

General Sewer Plan

October 2026 / DRAFT

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Abbreviations

°F	degrees Fahrenheit
2010 GSP	2010 General Sewer/Wastewater Facility Plan
AACE	American Associate of Cost Estimators
AAF	average annual flow
AAL	average annual load
AB	aeration basin
AD	Anaerobic Digesters
ADF	average day flow
ADWF	average dry weather flow
AKART	all known, available and reasonable methods of prevention, control and treatment
aSRT	Aerobic solids retention times
ATS	automatic transfer switch
BNR	biological nutrient removal
BOD	biochemical oxygen demand
BOD_5	5-day biochemical oxygen demand
CARA	critical aquifer recharge areas
$cBOD_5$	5-day carbonaceous biological oxygen demand
CCTV	closed-circuit television
cf/hr	cubic feet per hour
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIP	Capital Improvement Program
City	City of Camas
CMC	City municipal code
CMMS	Computerized Maintenance Management System
CMP	corrugated metal pipe
CWA	Clean Water Alliance
d/D	depth versus diameter
DNS	determination of non-significance
DSHT	Digested Sludge Holding Tank
DWF	dry weather flow
Ecology	Washington State Department of Ecology
EI&C	Electrical, instrumentation, and control
ELA	engineering, legal, and administration
ENR	Engineering News Report
FOG	fats, oil, and grease
FONSI	finding of no significant impact
fps	feet per second

ft^3	cubic feet
GIS	geographic information system
GMA	Growth Management Act
gpad	gallons per acre per day
gpcd	gallons per capita day
gpd	gallons per day
gpm	gallons per minute
GSP	General Sewer Plan
GWI	groundwater infiltration
H_2S	hydrogen sulfide
HARL	Hills at Round Lake
HGL	hydraulic grade line
HP	horsepower
HST	high speed turbo
I/I	infiltration and inflow
IDWF	influent dry weather flow
kcal/day	kilocalories per day
kVA	kilovolt-amperes
kW	killowatts
LS	lift station
M	million
MCC	motor control center
MDDF	maximum daily design flow
MDDL	maximum daily design load
MDF	minimum daily flow
MDS-EB	main distribution switchboard - elevator board
MG	million gallons
$Mg(OH)_2$	Magnesium hydroxide
mg/L	milligrams per liter
mgd	million gallons per day
MH	manhole
mL	milliliter
mL/g	milliliters per gram
MLSS	mixed liquor suspended solids
mm	millimeter
MMF	maximum monthly flow
MML	maximum month load
MS4	Municipal Separate Storm Sewer System
MWD	maximum week design load
MWDF	maximum week design flow

N/A	not applicable
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NH_3	ammonia
NH_3-N	ammonia-nitrogen
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PARIS	Permitting and Reporting Information System
PC	primary clarifier
PCB	polychlorinated biphenyls
PDF	peak day flow
PDL	peak day load
PFAS	per- and polyfluoroalkyl substances
PHDF	peak hour demand flow
PHDL	peak hour design load
PHF	peak hour flow
PIDF	peak instantaneous design flow
PLC	programmable logic controller
ppd	pounds per day
ppd/sf	pounds per day per square foot
ppm	parts per million
psig	pounds per square inch gauge
PVC	polyvinyl chloride
PWWF	peak wet weather flow
QA/QC	quality assurance and quality control
R&R	repair and replacement
RAS	return activated sludge
RCW	Revised Code of Washington
RDII	rainfall dependent infiltration and inflow
RDT	rotary drum thickener
RPA	Reasonable Potential Analysis
SC	secondary clarifier
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
SEPA	State Environmental Policy Act
SOR	surface overflow rate
SR	State Route
SRT	solids retention time
SS	stainless steel

SSF	slow sand filtration treatment plant
STE	septic tank effluent
STEF	septic tank effluent filter
STEG	septic tank effluent gravity
STEP	septic tank effluent pump
SU	standard units
SVI	sludge volume index
SWBD	switch board
SWCAA	Southwest Clean Air Agency
SWD	side water depth
SWPP	stormwater pollution prevention plan
TCLP	toxic characteristic leachate procedure
TDH	total dynamic head
TKN	total Kjeldahl nitrogen
TPS	thickened primary sludge
TSMC	Taiwan Semiconductor Manufacturing Co.
TSS	total suspended solids
UGA	urban growth area
UGB	urban growth boundary
USEPA	United States Environmental Protection Agency
UT1	Utility Transformer No. 1
UT2	Utility Transformer No. 2
UV	ultraviolet
UVT	ultraviolet transmittance
VCP	vitrified clay pipe
VFD	variable frequency drive
WAC	Washington Administrative Code
WAS	waste activated sludge
WRF	water reclamation facility
WSE	water surface elevation
WWF	wet weather flow
WWTF	wastewater treatment facility
WWTFO	Washington Wastewater Treatment Facility Operator

