrate through a longstanding history an ability to meet treatment objectives , be easily implemented, and be easy to operate and maintain. New, emerging, or cutting edge treatment technologies would not rank highly under this criteria.

Environmental – A preference for this criteria emphasizes a desire to provide low impact to, protection of, or enhancement of the environment. Environmentally favorable alternative traits include, but are not limited to: reducing greenhouse gases, providing better effluent quality than required, reusing or conserving water, reducin energy use, improving air quality, constructing LEED certified facilities, generating/recovering energy or resources, etc.

Societal – A preference for this criteria shows a desire to protect and enhance public health and safety; enhance cultural, educational, and recreational assets; and maintain/enhance good public relations. For example, socially preferred alternatives would provide or compliment a City amenity (park, wetland, etc...), include public education features, or minimize off-site impacts (traffic, noise, odors), etc.

Future Uncertainty/Flexibility – The major unit process of a WWTP are routinely used beyond their 20-year planning horizon and future growth and regulatory requirements in theis planning horizon are never truly known and can only be estimated based on existing information and trends. Favoring this critieria shows a desire for alternatives that not only meet the anticipated future growth and regulatory conditions but also can meet (or easily be adapted to meet) faster or slower growth and/or more stringent regulatory conditions such as nutrient removal versus just BOD removal.

Completed by:

Date:

Phone:

Email:

Rating Scale

Very Strongly Disfavor	Strongly Disfavors	Disfavor	Slightly Disfavor	Equal	Slightly Favor	Favor	Strongly Favor	Very Strongly Favor
-4	-3	-2	-1	0	1	2	3	4

murraysmith

APPENDIX 8-2

Appendix 8-2

Ranking Summary of Alternatives

8-2 Introduction

This appendix of the Wastewater Facility Plan summarizes the City of Pasco's (City) wastewater treatment plant (WWTP) expansion alternatives ranking.

8-2.1 Liquid Alternative Ranking

8-2.1.1 Preliminary Treatment Alternative Ranking

The preliminary treatment alternative rankings are summarized in **Table 8-2.1**. The City selected the headworks expansion project because this will increase the capacity of the screenings process and the reliability and redundancy. The No Action alternative will not meet the required future reliability and redundancy requirements. Also, as the flow increases, the No Action alternative is likely to allow rags and material to pass through the screens.

Table 8-2.1
Preliminary Treatment Alternatives Ranking Summary

FINAL RANK	Alternative Number	Alternative Name	Econ	Enviro	Social	Functional/ Operational	Future Uncertainty/ Flexibility
2	PRE-1	Screening No Action	1	2	2	2	2
1	**PRE-2**	**Headworks Expansion**	**2**	**1**	**1**	**1**	**1**

8-2.1.2 Secondary Treatment Alternative Ranking

The secondary treatment alternative rankings are summarized in **Table 8-2.2**. The City selected the Activated Sludge Plug Flow alternative because it is a tried and true treatment method, it is expandable, can be modified if future permit requirements include nutrient limits, and was nearly the lowest cost alternative.

The Trickling Filter/Activated sludge was the least expensive option but was not selected as it has the greatest likelihood to have lost assets/options (biological) if future permits include nutrient limits. Other options are quite a bit more expensive with high upfront capital costs as well as long term operation and maintenance costs. They also will require additional level of operational complexity.

Table 8-2.2
Secondary Treatment Alternatives Ranking Summary

FINAL RANK	Alternative Number	Alternative Name	Economic	Environmental	Social	Functional/Operational	Future Uncertainty/Flexibility
8	SEC-1	Secondary Treatment No Action	7	8	8	8	8
1	**SEC-2**	**Activated Sludge - Plug Flow**	**3**	**2**	**2**	**1**	**1**
2	SEC-3	Membrane Bioreactor (MBR)	6	1	1	1	1
5	SEC-4	Internal Fixed Film Activated Sludge (IFAS) – Fixed Growth	5	2	2	5	3
6	SEC-5	Zee lung membrane aeration bioreactor – Fixed Growth	7	2	2	6	3
		Trickling Filter/Activated Sludge					
4	SEC-6a	▪ Nitrification Only	2	6	6	1	5
3	SEC-6b	▪ Nitrification and Denitrification	1	2	2	1	5
3	SEC-7	BioMag Activated Sludge	4	2	2	4	7

8-2.1.3 Disinfection Alternative Ranking

This section documents the disinfection alternative rankings and the resulting rank is summarized in **Table 8-2.3**.

Table 8-2.3
Disinfection Alternatives Ranking Summary

FINAL RANK	Alternative Number	Alternative Name	Econ	Enviro	Social	Functional/ Operational	Future Uncertainty/ Flexibility
2	DIS-1	UV Disinfection No Action	2	2	2	2	2
1	**DIS-2**	**UV Disinfection Expansion**	**1**	**1**	**1**	**1**	**1**

8-2.1.4 Outfall Alternative Ranking

The outfall alternative rankings are summarized in **Table 8-2.4**. The City selected the Gravity Outfall project because this will increase the capacity of the outfall and is operationally very simple and reliable. The No Action alternative will not meet the required future capacity requirements. Also, as the flow increases, the No Action alternative will likely lead to uncontrolled overflows of plant effluent.

Table 8-2.4
Outfall Alternatives Ranking Summary

FINAL RANK	Alternative Number	Alternative Name	Econo	Enviro	Social	Functional/ Operational	Future Uncertainty/ Flexibility
2	OUT-1	Outfall No Action	2	2	2	2	2
1	**OUT-2**	**Gravity Outfall Replacement**	**1**	**1**	**1**	**1**	**1**

8-2.2 Biosolids Handling Alternative Ranking

8-2.2.1 WAS Thickening Alternative Ranking

The WAS thickening alternative rankings are summarized in **Table 8-2.5**. The City selected the Mechanical WAS Thickening alternative because this will increase the capacity of the WAS thickening process and is operationally very simple and reliable. It also has the benefit of increasing the anaerobic digester capacity by thickening the feed sludge concentration. The No Action alternative would force the City to rely on the existing DAFT which is old and has not been able to be maintained because it operates 24 hours a day. If the DAFT were not operational, the biosolids handling system will quickly become overloaded and class B biosolids will not be generated which will increase the system operation and maintenance costs considerably.

Table 8-2.5
WAS Thickening Alternatives Ranking Summary

FINAL RANK	Alternative Number	Alternative Name	Econo	Environ	Social	Functional/ Operational	Future Uncertainty/ Flexibility
2	WAS-1	WAS Thickening No Action	1	2	2	2	2
1	**WAS-2**	**Mechanical Thickening**	**2**	**1**	**1**	**1**	**1**

8-2.2.2 Solids Stabilization Alternative Ranking

The solids stabilization alternative rankings are summarized in **Table 8-2.6**. The City selected the Anaerobic Digestion Expansion alternative because this will increase the capacity of the biosolids stabilization process and maintain class B biosolids through the planning horizon. The No Action alternative would force the City to rely on the existing anaerobic digesters which are nearing capacity. Class B biosolids can be generated in the drying beds but this requires additional operation and maintenance costs and the drying beds are nearing capacity.

Table 8-2.6
Solids Stabilization Alternatives Ranking Summary

FINAL RANK	Alternative Number	Alternative Name	Econo	Enviro	Social	Functional/ Operational	Future Uncertainty/ Flexibility
4	STA-1	No Action	3	4	4	4	1
1	**STA-2**	**Anaerobic Digestion Expansion**	**1**	**1**	**1**	**1**	**1**
3	STA-3	Chemical Hydrolysis	4	2	1	3	3
2	STA-4	Thermal Drying	2	2	1	2	2

8-2.2.3 Solids Finishing Alternative Ranking

The solids finishing alternative rankings are summarized in **Table 8-2.7**.

The City selected the Mechanical Dewatering alternative because this will increase the capacity of the biosolids drying process (maintaining a second method for class B biosolids generation) and is operationally very simple and reliable. The No Action alternative would force the City to rely on the single existing RDT and drying beds which are nearing capacity.

Table 8-2.7
Solids Finishing Alternatives Ranking Summary

FINAL RANK	Alternative Number	Alternative Name	Econo	Enviro	Social	Functional/ Operational	Future Uncertainty/ Flexibility
2	FIN-1	Biosolids Finishing No Action	1	2	2	2	2
1	FIN-2	Mechanical Dewatering	2	1	1	1	1

APPENDIX 8-3

City of Pasco

WWTP Facility Plan

Workshop 4: Capital Improvement Plan Development

Presented by: Craig Anderson & Mark Cummings

March 7, 2019

murraysmith

WELCOME & INTRODUCTIONS

1. **Looking Back**: Project Review & Update
2. **WDOE SERP & Funding Discussion**
3. **Improvement Timeline**: Capital Improvement Plan
4. **Project Next Steps**

AGENDA

LOOKING BACK:
Project Review & Update

Facility Plan Sections

01 Introduction

02 Existing Conditions — General

03 Existing Conditions — WWTP

04 Capacity Analysis

05 Future Conditions

06 Liquids Stream Alternatives

07 Solids Stream Alternatives

08 Project Implementation

Draft Document Developed & into WDOE for Review

Consultant Internal Draft complete

Today

Future Work (Finalize)

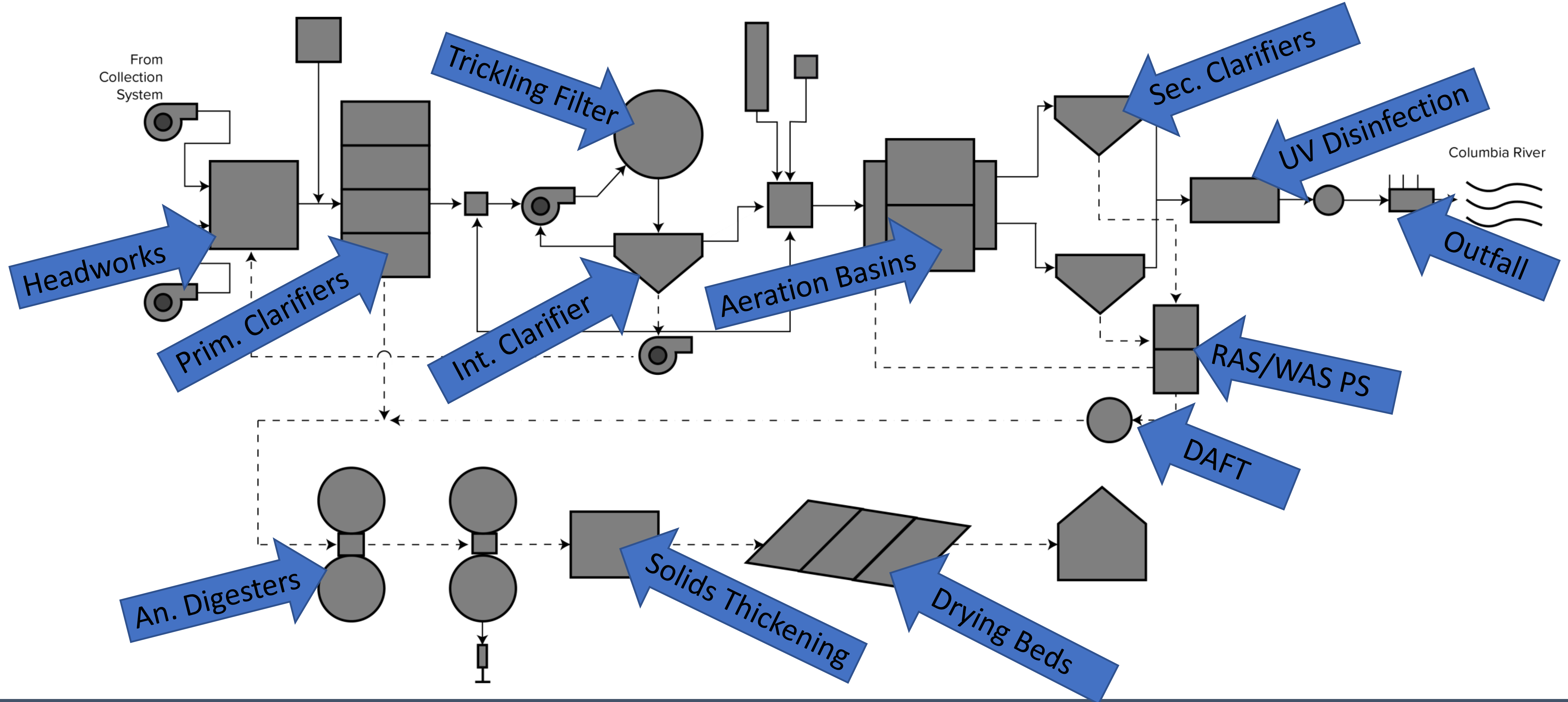
WWTP Aerial

Item	Description
1	Headworks
2	Screen
3	Grit Removal
4	Primary Clarifier
5	PC Effluent Box
6	Trickling Filter Recirculation Pump Station
7	Trickling Filter
8	Intermediate Clarifier
9	ICE Box

Item	Description
10	Aeration Basin Splitter Box
11	Aeration Basin
12	Aeration Basin Effluent Splitter Box
13	Secondary Clarifier
14	UV Disinfection
15	Effluent Flume Flow Meter
16	Outfall to Columbia River (not pictured)
17	Columbia River Diffuser (not pictured)
18	Primary Sludge Pump Station

Item	Description
19	Intermediate Clarifier Sludge Pump Station
20	RAS/WAS Pump Station
21	DAFT
22	Anaerobic Digester
23	Sludge Storage
24	Gas Storage
25	Flare
26	Solids Thickening
27	Drying Bed

Item	Description
28	Solids Drying Building
29	Ferric Chloride
30	Caustic
31	Lime Silo
32	Administration building
33	Laboratory
34	Blower Building
35	Machine Shop (not pictured)
36	Equipent Building



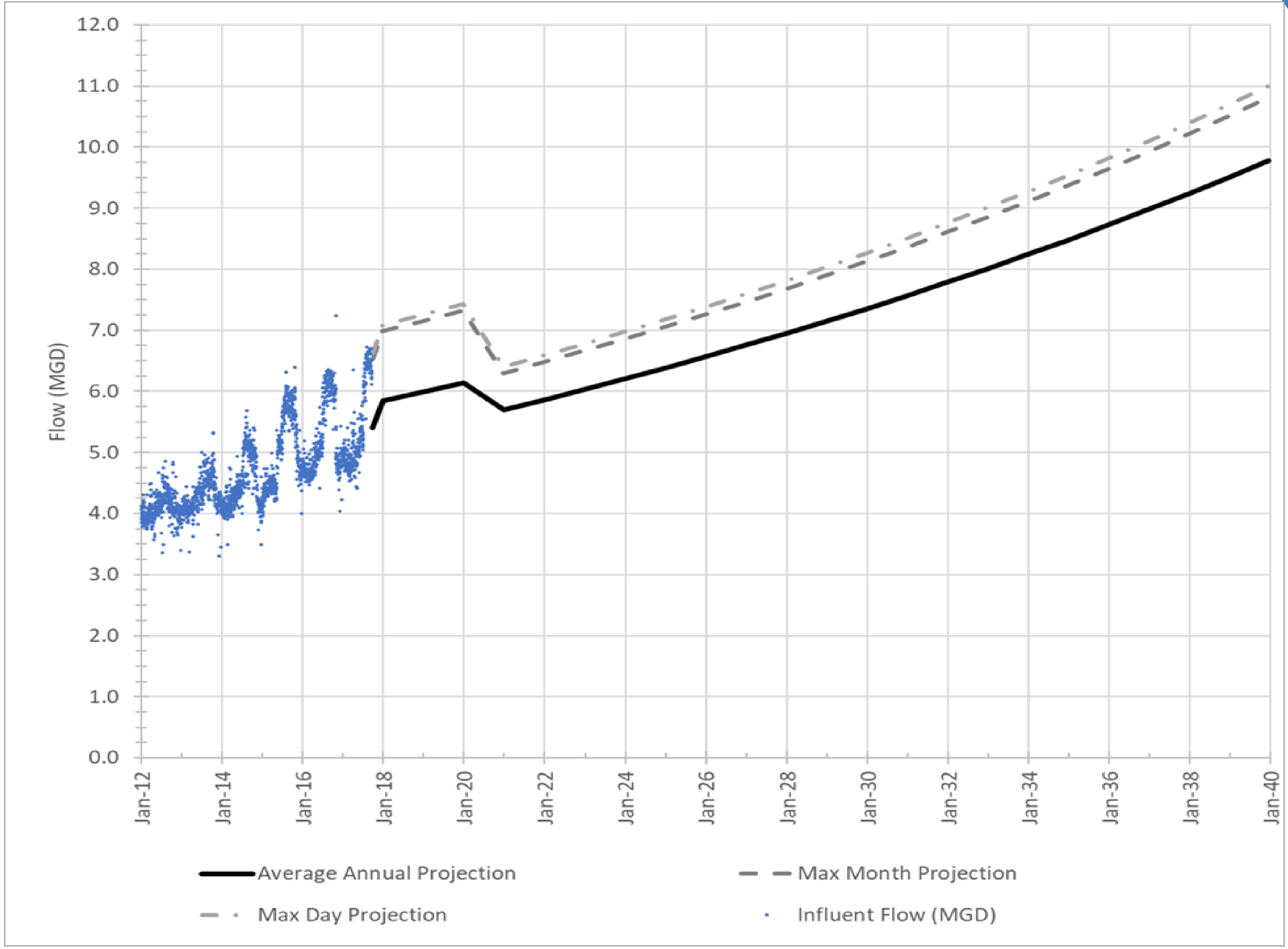
Existing Facility Schematic

Future Flow and Loads (2040)