EXECUTIVE SUMMARY

ES.1 Introduction

The City of Camas (City) is located in Clark County, Washington, near the border of Washington and Oregon, along the Columbia River near Vancouver, Washington. The City owns and operates most of the sewer collection system within the City limits and its urban growth area (UGA). The collection system is a combination of gravity sewers, lift stations (LS), force mains (FM), and septic tank effluent pump (STEP) systems. Wastewater is collected and treated by the City at the Camas Wastewater Treatment Facility (WWTF) and then discharged to the Columbia River.

The purpose of the City's General Sewer Plan (GSP) is to provide a roadmap for managing the wastewater collection system over the next 20 years, accommodating growth, and maintaining a high level of service for existing customers. The Plan addresses key issues such as the replacement of older, deteriorating sanitary sewer facilities, evaluation of collection and treatment capacity for existing deficiencies and future development, assessment of sanitary sewer lift stations and force mains, and the City's infiltration and inflow (I/I) reduction program. The GSP and its recommendations were prepared in accordance with Washington Administrative Code (WAC) 173-240-050 and meet the requirements of the Washington Growth Management Act (GMA). The City owns and operates most of its sewer collection system, which includes gravity sewers, pump stations, force mains, and Septic Tank Effluent Pump (STEP) systems, and treats wastewater at the Camas Wastewater Treatment Plant (WWTF) before discharge to the Columbia River. Key elements addressed in the GSP include:

- The need and timing of the replacement of older, deteriorating sanitary sewer facilities within large, neighborhood-size areas within the City.
- The evaluation of the City's collection system and treatment capacity to address both existing system deficiencies and future development, as well as plan for future potential development-driven deficiencies.
- The evaluation of sanitary sewer LS and FM for removal, rehabilitation and replacement.
- The City's infiltration and inflow (I/I) program to evaluate options and needs for I/I reduction.
- Implementation of recommended improvements by priority which maintains affordable rates for the system users.

ES.1.1 Sewer Service Area

The current sewer service area covers approximately 7,600 acres, including properties within the City limits, and the future service area extends to the UGA, totaling 8,900 acres. A map of the sewer service area is presented in Figure ES.1.