- Municipal Component
- Industrial Component
- Commitments

- Overall Average Annual
    - 5.9 MGD now
    - 9.8 MGD 2040

- **Overall Max Month**
    - **6.5 MGD now**
    - **10.9 MGD 2040**



Reliability and Redundancy Review

Firm Capacity

- Secondary Treatment
- Secondary Clarifiers
- UV Disinfection
- Alkalinity Feed System
- Anaerobic Digestion
- WAS Thickening
- Biosolids Dewatering

Orangebook as Minimum

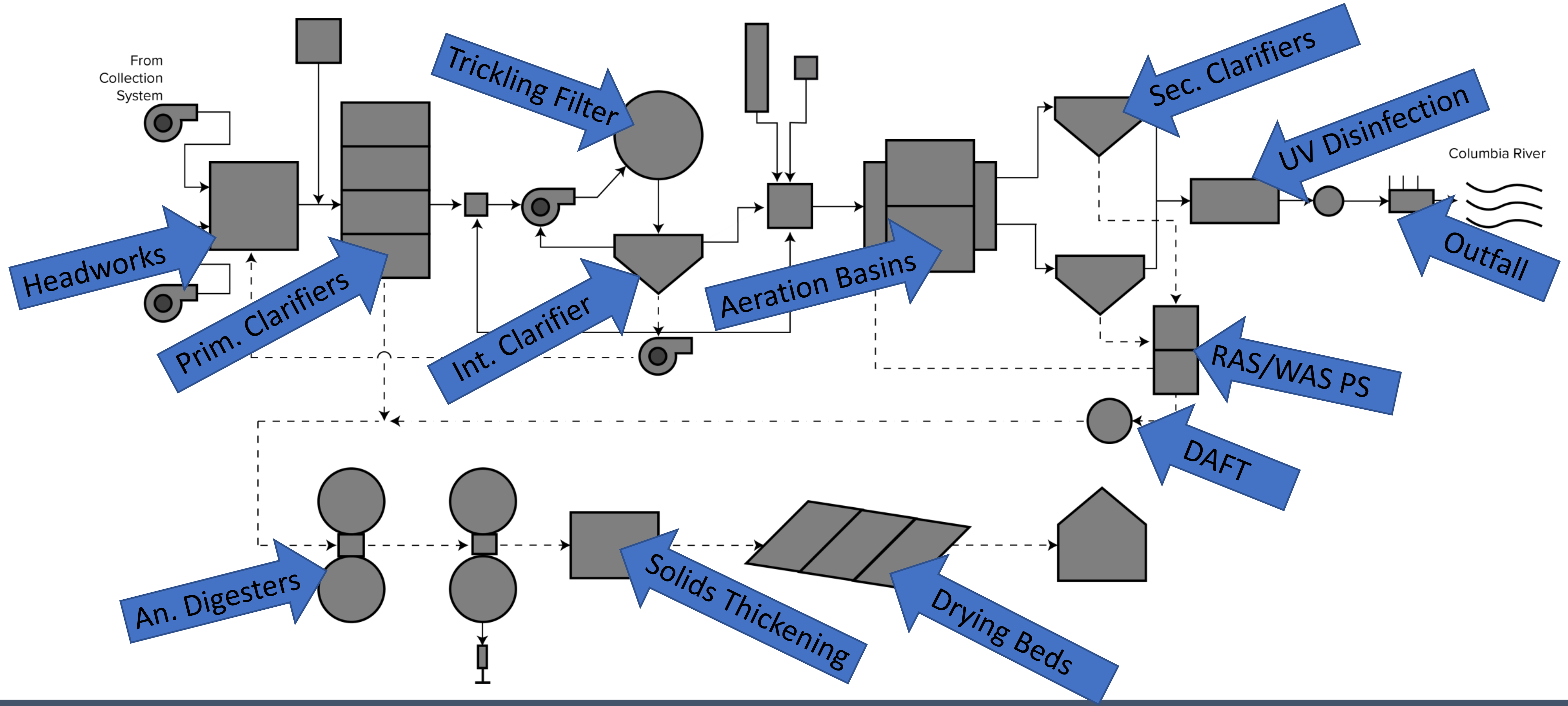
- Screening
- Primary Clarifier
- Blowers
- Air diffusers
- Pump Stations

Single Unit Operation Allowable

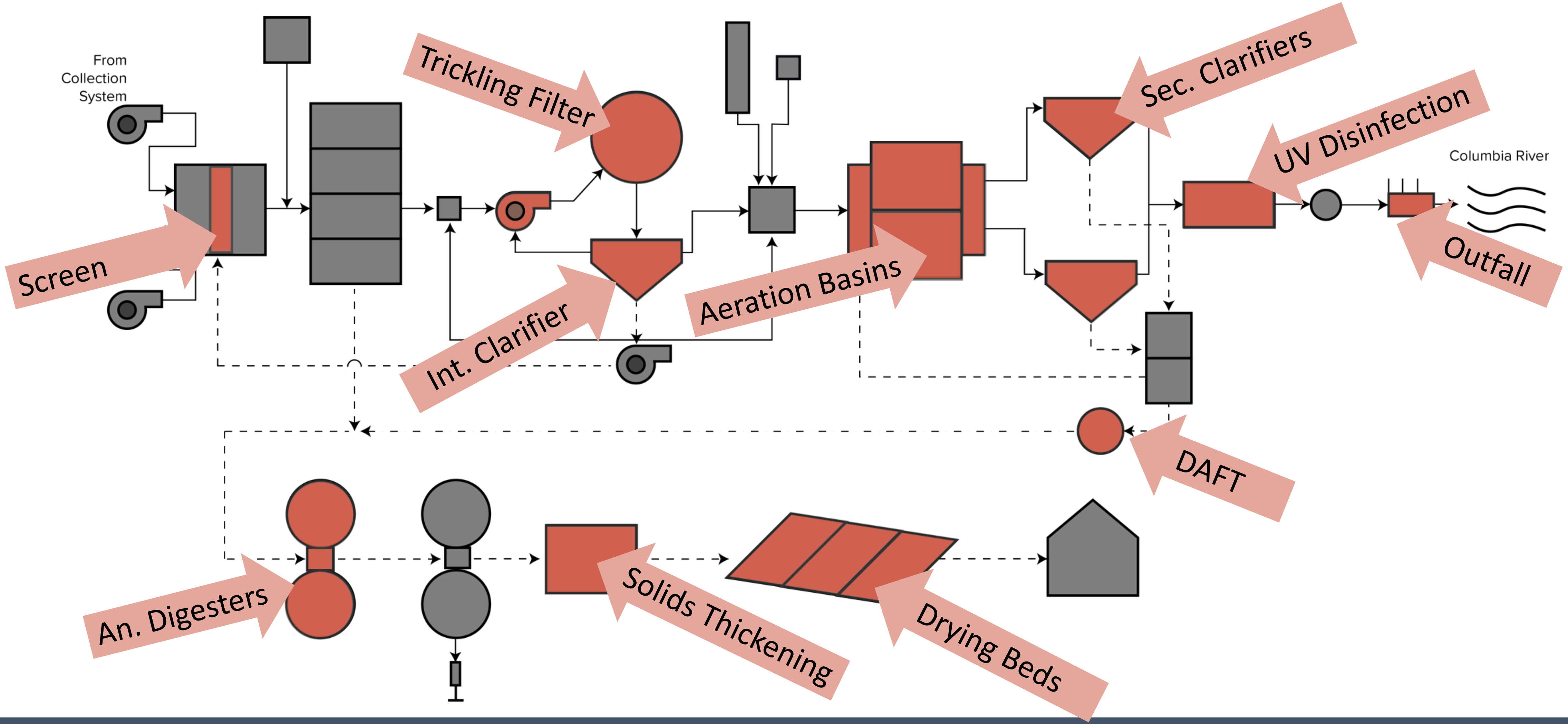
- Effluent Flow Meter
- Outfall
- Sludge Storage
- Gas Storage
- Biosolids Storage Building

Other Requirement

- Grit Removal – Minimum of Two Units



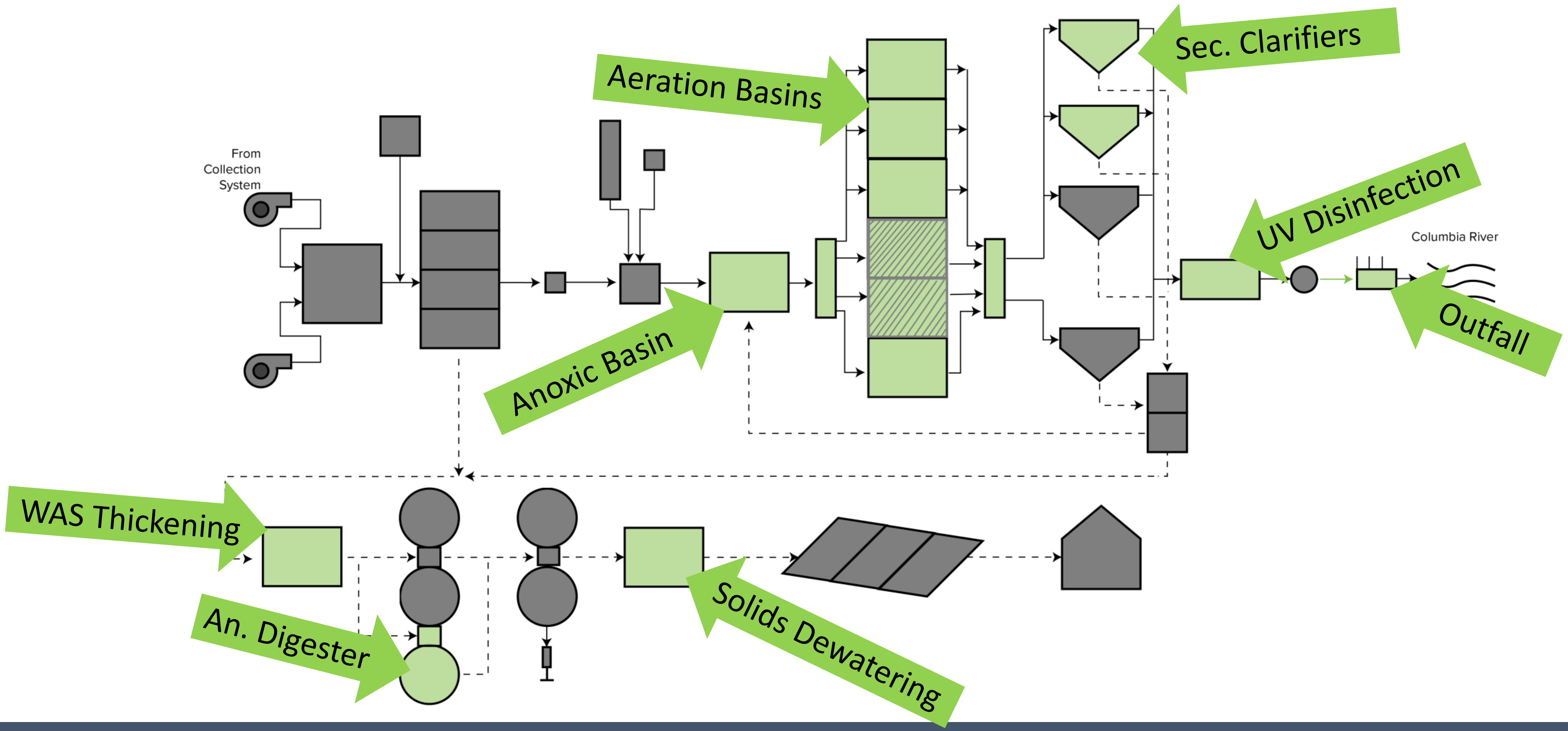
Identified Deficiency



Identified Deficiency

Alternative Comparisons

General Process	General Description	Alternative	Description	Pasco Feasible	WWTP Size/ Type Typical	Future Uncertainty/ Flexibility (Regs)	Future Uncertainty/ Flexibility (Growth)	Functional/ Operational	Economics (Capital)	Economics (O&M)	Societal	Environment	Additional Factors			Pasco Alternative Preference
Attached Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth on media (fixed film).	Trickling Filters Only	Biological growth covered media filled tower with natural or force ventilated pore space that is dosed with wastewater on regular basis.	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Medium footprint	Well Established Technology	$$$	$	Odors if not force ventilated. Potential for flies	Treatment level not consistent with permit				No. Alternative will not satisfy City's needs.
		Moving Bed Biological Reactor (MBBR)	Single pass aeration basins with suspended plastic media based biological growth. Like a submerged trickling filter	No	No		Medium footprint	Newer, but proven technology	$$$	$$$						No. Alternative will not satisfy City's needs.
		Rotating Biological Contactor (RBC)	Rotating partially submerged discs that support biological growth	No	No		Large footprint	Antiquated technology	$$$	$$$						No. Alternative will not satisfy City's needs.
Suspended Growth Biological Secondary Treatment	Removal of organics and conversion of ammonia to nitrate by microbiological growth floating in water suspension. Denitrification and biological phosphorous removal possible with addition of anoxic and anaerobic selectors/zones.	Activated Sludge - Complete Mix	SIMILAR TO EXISTING PASCO WWTP - Aeration basins with less than 4:1 aspect ratio. Typical of early versions of aeration basin technology	No	Yes	Compatible with biological nutrient removal, but not efficient nitrification	Medium footprint	Antiquated technology	$$	$$			short-circuiting	filament growth		No. Alternative will not satisfy City's needs.
		Activated Sludge - Plug Flow	Aeration basins with greater than 4:1 aspect ratio and/or multiple baffled stages	Yes	Yes	Compatible with biological nutrient removal	Medium footprint	Well Established Technology	$$$	$$						YES
		Activated Sludge - Step Feed	Aeration basins with staged wastewater feed and RAS to increase overall basin mixed liquor mass.	No	Yes		Small Footprint	Well Established Technology	$$$	$$						No. Alternative not considered feasible
		Activated Sludge - with granular sludge	aeration basin with mixed liquor that is predominantly in a granular form which allows for higher mixed liquor concentration and rapid solids separation	No	Yes	Very compatible with biological nutrient removal	Small Footprint	Emerging Technology	$$$	$$						No. Alternative not considered feasible
		Oxidation Ditch	Circular or oval aeration basin with mixed liquor rotating in a continuous loop.	No	Yes	Compatible with biological nutrient removal	Large footprint	Well Established Technology	$$$	$						No. Alternative not considered feasible
		Deep Shaft Aeration Basin	A deep vertical orientated aeration basin that has a low footprint and high oxygen transfer rate.	No	No		Small Footprint	Novel Technology	$$$	$$$						No. Alternative not considered feasible
		Membrane Bioreactor (MBR)	Aeration basin with internal semipermeable membranes that are used to separate mixed liquor from treated effluent	Yes	Yes		Small Footprint	Established technology	$$$$	$$$$		Higher level treatment	Potentially installed in existing basins/infrastructure.	Requires headworks expansion to increase screening removal system capacity and capabilities.	Potential to maintain existing capacity during construction	YES
		Sequencing Batch Reactor - Conventional	Standard mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes		Medium footprint	Well Established Technology	$$$$	$$$				Requires multiple trains to continue treatment process		No. Alternative not considered feasible
		Sequencing Batch Reactor - Granular (Nerada)	Granular Sludge based mixed liquor filled basin that performs the function of a conventional aeration basin and secondary clarifier through staged aeration and feeding. Wastewater feed is traditionally intermittent, but can be continuous.	No	Yes	Very compatible with biological nutrient removal	Small footprint	Newer technology	$$$$	$$$			Potential patent issues			No. Alternative not considered feasible
		Facultative/partially aerated lagoons	Typically large lined one-pass earthen diked basins that utilize algae and other naturally occurring microbiology to treat wastewater	No	No	Partially compatible with biological nutrient removal. Requires chemical P removal	Very large footprint	Well Established Technology	$$$$$	$	Attractive Nuisance Odors and Vectors	Waterfowl habitat				No. Alternative will not satisfy City's needs.



City Selected WWTP Path

Alternatives to Projects

- Headworks Expansion
- Activated Sludge Plug Flow
- UV Expansion
- Outfall Improvement
- Mechanical WAS Thickening
- Mechanical Dewater
- Anaerobic Digestion Expansion

1. Outfall Study
2. Secondary Treatment Project 1
3. Outfall Project 1
4. Mechanical Dewatering
5. Secondary Treatment Project 2
6. Outfall Project 2
7. UV Expansion Project
8. WWTP Facility Plan
9. Secondary Treatment Project 3
10. Mechanical WAS Thickening
11. Secondary Treatment Project 4
12. Anaerobic Digestion Expansion
13. Administration Building
14. Laboratory Building
15. Headworks Expansion

WDOE SERP & FUNDING

SEPA and SERP and SRF

State Environmental Policy Act (SEPA)

- Analyzes environmental impacts associated with governmental decisions
  - Environmental Checklist: 16 Areas Considered

State Environmental Review Process (SERP)

- Checklist Ensures: SEPA Complete, Cost Effectiveness and Public Documentation

Federal Cross Cutter Checklist:

- Clean Air Act
- Endangered Species Act
- Farmland Protection Policy Act
- National Historic Preservation Act
- Essential Fish Habitat
- Wild and Scenic Rivers Act
- Coastal Zone Management Act
- Environmental Justice
- Floodplain Management
- Safe Drinking Water Act
- Wetland Protection

Potentially will not need to complete cross cutter if it is "Not a Designated Equivalency Project"

State Revolving Funds (SRF)

- Funding by low-interest loans administered by Department of Ecology (DOE)
- SERP/Federal Cross Cutter Required/Timing?

SEPA and SERP and SRF

SEPA, SERP and SRF

- Historically completed SEPA, SERP with Facility Plan to prepare for SRF
- New recommendation is completiong with each project
    - Avoid completing the process twice

SRF Funding

- Application: SERP not needed to be complete for application
- Funding Step Process:
    - Step 1 - $ for Planning
    - Step 2 - $ for Design
    - Step 3 - $ for Construction
    - Step 4 - $ for Design and Construction - Limited to under $7,000,000 and other requirements

CAPITAL IMPROVEMENT PLAN: Project Implementation

Project Considerations

- **Risk**
- **Funding**: Rate Impact, Cashflow, loan, bonding
- **Scheduling**:
  - In advance of need
  - Delivery Strategy
- **Project Economy of Scale**
- **Internal Staff Workload**
  - Number of Projects
  - Number of Consultants
  - Number of Contractors
- **Timing**: System/Component Capacity
  - Flow/Loading Projections

    versus
  - All-On Capacity
  - Reliability and Redundancy (R&R) Capacity
  - 85% Trigger

Project #1 – Outfall Study

Driver / Reasoning

1. Study and coordinated plan for future outfall improvements

Includes

1. Full concept plan of outfall pipeline and diffuser with possible staged improvements
2. Mixing zone analysis of future diffuser
3. Hydraulic analysis
4. Diver inspection of existing diffuser
5. Feasibility of additional port on existing diffuser
6. UV Protection Plan

Timing

1. 2019

Project Cost

1. $175,000

Note: Engineering design designated with hatched pattern (e.g.)

DRAFT Cash Flow

Project #2 – Secondary Treatment Project 1

Capacity

1. All On Capacity – 6.5 mgd, Existing
2. 85% Trigger – 5.5 mgd, Existing
3. R&R Capacity – 3.5, Existing

Timing

1. Immediate Need
2. Estimated Design & Construction Window 2019-2021

Deficiencies Addressed

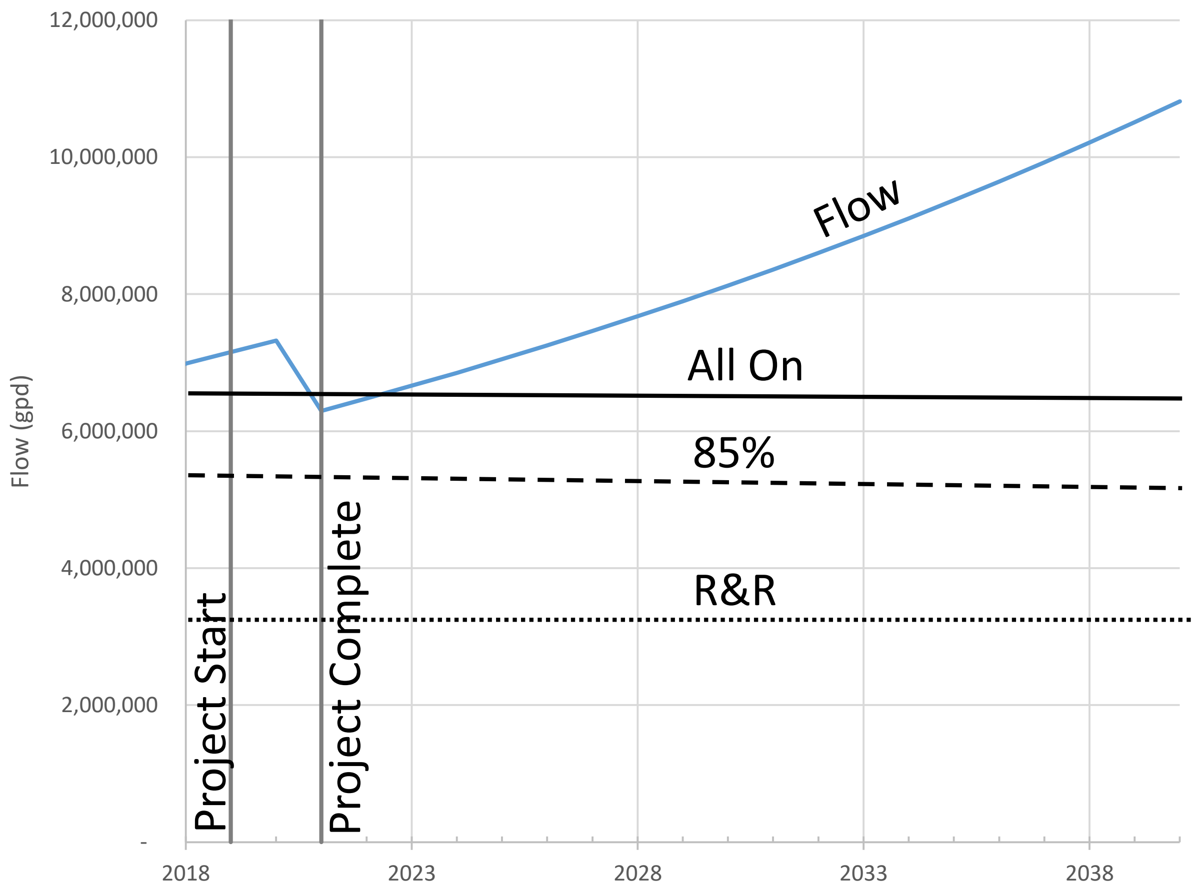
1. Secondary Treatment: Capacity and R&R

Included components

1. Anoxic Basin 1
2. AB Influent Splitter
3. Aeration Basin 3 & Two New Blowers
4. AB Effluent Splitter
5. Aeration Basin 1 Retrofit
6. Aeration Basin 2 Retrofit

Project Cost

1. $9,263,000



DRAFT Cash Flow

Project #3 – Outfall Project 1

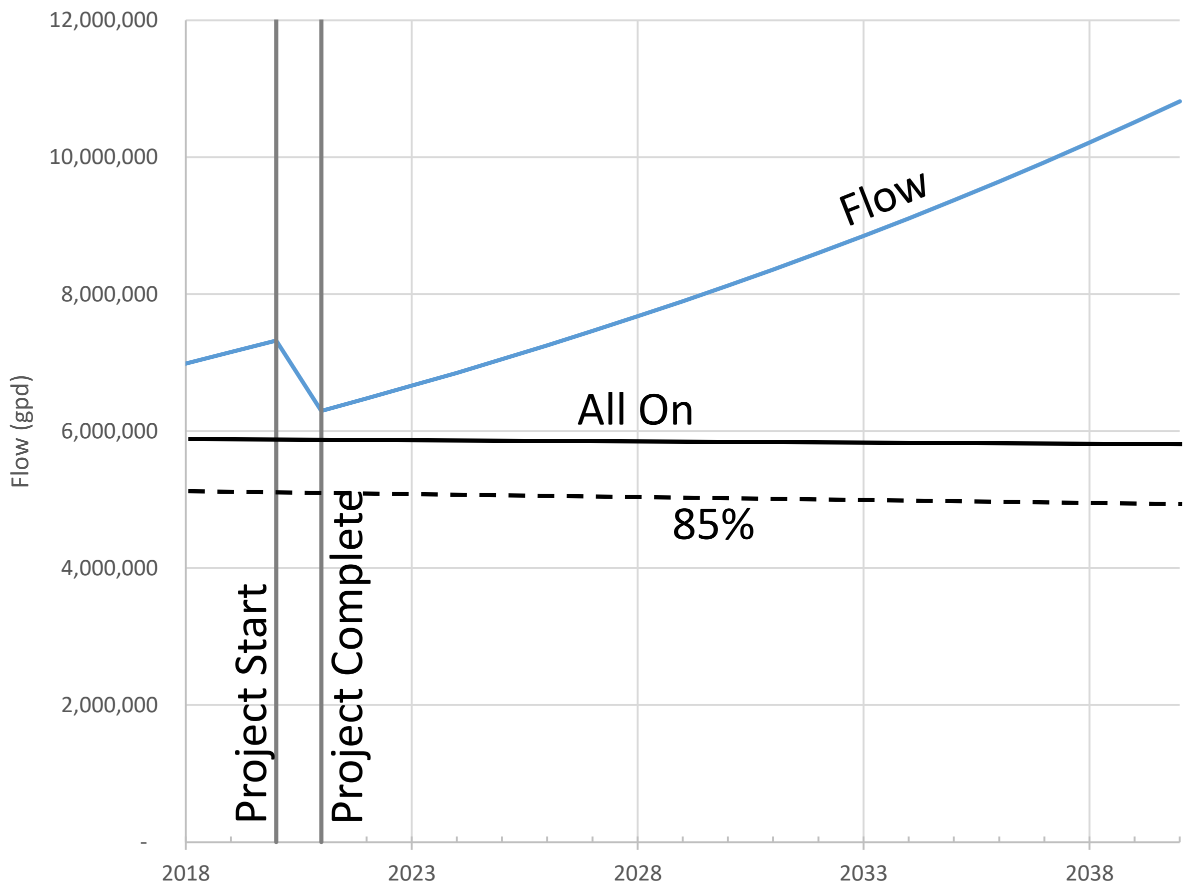
Capacity
1. All On Capacity – 5.9 mgd, Existing
2. 85% Trigger – 5.0 mgd, Existing
3. R&R Capacity – NA

Timing
1. Immediate Need
2. Estimated Design & Construction Window 2020-2021

Deficiencies Addressed
1. Outfall hydraulics
2. Hydraulic deficiency of existing outfall

Included components
1. Inland Work & Flow Meter

Project Cost
1. $1,392,000



DRAFT Cash Flow

Project #4 – Mechanical Dewatering

Capacity

1. All On Capacity – 9.2 mgd, 2035
2. 85% Trigger – 7.8 mgd, 2026
3. R&R Capacity – NA

Timing

1. Estimated Design & Construction Window 2021-2022

Deficiencies Addressed

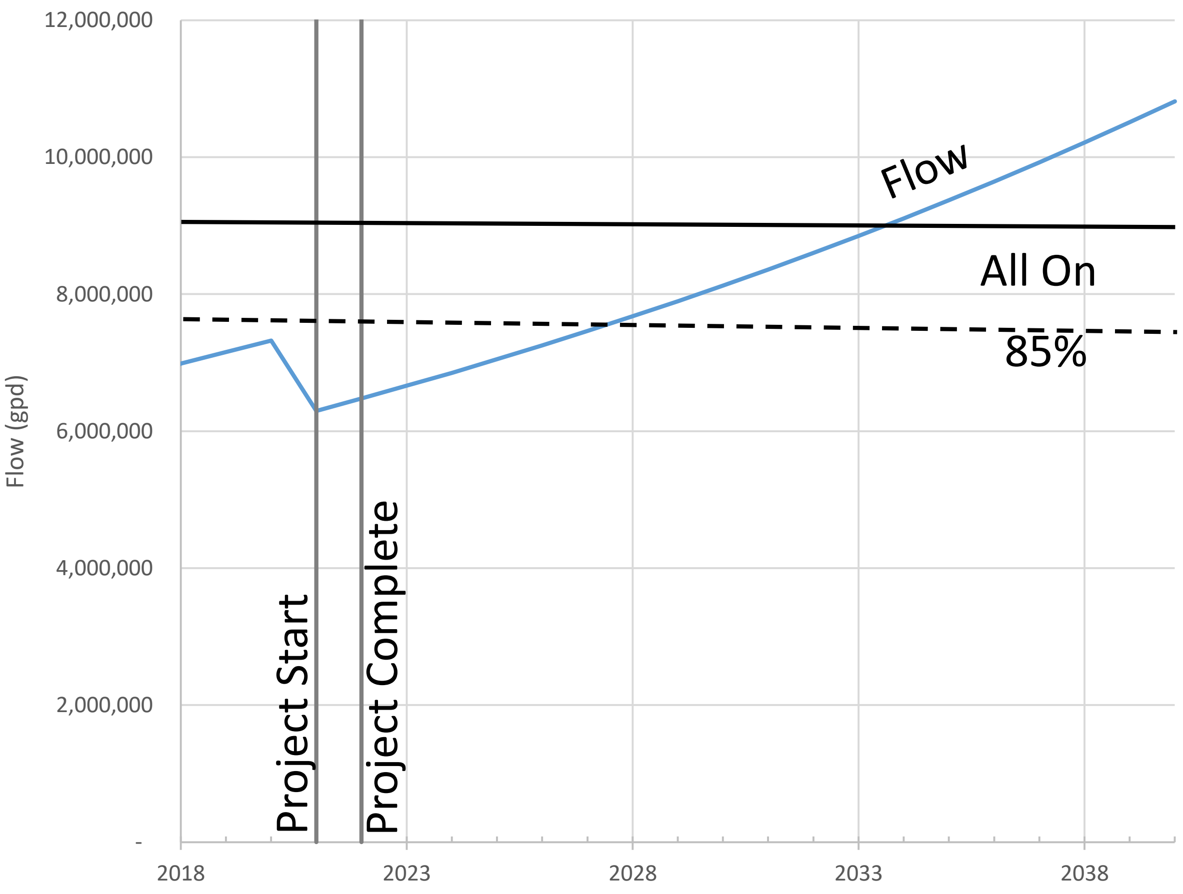
1. WAS Thickening
2. Class B Biosolids
    1. Anaerobic Digestion
    2. Drying Beds