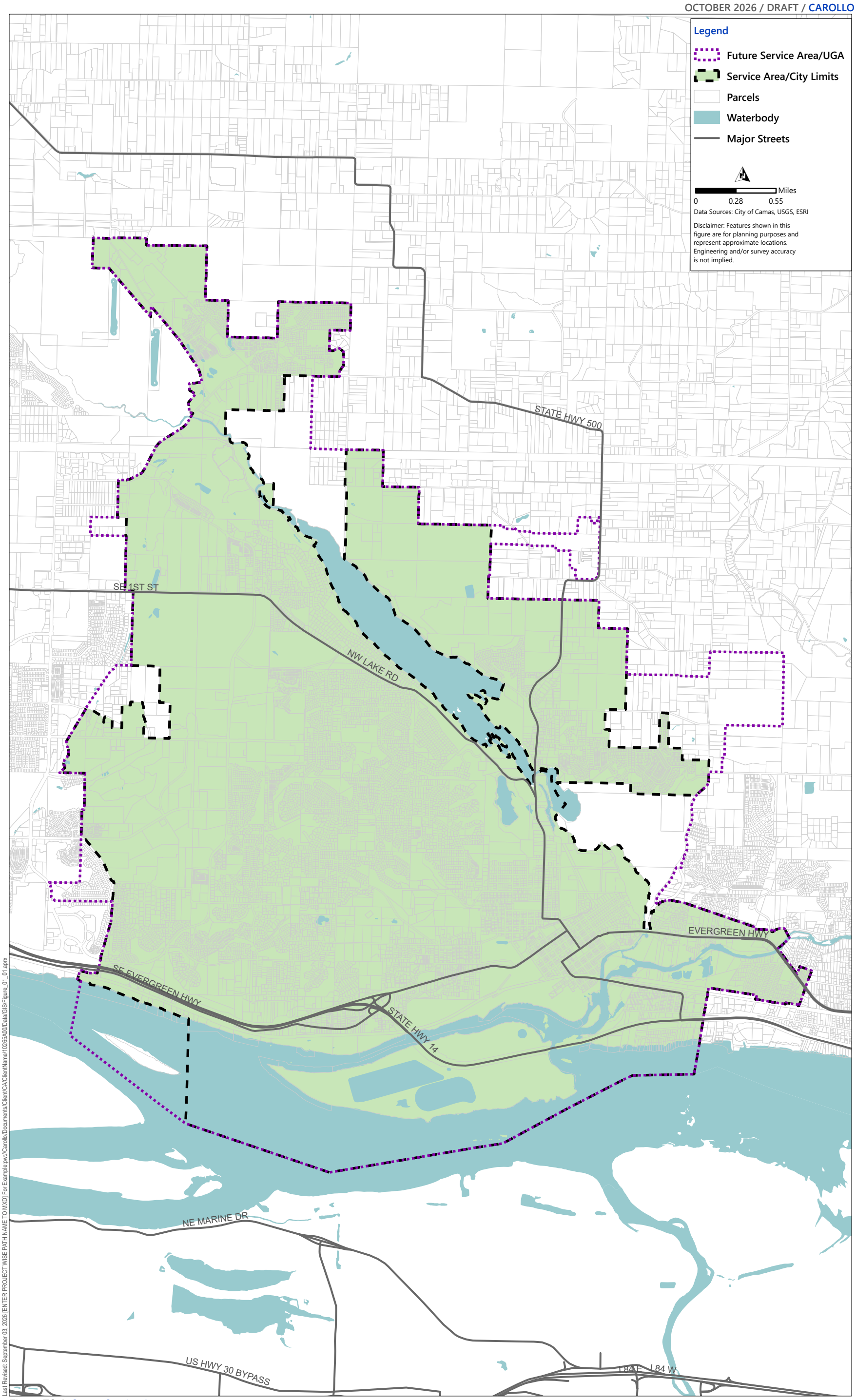


Figure ES.1 Sewer Service Area

ES.2 Policies

The City is responsible for managing and operating its wastewater system in accordance with all local, state, and federal regulations. To best manage the wastewater system and comply with regulations, the City has adopted wastewater system policies and criteria. These policies guide the development and financing of the infrastructure required to provide wastewater service and document the City's commitments to current wastewater system customers as well as those considering service from the City. The policies and criteria are organized into the following categories:

- Sewer Service.
- Environmental Stewardship.
- Design Criteria and Standards.
- Financial Policies.
- Regulatory Requirements.

ES.3 Basis of Planning

Chapter 3 of the GSP presents flow and load projections for the collection system and WWTF based on planned development and future population growth through 2045. Slightly different methodologies were used to project wastewater flows for the collection system and the WWTF due to the specific requirements of each analysis and the availability of data. For example, collection system flow monitoring data was collected from January 15, 2025, to April 29, 2025, while WWTF flow and load projections are based on an evaluation of historical plant data. The collection system was projected for both 2045 and buildout conditions, while the WWTF analysis was projected through 2045.

ES.3.1 Collection System Flow Projections

The collection system flow projections were developed for use in the City's calibrated hydraulic model of the sewer system. The modeled system primarily includes gravity sewers that are 8-inch or larger and the trunk of the STEP system. The data collected during the flow monitoring program, along with population growth projections, land use development projections, and wastewater flow factors, were used to develop the flow projections. The updated hydraulic model flow projections summary is presented below, reflecting 2025, 2045, and buildout planning horizons:

Table ES.1 Hydraulic Model Flow Projections Summary

Planning Horizon	ADWF (mgd)	PWWF (mgd)	Peaking Factor (PWWF:ADWF)
2025	2.85	22.9	8.04
2045	5.32	26.8	5.04
Buildout	7.55	35.2	4.67

Notes:
ADWF - average dry weather flow; mgd - million gallons per day; PWWF - peak wet weather flow.