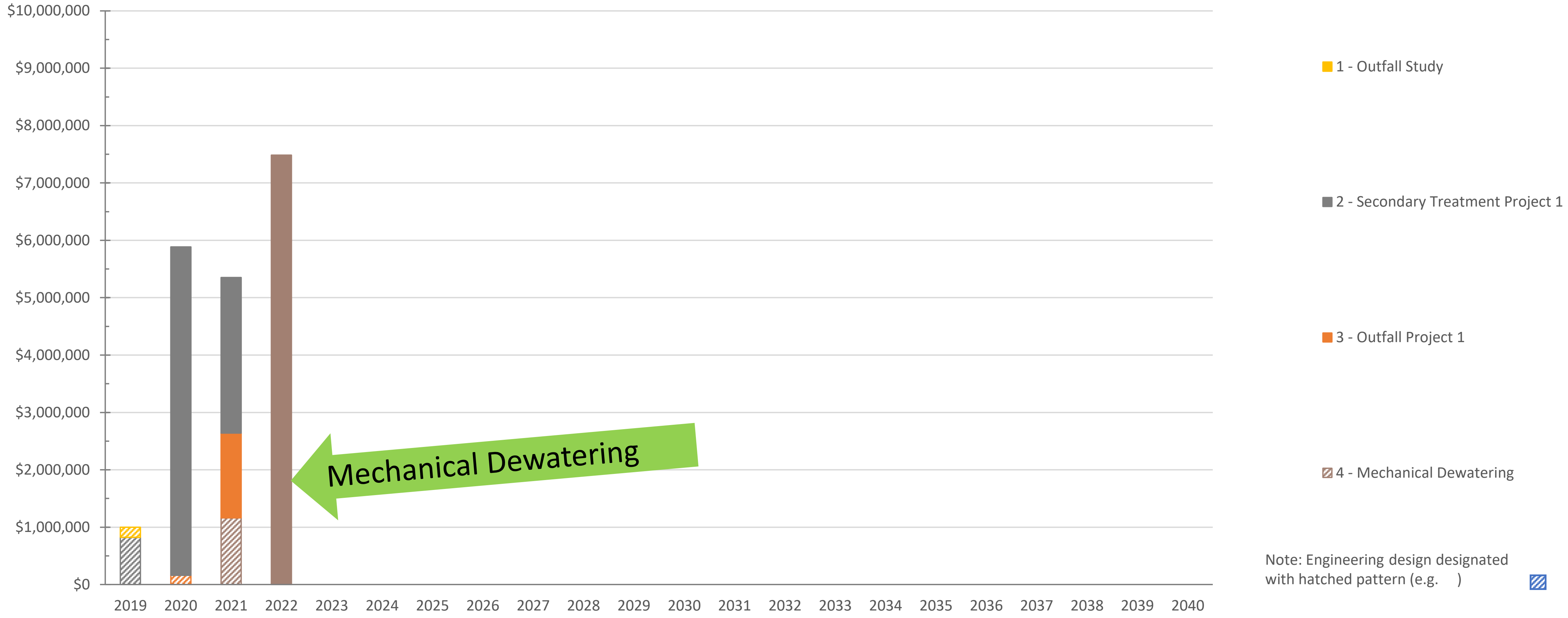
Included Components

1. Mechanical Dewatering
2. Dewatering Building
3. Mechanical WAS Thickening (repurpose RDT)

Project Cost

1. $8,650,000





DRAFT Cash Flow

Project #5 – Secondary Treatment Project 2

Capacity

1. All On Capacity – 7.4 mgd, 2026
2. 85% Trigger – 6.3 mgd, Existing
3. R&R Capacity – 5.7, Existing
4. Trickling filter age

Timing

1. Immediate Need
2. Estimated Design & Construction Window 2023-2026
3. Trickling Demo at end of project

Deficiencies Addressed

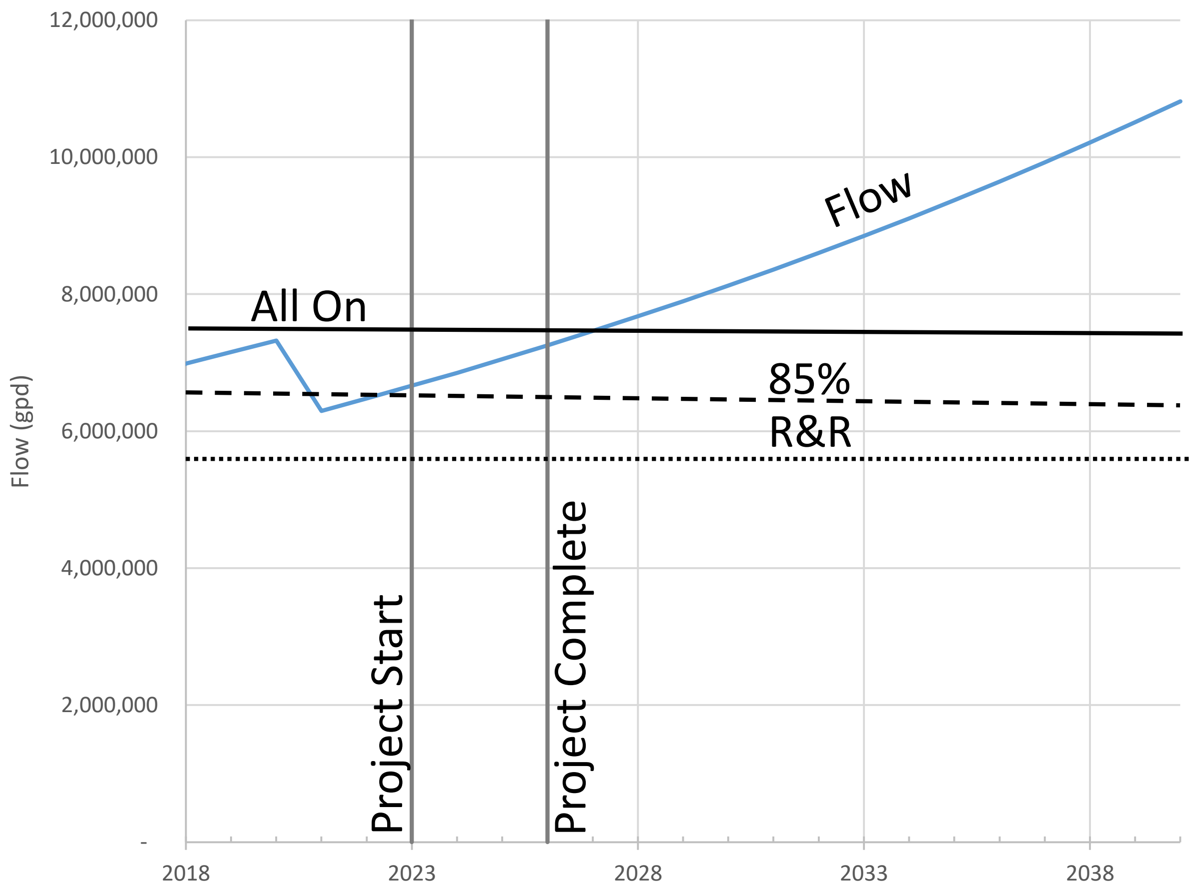
1. Secondary Treatment Capacity and R&R

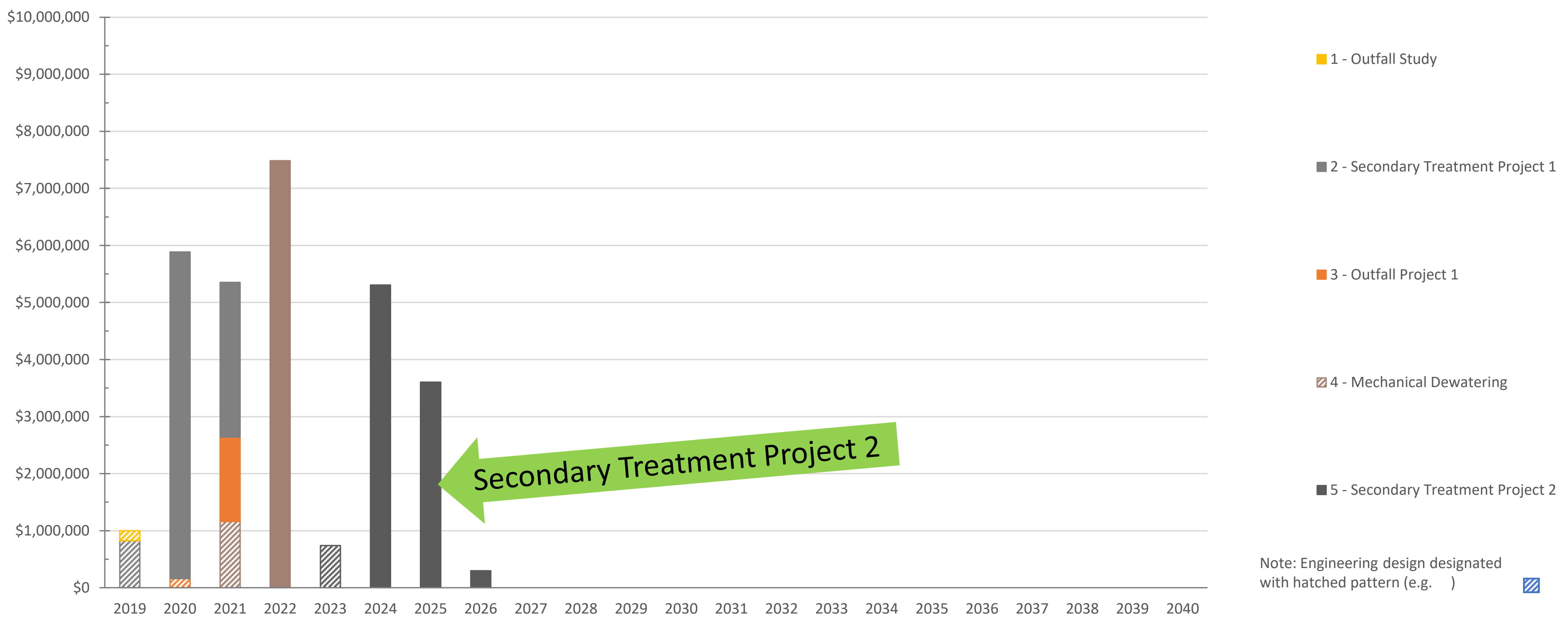
Included Components

1. Anoxic Basin 2
2. Demo Existing Trickling Filter and Intermediate Clarifier
3. Blower Building
4. Aeration Basin 4

Project Cost

1. $9,949,000





DRAFT Cash Flow

Project #6 – Outfall Project 2

Capacity

1. All On Capacity – 7.0 mgd, 2025
2. 85% Trigger – 5.9 mgd, Existing
3. R&R Capacity – NA

Timing

1. Estimated Design & Construction Window 2025-2026

Deficiencies Addressed

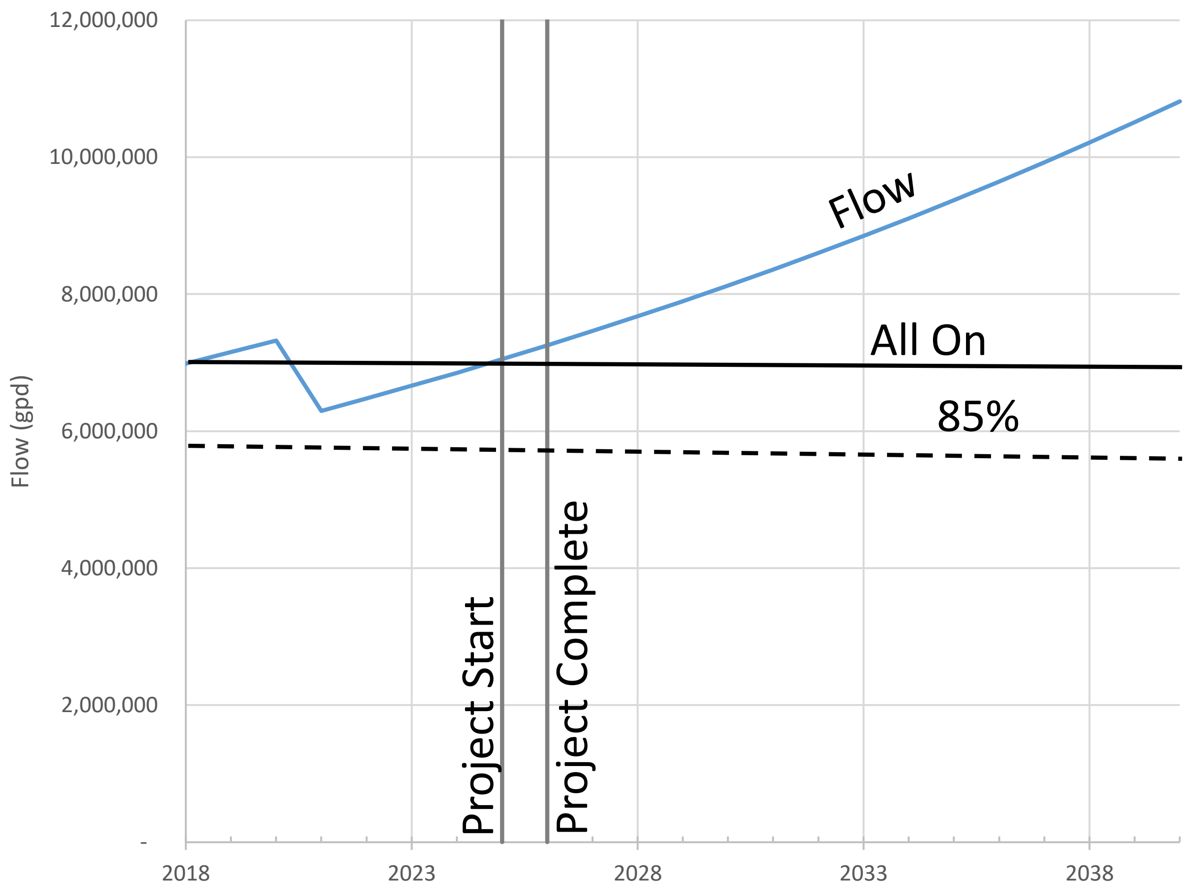
1. Hydraulic deficiency of outfall at future flow