ES.3.2 WWTF Flow and Load Projections

The City's WWTF receives flows from the gravity collection system, septic tank effluent from the City's STEP system, and the septage receiving station. Load and flow projections were developed independently for the WWTF based on historical influent flow and raw wastewater pollutant concentrations, typical septage and STEP system characteristics and population growth projections, and industrial flow contributions. The influent flow projections developed for the WWTF for 2025 and 2045 are summarized in Table ES.2:

Table ES.2 Current and Projected WWTF Flows

Flow Parameter	2025 Flow (mgd)	2045 Flow (mgd)
Average Annual Flow (AAF)	2.9	5.4
Maximum Monthly Flow (MMF)	4.0	7.5
Minimum Daily Flow (MDF)	5.7	10.7
Peak Hourly Flow (PHF)	10.8	20.4
Peak Instantaneous Design Flow (PIDF)	11.8	22.2

Wastewater loading data, related to effluent limitations contained in the City's WWTF National Pollution Discharge Elimination System (NPDES) permit, were also projected to evaluate treatment capacity for future conditions. Historical values for 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and Total Kjeldahl Nitrogen (TKN) and projections to 2045 are detailed and summarized in Table ES.3:

Table ES.3 Current and Projected WWTF Loads

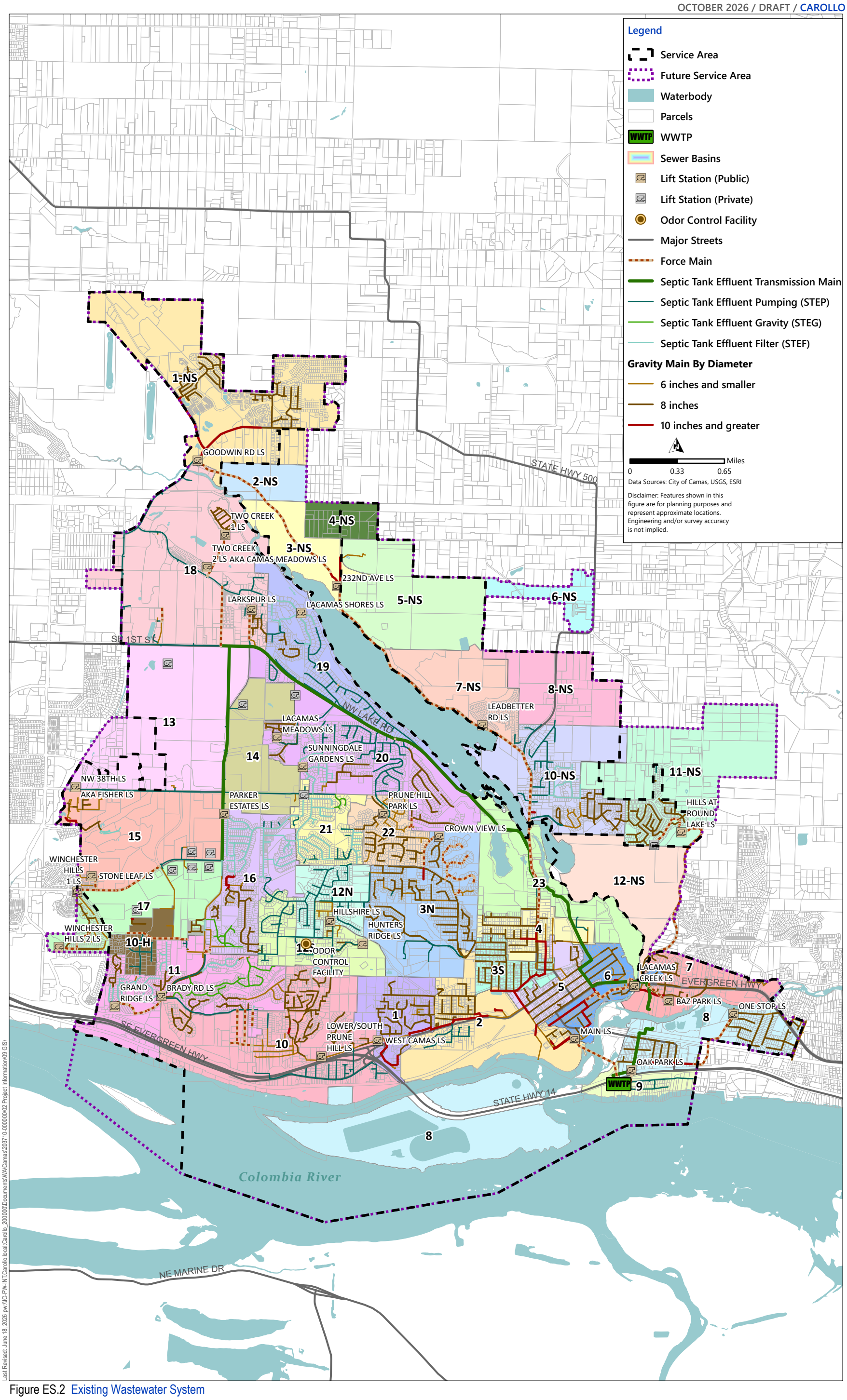
Load Parameter	2025 Influent Load (ppd)	2045 Influent Load (ppd)
Sewered Population	30,056	37,080
BOD_5 (ppd)		
Average Annual	3,200	6,000
Maximum Month	4,000	7,500
Maximum Week	4,500	8,500
TSS (ppd)		
Average Annual	3,100	5,800
Maximum Month	3,900	7,300
Maximum Week	4,300	8,100
TKN (ppd)		
Average Annual	1,300	2,500
Maximum Month	1,500	2,800
Maximum Week	1,600	3,000