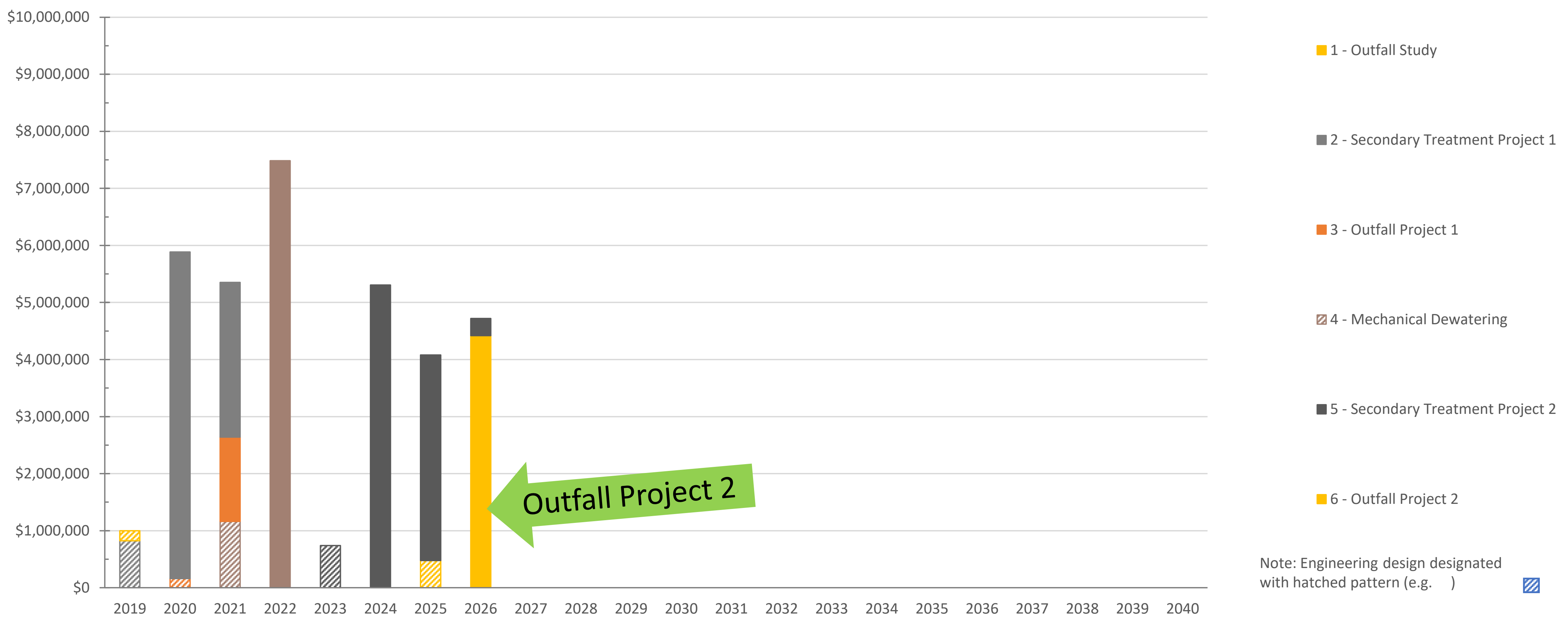
Included Components

1. In-water pipeline and diffuser replacement

Project Cost

1. $4,897,000





DRAFT Cash Flow

Project #7 – UV Expansion

Capacity

1. All On Capacity – 11.0 mgd, 2040
2. 85% Trigger – 9.3 mgd, 2035
3. R&R Capacity – 7.3 mgd, 2027

Timing

1. Estimated Design & Construction Window 2026-2027

Deficiencies Addressed

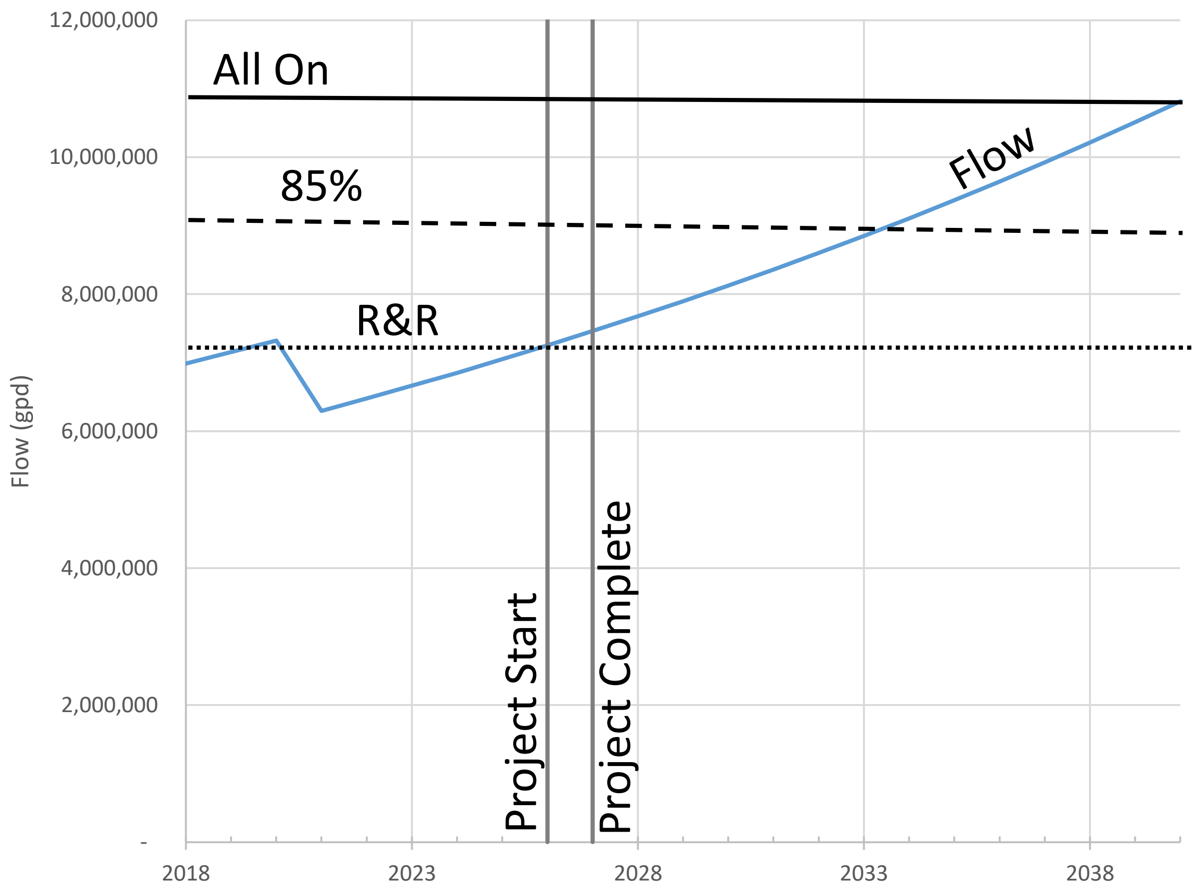
1. System Capacity, O&M, R&R

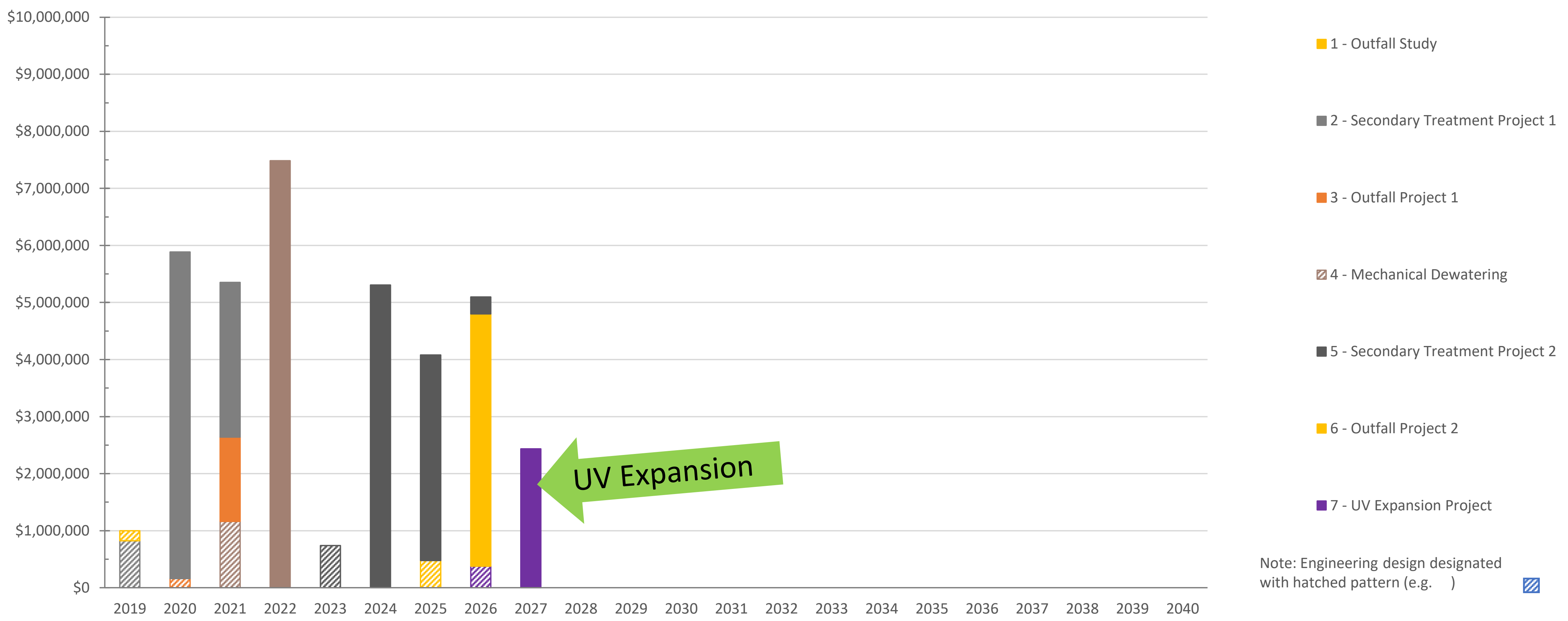
Included Components

1. 16 UV Modules, Electrical, Control

Project Cost

1. $2,815,000





DRAFT Cash Flow

Project #8 – WWTP Facility Plan

Driver / Reasoning

1. Update WWTP Facility Plan with "Existing WWTP", "Future Projection", and CIP

Timing

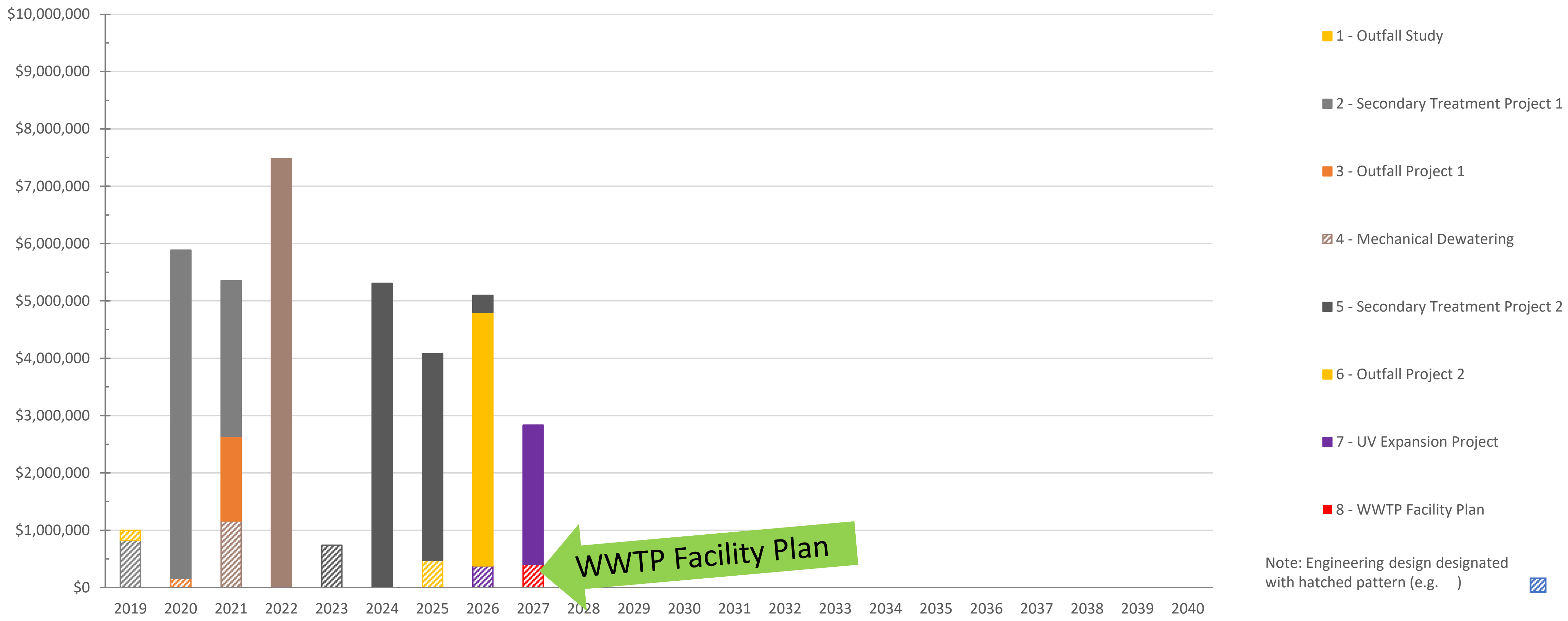
1. Estimated in 2027

Included Components

1. Update WWTP Facility Plan

Project Cost

1. $400,000



DRAFT Cash Flow

Project #9 – Secondary Treatment Project 3

Capacity

1. All On Capacity – 8.2 mgd, 2031
2. 85% Trigger – 6.9 mgd, 2025
3. R&R Capacity – 3.3 mgd, Existing

Timing

1. Estimated Design & Construction Window 2027-2028

Deficiencies Addressed

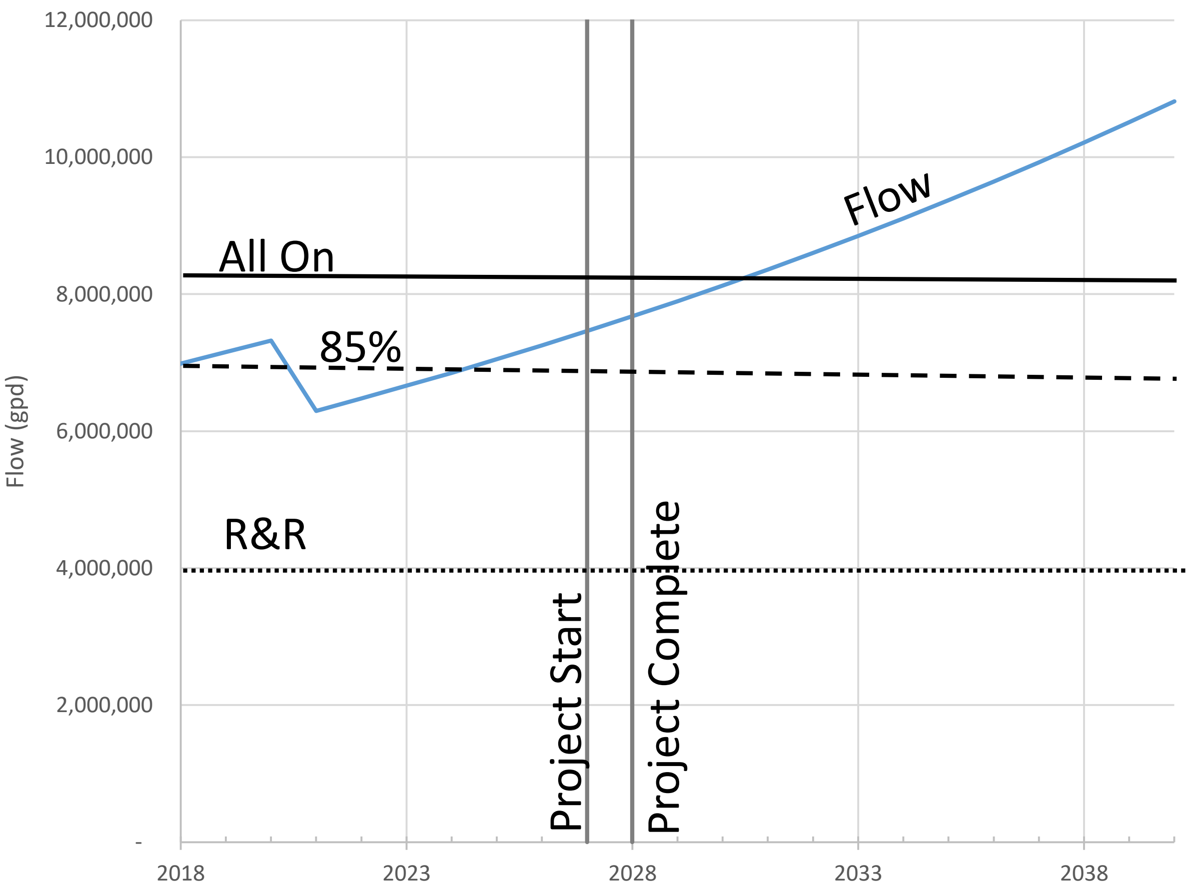
1. Secondary Treatment: Capacity and R&R

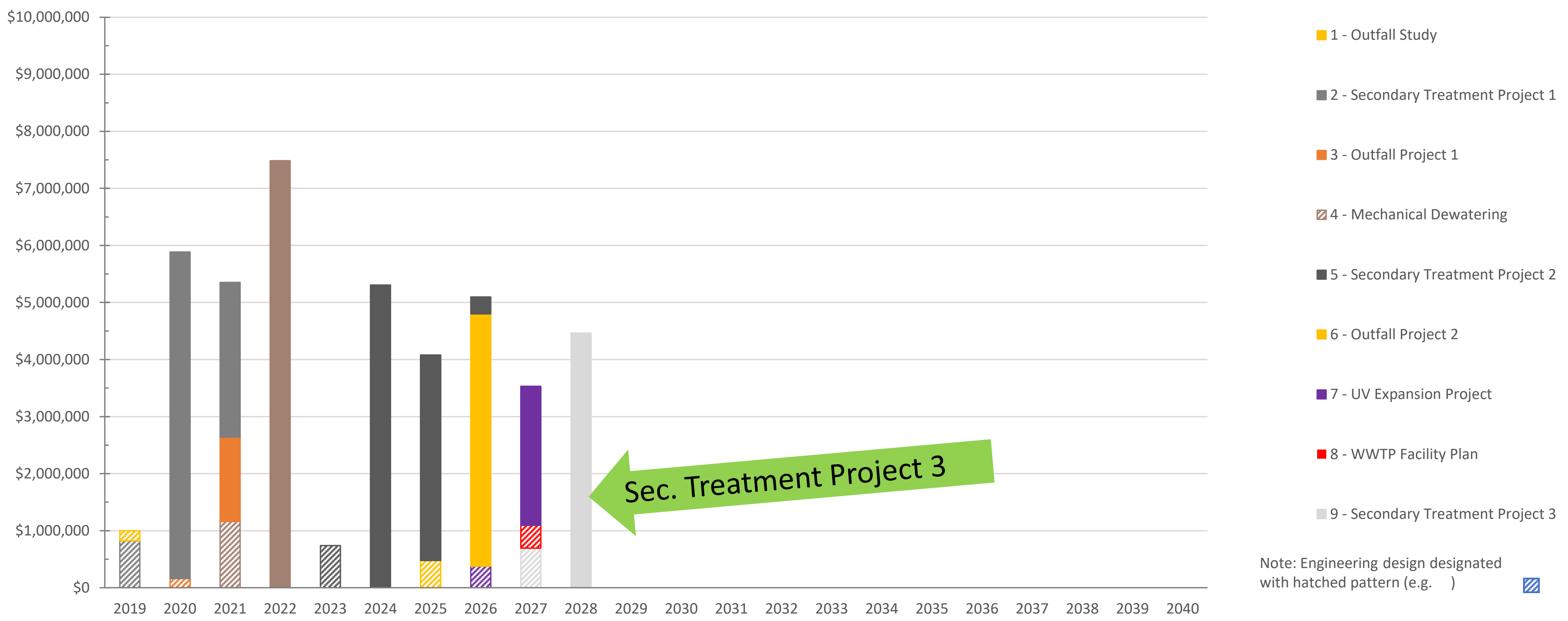
Included Components

1. Secondary Clarifier 3
2. RAS/WAS Pump Station

Project Cost

1. $5,158,000





DRAFT Cash Flow

Project #10 – Mechanical WAS Thickening

Capacity

1. All On Capacity – 12 mgd, >2040
2. 85% Trigger – 10.2 mgd, 2038
3. R&R Capacity – 6.7, Existing
    1. Existing Thickening Age and Condition

Timing

1. Estimated Design & Construction Window 2028-2029

Deficiencies Addressed

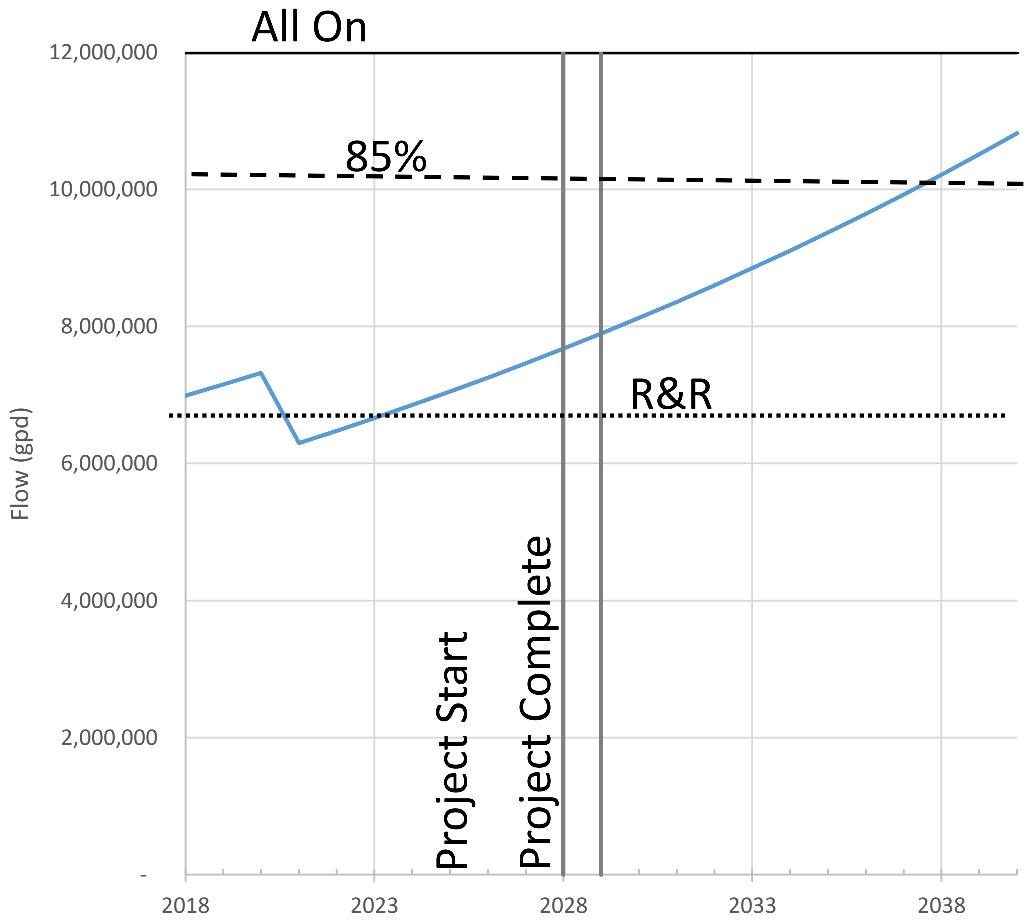
1. WAS Thickening
2. Anaerobic Digestion

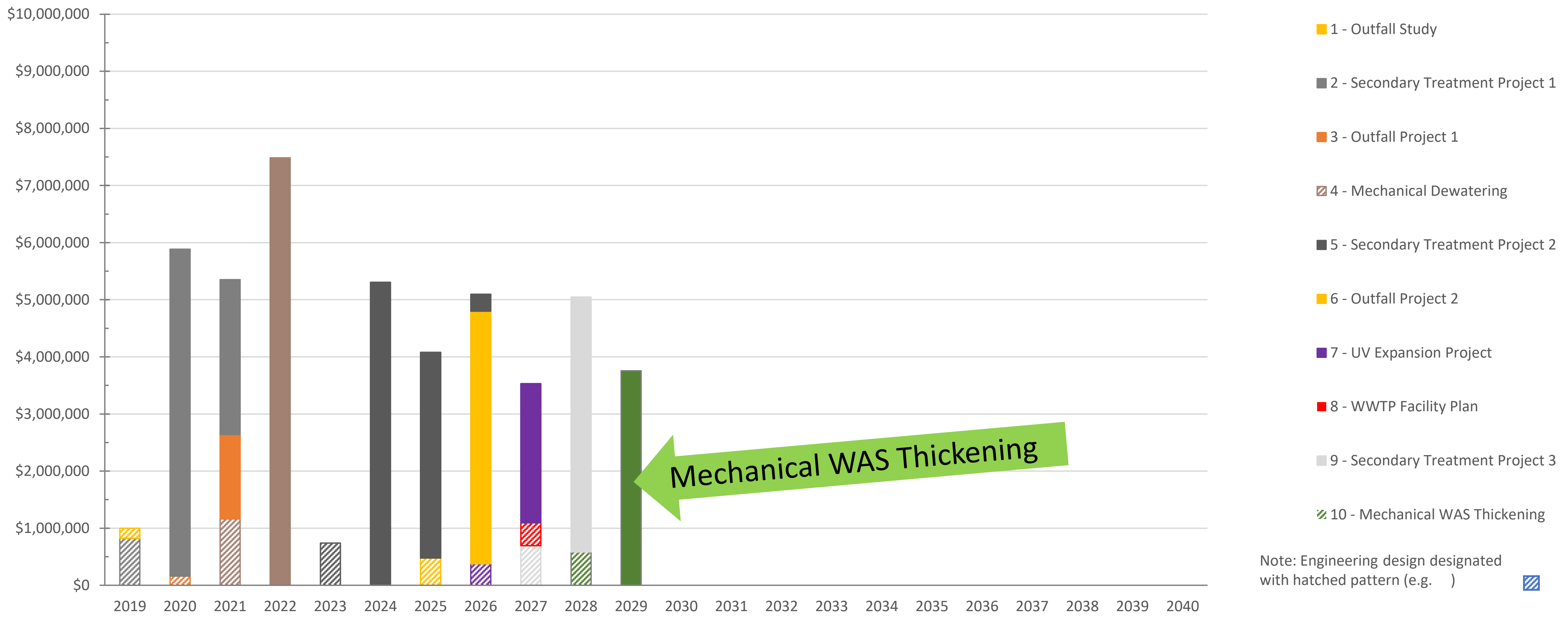
Included Components

1. Mechanical WAS Thickening
2. Thickening Building

Project Cost

1. $4,342,000





DRAFT Cash Flow

Project #11 – Secondary Treatment Project 4

Capacity

1. All On Capacity – 9.3 mgd, 2035
2. 85% Trigger – 7.7 mgd, 2028
3. R&R Capacity – 8.2 mgd, 2031

Timing

1. Estimated Design & Construction Window 2029-2031

Deficiencies Addressed

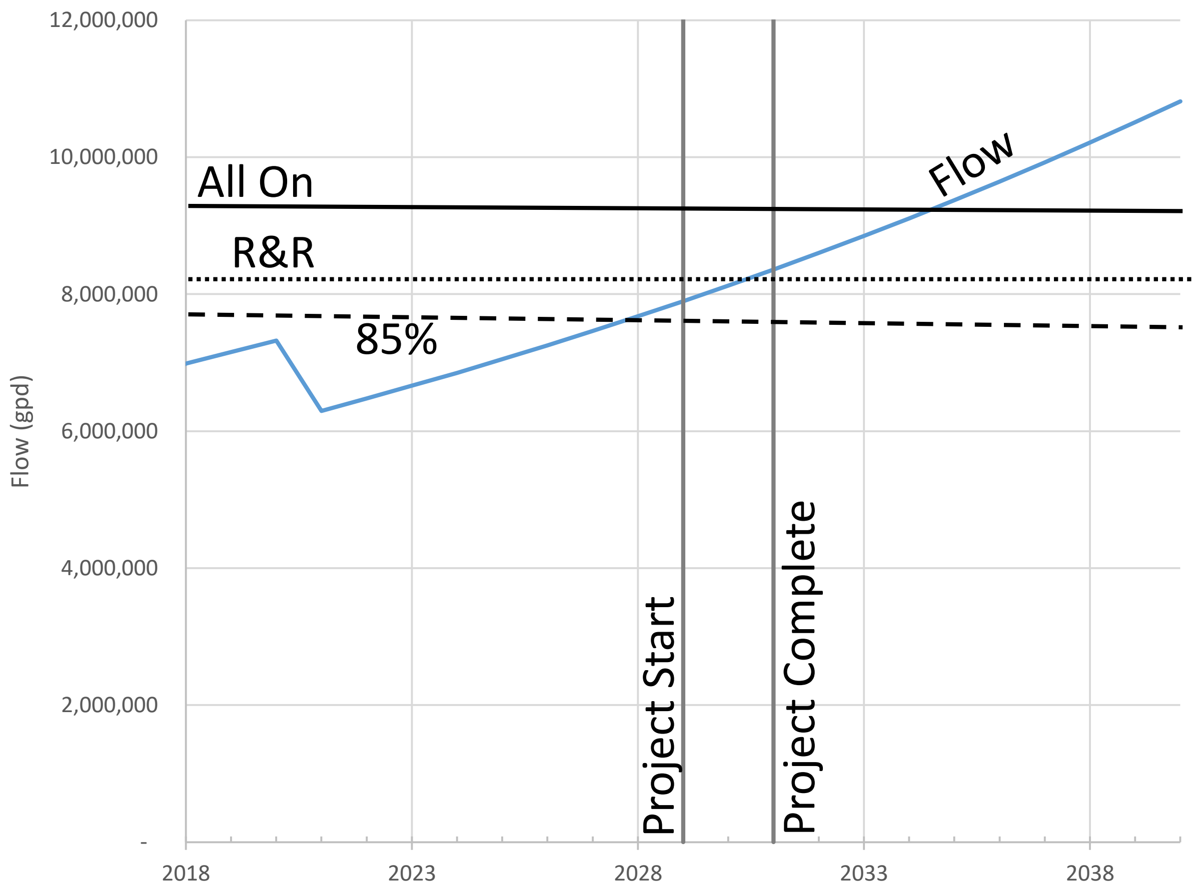
1. Secondary Treatment: Capacity and R&R

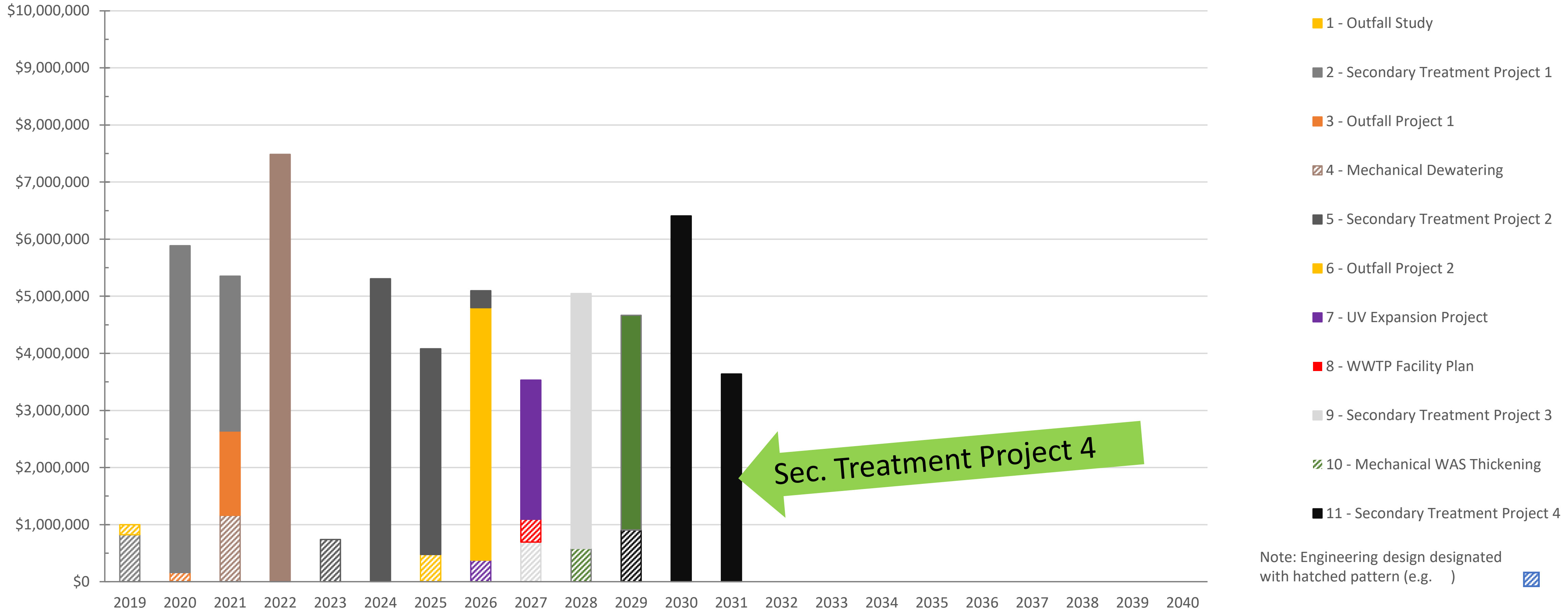
Included Components:

1. Aeration Basin 5
2. Aeration Basin 6
3. Secondary Clarifier 4

Project Cost

1. $10,951,000





DRAFT Cash Flow

Project #12 – Anaerobic Digestion Expansion

Capacity

1. All On Capacity – 8.1 mgd, 2030
2. 85% Trigger – 6.9 mgd, 2024
3. R&R Capacity – Existing

Timing

1. Estimated Design & Construction Window 2031-2032

Deficiencies Addressed

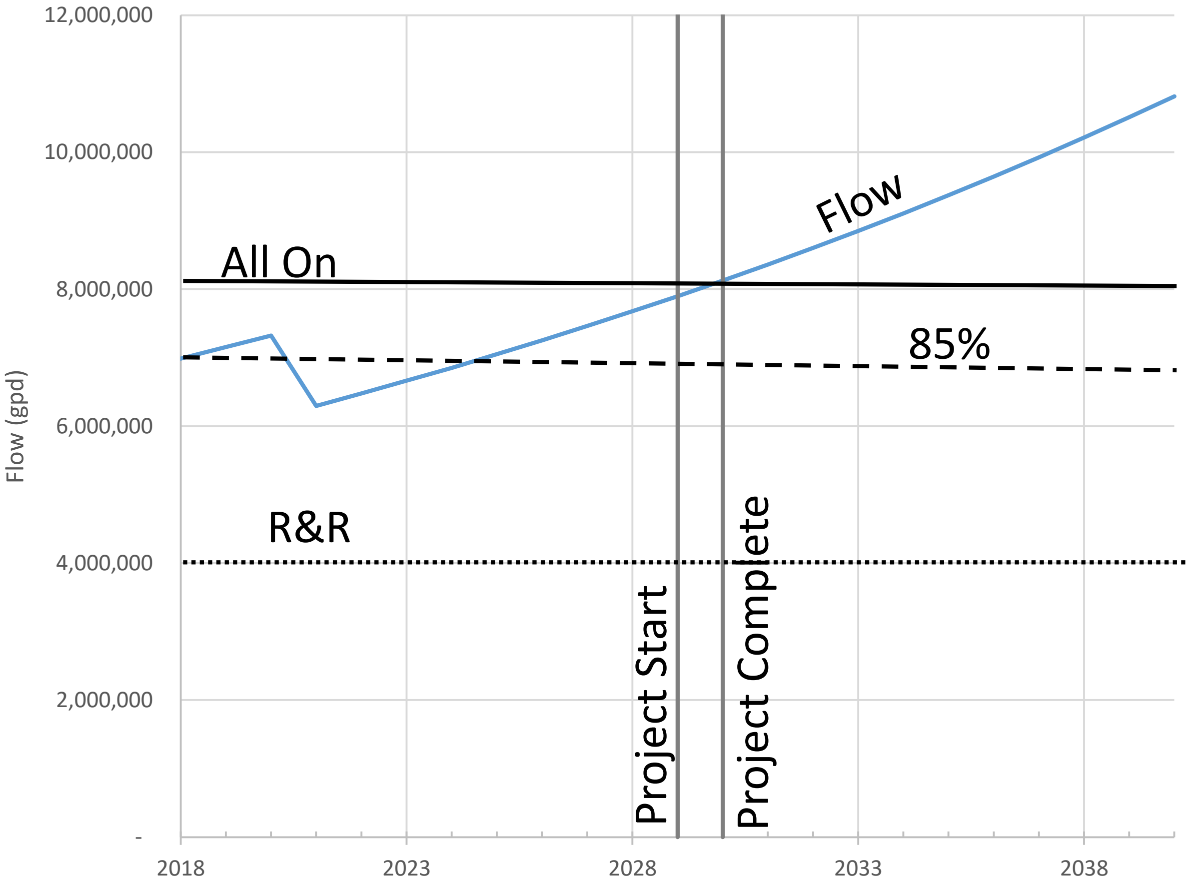
1. Anaerobic Digestion

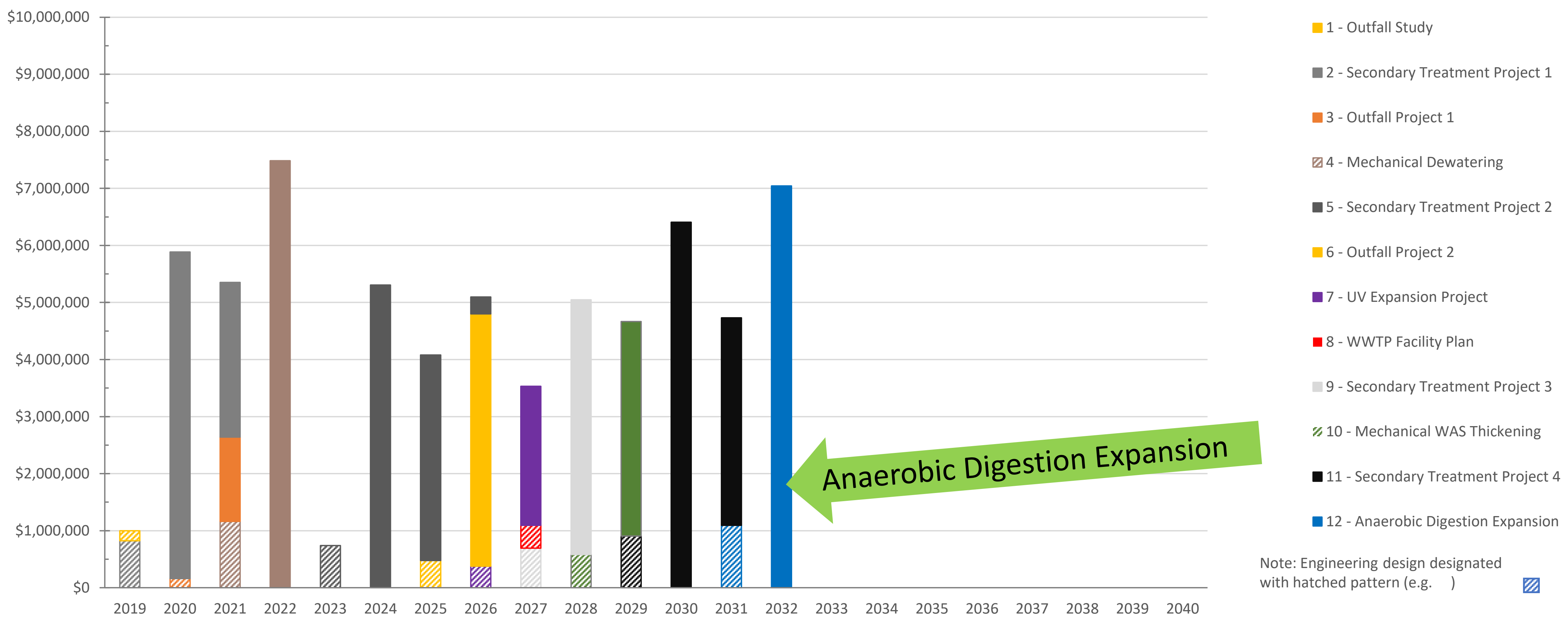
Included Components

1. Anaerobic Digester 3
2. Solids Handling Building

Project Cost

1. $8,137,000





DRAFT Cash Flow

Project #13 – Administration Building

Driver / Reasoning

1. Needed for future administration, operations and staffing
2. Multiple methods to compare existing and project WWTP staffing
    1. EPA, WEF MOP8

Timing

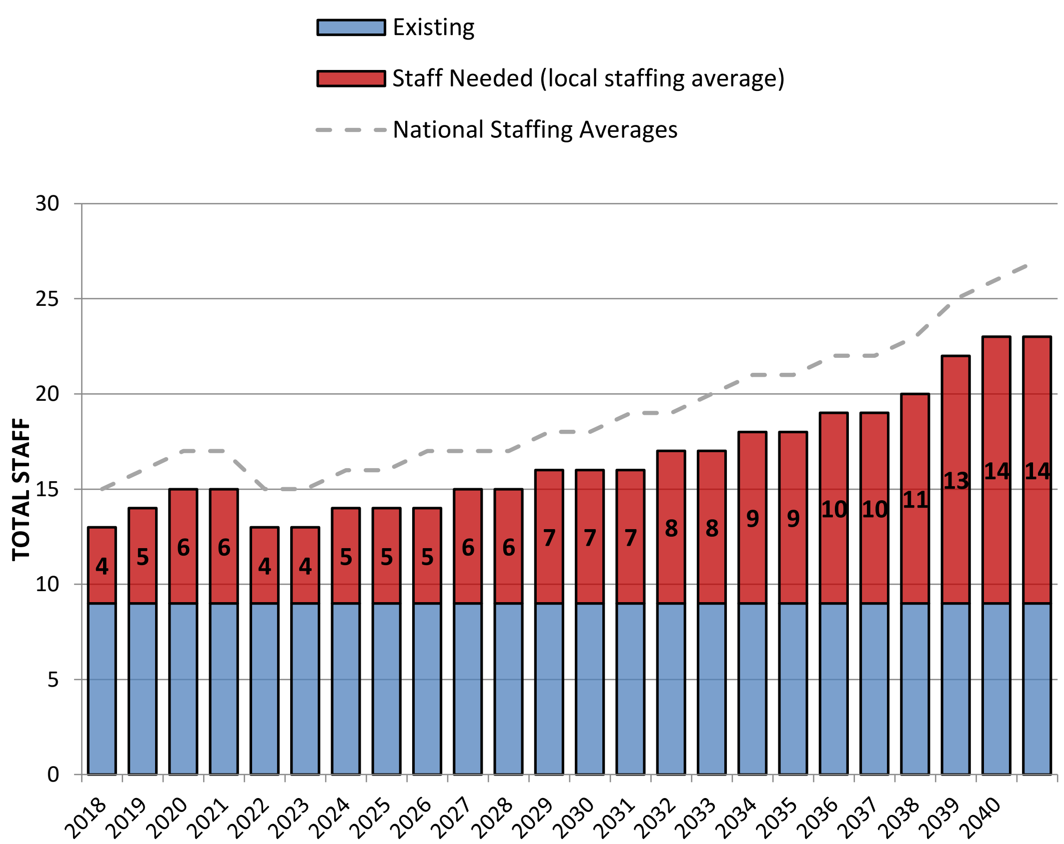
1. Estimated Design & Construction Window 2034-2035

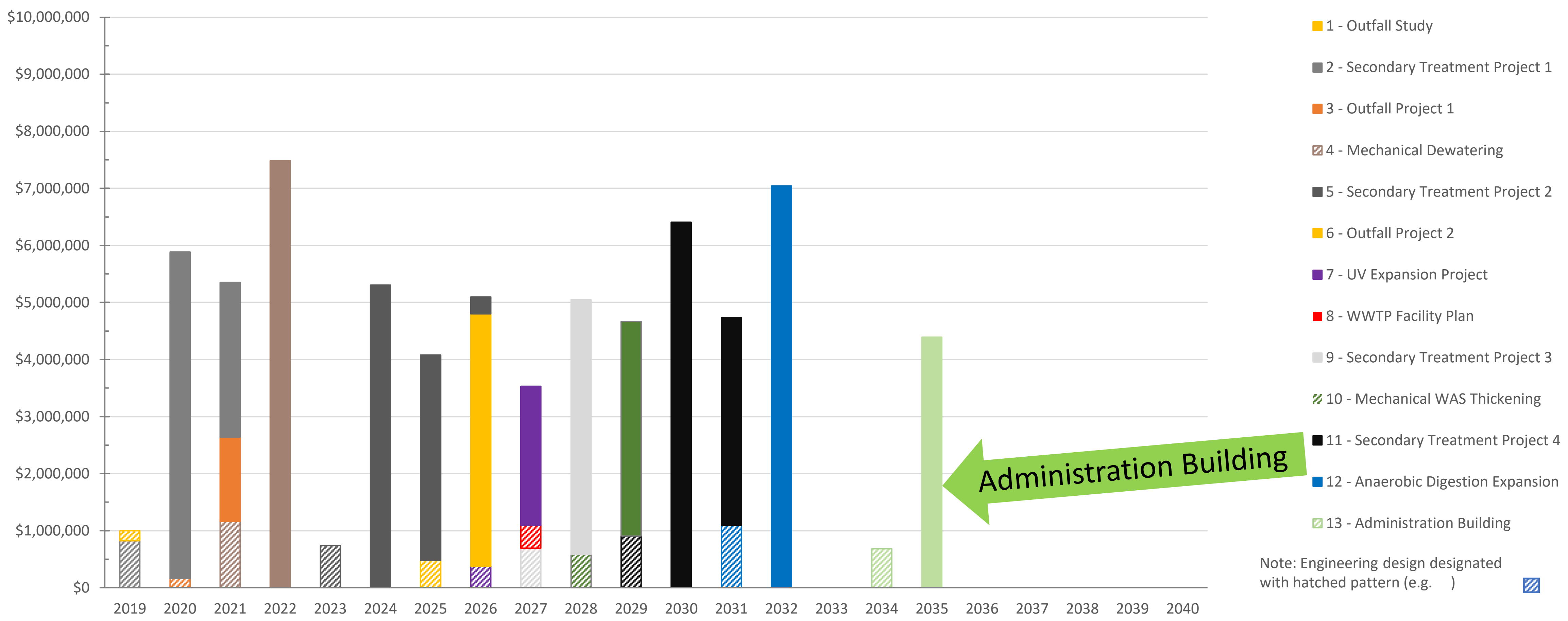
Included Components:

1. New Administration Building

Project Cost

1. $5,075,000





DRAFT Cash Flow

Project #14 – Laboratory Building

Driver / Reasoning

1. Needed for future laboratory and staffing

Timing

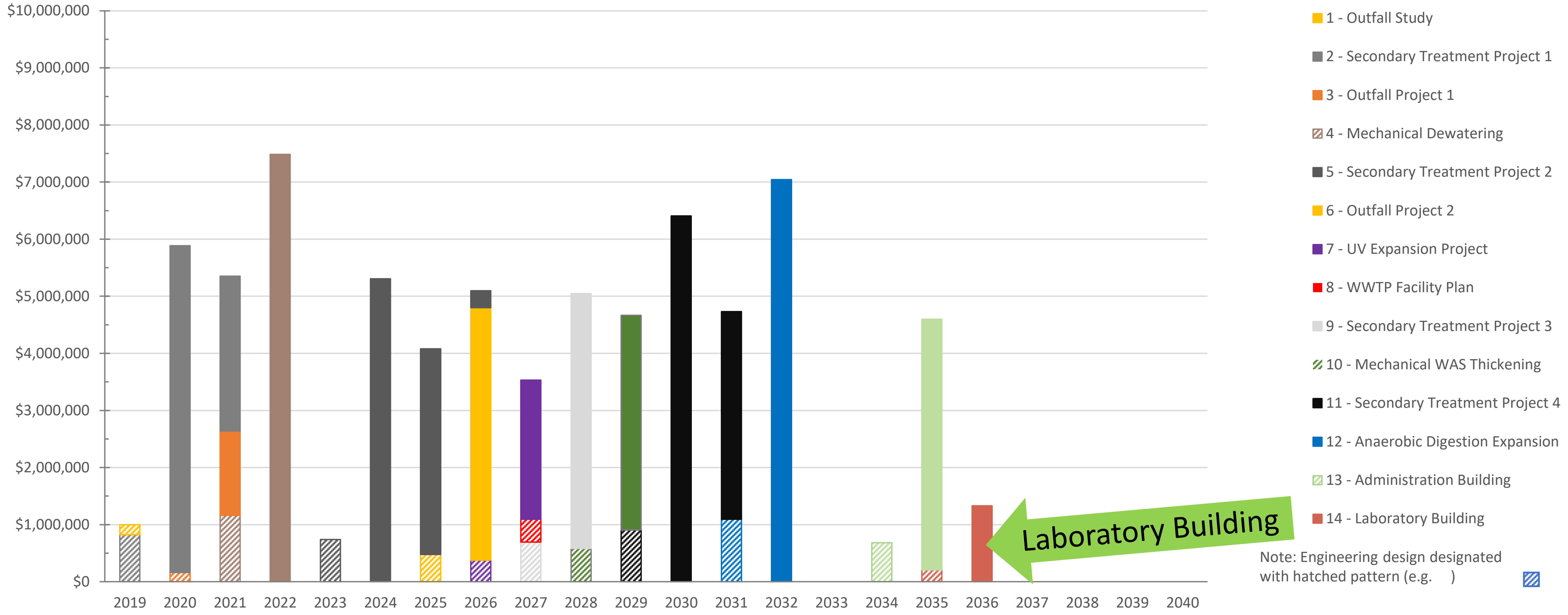
1. Estimated Design & Construction Window 2035-2036

Included Components:

1. New Laboratory Building

Project Cost

1. $1,583,000



DRAFT Cash Flow

Project #15 – Headworks Expansion

Capacity

1. All On Capacity – 13.7 mgd, >2040
2. 85% Trigger – 11.6 mgd, >2040
3. R&R Capacity – 10.1, 2038

Timing

1. Estimated Design & Construction Window 2037-2038

Deficiencies Addressed

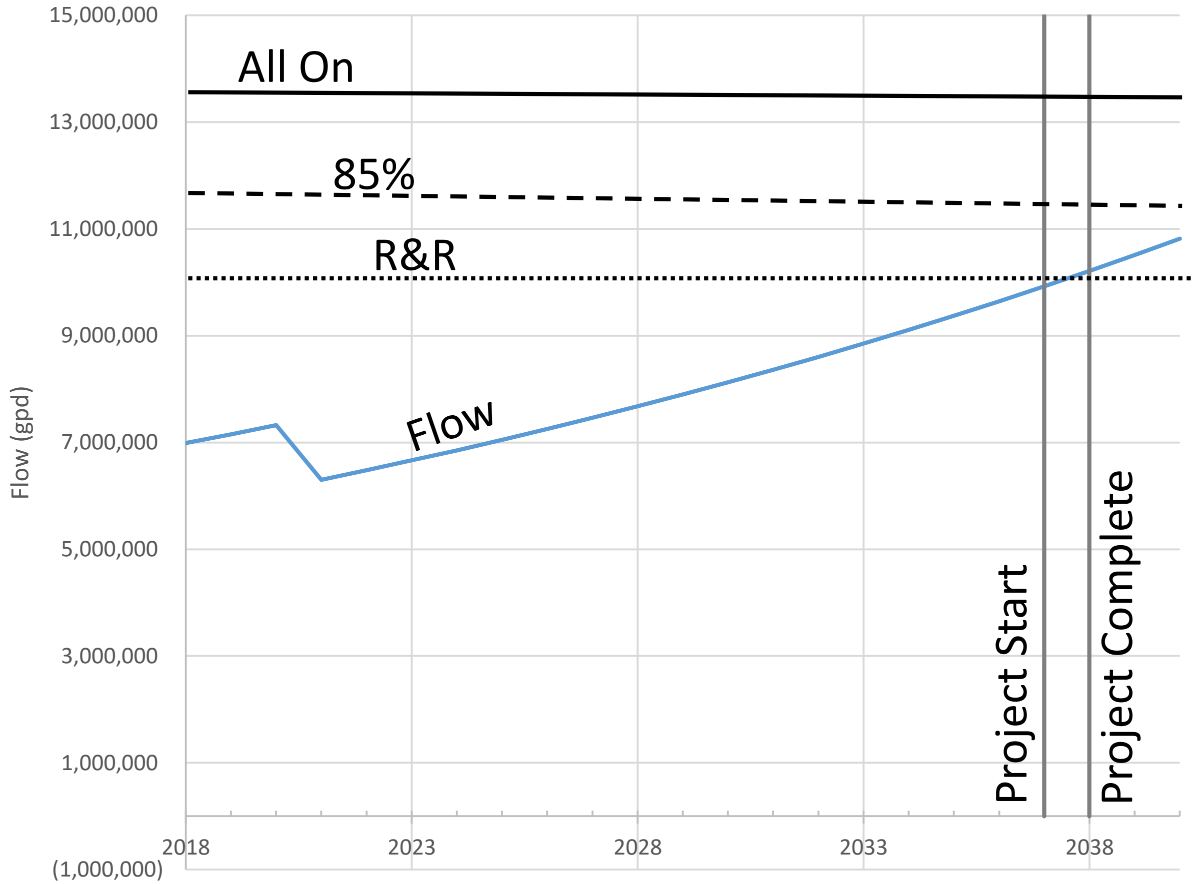
1. Reliability and Redundancy of screening at future flow

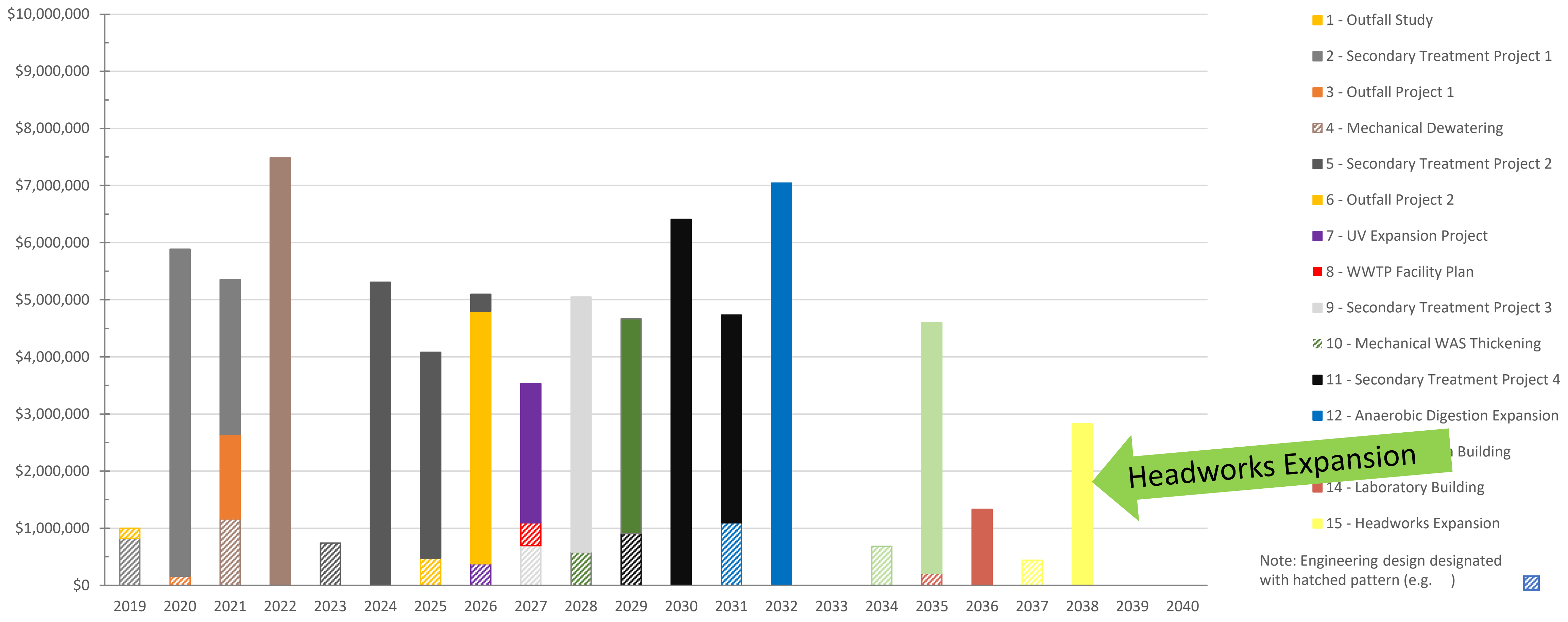
Included Components:

1. Screen #4 Expansion

Project Cost

1. $3,268,000





DRAFT Cash Flow

Site Plan

1. Outfall Study (no construction)
2. Secondary Treatment Project 1
3. Outfall Project 1
4. Mechanical Dewatering
5. Secondary Treatment Project 2
6. Outfall Project 2 (not in viewport)
7. UV Expansion Project
8. WWTP Facility Plan (no construction)
9. Secondary Treatment Project 3
10. Mechanical WAS Thickening
11. Secondary Treatment Project 4
12. Anaerobic Digestion Expansion
13. Administration Building
14. Laboratory Building
15. Headworks Expansion

Project #X

Deficiencies Addressed

1. Secondary Treatment, Outfall, WAS Thickening, Anaerobic Digestion, UV Disinfection

Capacity

1. All On Capacity – 5.9-6.3 mgd, Existing
2. 85% Trigger – 5.0-5.3 mgd, Existing
3. R&R Capacity – 3.0-3.1, Existing

Timing

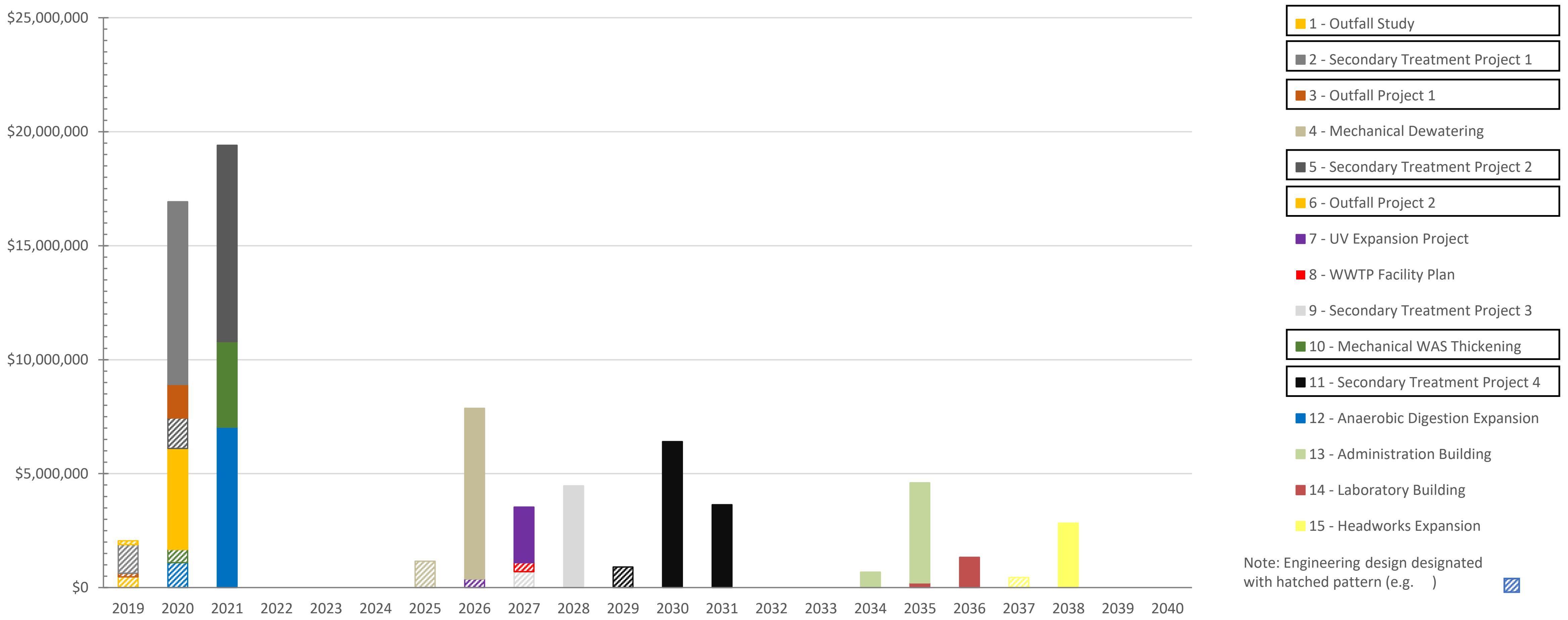
1. Estimated Design & Construction Window 2019-2021

Included Components

1. Outfall Study and Project 1, 2 and 3
2. Aeration Basin 3, 4
3. Aeration Basin 1 and 2 Retrofit
4. Blower Building
5. Anoxic 1 and 2
6. Demo Existing Trickling Filter and Intermediate Clarifier
7. UV Expansion
8. WAS Thickening
9. Anaerobic Digestion

Project Cost

1. $38,399,000



DRAFT Cash Flow

Project Next Steps

Next Steps Continued…

- City Financial Analysis/Final CIP (*Section 8*)
- Council/Public presentation (*Timing TBD)*
- Facility Plan Section 6, 7, and 8 Drafts Completed
- City Document Review
- WDOE Review
- Federal Cross-Cutter Document Review (*timing/extent TBD*)

City of Pasco

WWTP Facility Plan

Workshop 4: Capital Improvement Plan Development

Presented by: Craig Anderson & Mark Cummings

March 7, 2019

murraysmith

APPENDIX 8-4

Appendix 8-4

Design Summary of Selected Alternatives

8-4.1 Introduction

This section of the Wastewater Facility Plan documents the City of Pasco's (City) wastewater treatment plant (WWTP) selected alternative design criteria.

8-4.2 Selected Liquid Treatment Design Summary

Selected liquid treatment alternatives include a headworks expansion, expansion of the activated sludge treatment system, Ultraviolet (UV) disinfection module replacement and upgrade, and gravity outfall replacement. These alternatives design criteria are summarized in **Table 8-4.1**.

Table 8-4.1
Liquid Treatment Design Summary

Name	Design Criteria
Preliminary Treatment: Headworks Expansion	▪ Perforated plate mechanical screen and channel to the south of the existing headworks building. Screening and equipment and channel similar to the existing in dimensions and capacity.
Secondary Treatment: Activated Sludge - Plug Flow	▪ Anoxic Bains – Two 0.3 million gallon (MG) basins mixed with mechanical mixers. The dimension of each basin will be 50 feet long, 50 feet wide and 20.5 feet tall. Includes power, electrical, instrumentation, control, mechanical and yard piping. ▪ Aeration Basins - Series of 0.6 MG basins similar to existing with fine bubble diffused aeration and partitioned into a "cells in series" configuration to better mimic plug flow conditions. The dimension of each basin will be 100 feet long, 50 feet wide and 20.5 feet tall. Each basin will include RAS piping, air piping, sensors, and other items similar to the existing aeration basins. Includes power, electrical, instrumentation, control, mechanical and yard piping. ▪ Blower Building – 2,400 SF blower building expansion with additional 200 horsepower (hp) high speed turbo blowers delivering 4,500 SCFM air flow similar to the existing blowers.

Name	Design Criteria
Secondary Treatment: Activated Sludge - Plug Flow (cont…)	Includes power, electrical, instrumentation, control, and mechanical. ▪ Secondary Clarifiers – Two new secondary clarifiers similar to the existing: 95-foot diameter with 14-foot sidewater depth. Includes energy dissipating inlet, suction style removal mechanism, power, electrical, instrumentation, control, mechanical and yard piping. ▪ RAS/WAS Pump Station – Expansion of RAS/WAS Pump station with new Return Activated Sludge (RAS) pumps, Waste Activated Sludge (WAS) pumps, and scum pumps similar to the existing. Includes power, electrical, instrumentation, control, mechanical and yard piping. ▪ Influent Splitter - New weir flow splitting concrete structure to evenly split flow to each aeration basin. ▪ Effluent Splitter - New weir flow splitting concrete structure to evenly split flow to four secondary clarifiers.
UV Disinfection	▪ Replacement of existing system with similar but new and larger Suez Aquaray 40 HO UV 16 total disinfection modules in existing channels with new ballasts, sensors, wiper system, Programable Logic Controller (PLC), electrical, outlet hydraulic control, inlet stilling plate and stepped floor for hydraulics.
Gravity Outfall	▪ 42-inch subcritical flow gravity pipeline from UV building to Grey Avenue and 36-inch supercritical flow pipeline following current alignment to a new multiport diffuser in the Columbia River ▪ Multiport diffuser (designed as part of detailed mixing zone analysis completed in Project 1A).

8-4.2 Selected Biosolids Handling Design Summary

Selected biosolids handling alternatives include mechanical thickening, a third anaerobic digester and mechanical dewatering. These alternatives design criteria are summarized in **Table 8-4.2**.

Table 8-4.2
Biosolids Handling Design Summary

Unit Process	Name	Alternative Number	Design Criteria
WAS Thickening	Mechanical Thickening	WAS-2	Mechanical WAS thickening system consisting of two thickeners at a minimum and polymer system in a new 1,440 SF building. Equipment sized for 24 hour per day operation at 2040 taking 11,500 pounds per day (lb/day) of WAS from 0.7 percent total solids to minimum of 4 to 5 percent total solids. Includes TWAS positive displacement style transfer pumps to pump to the anaerobic digesters. City operations currently prefers rotary drum thickener or thickening centrifuge. Includes power, electrical, instrumentation, control, mechanical and yard piping.
Solids Stabilization	Anaerobic Digestion	STA-2	A third anaerobic digester similar to existing: 66-foot diameter, 32-foot depth with solid roof and vertical mechanical mixer. Also, a 1,664 square feet (SF) solids handling building expansion similar to existing between the digester 2 and 3. Building will house heat exchangers, boilers, mixing pumps. Includes power, electrical, instrumentation, control, mechanical and yard piping.
Solids Finishing	Mechanical Dewatering	FIN-2	Mechanical digested sludge dewatering system consisting of two dewatering units at a minimum and polymer system in a new 1,440 SF building. Equipment sized for 24 hour per day operation at 2040 loading: 17,700 lb/day of digested sludge from 2.5 percent total solids to 18-23 percent total solids. Includes new cake transfer auger and biosolids loading pad. City operations currently prefers screw press or centrifuge. Selection of dewatering technology deferred to the design process. One unit fully redundant. Includes power, electrical, instrumentation, control, mechanical and yard piping.

8-4.3 Other Alternatives Criteria

Other selected alternatives include non-process improvements to the WWTP including Administration/Process Control Building, Laboratory and a WWTP Facility Plan. These alternatives are summarized in **Table 8-4.3**.

Table 8-4.3
Other Alternatives Design Planning Summary

Unit Process	Name	Alternative Number	Design Criteria
Administration/Process Control Building	Administration/Process Control Building Expansion	PCB-1	6,600 SF building with reception area, offices, meeting rooms, training rooms, break rooms, locker rooms, and bathrooms.
Laboratory	Laboratory Expansion	LAB-1	2,000 SF WWTP laboratory building.
WWTP Facility Plan	WWTP Facility Plan	FP-1	WWTP Facility Plan Update at the completion of Projects 1 and 2 (approximate mid-point of 20-year capital improvement plan) to reassess priority and need to remaining capital improvement plan projects based on potentially changing City growth and regulatory conditions.

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