Notes:
ppd - pounds per day.

ES.4 Existing System

Chapter 4 describes the sewer system within the City's service area, which is owned, maintained, and operated by the City. A map of the existing system is shown in Figure ES.2. The City's conventional gravity sewer system includes 405,499 (76.8 miles) linear feet of gravity mains, while STEP systems account for 290,019 linear feet (54.9 miles). The earliest portions of the gravity system date back to the 1920s. There are 28 lift stations operated within the service area and approximately 65,218 linear feet (12.4 miles) of force main. These systems convey wastewater to the City's WWTF. The septic tanks provide preliminary wastewater treatment, solids settling, and some digestion such that the effluent is not as strong as raw sewage collected in the conventional system. The City pumps out the septage from the STEP systems on a 5 to 7-year cycle.

The City's WWTF is located along the Columbia River in the southeastern portion of its sewer service area. The WWTF was originally constructed in 1972 and has had several modifications since that time to increase capacity and improve treatment capabilities to continue to meet all effluent permit requirements. The City's NPDES effluent discharge limitations, prohibitions, and requirements are similar to other municipal facilities, with standard 30/30 monthly TSS and BOD concentration limits and a mandatory 85 percent reduction in each. Additionally, the WWTF has ammonia limits of 20 milligrams per liter (mg/L) (NH_3 as N) in the summer and 7 mg/L (NH_3 as N) in the winter. An aerial view of the WWTF with each unit process and building identified is shown in Figure ES.3.



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Figure ES.2 Existing Wastewater System



Figure ES.3 WWTF Aerial Image with Site Plan

ES.5 Infiltration and Inflow Program

Chapter 5 of this GSP summarizes the City's efforts to reduce I/I from 2016 through 2024 and the quantifiable, positive improvement that has been accomplished. I/I consist of two components which may combine or act independently to increase flow volume and peak flows in the sewer system. If too much I/I enters the sewer system such that it operates at or above capacity, sanitary sewer overflows (SSO) could occur. More dilute wastewater can also be more difficult to treat under percent removal NPDES permits, such as those held by the City. The City has a long history of I/I studies and control efforts, investing over $4.55 million (M) in collection system I/I work and $750,000 in WWTF improvements to address I/I flows. I/I, comprising infiltration (groundwater entering through defects) and inflow (stormwater entering directly), can lead to surcharging, sewage backups, hydraulic overloading, and reduced treatment efficiency.

Though the City has reduced I/I on a gpcd basis and the 2025 NPDES permit no longer requires annual I/I reporting, the City is continuing to invest in the collection system to further reduce I/I through its ongoing repair and replacement program. Specifically, it is recommended to investigate I/I sources in flow meter basins with high I/I based on the recent flow monitoring completed in 2025 as part of this planning effort, including 5-1-2 (upstream of Crown View LS and South Prune Hill LS) and 4-1-3 (downtown).

ES.6 System Analysis

Chapter 6 describes the hydraulic modeling analysis conducted for gravity pipes, STEP main, force main, and LS in the modeled portion of the City's collection system. The modeled collection system includes primarily gravity sewers 8-inch or larger, force mains, lift stations, and the trunk of the STEP system. The analysis identified capacity deficiencies associated with current and projected future use and recommends improvements to alleviate any identified concerns. The collection system was evaluated by applying three planning scenarios:

- **Existing:** Matching existing (2026) calibrated conditions.
- **20-Year:** Incorporating growth through 2045 as identified in the 2045 Comprehensive Plan.
- **Build-Out:** Development of the full-service area including UGA.

Performance and design criteria for the conveyance system are outlined below:

- **Performance Criteria:**
  - Sewer pipes can be surcharged. If surcharging is within 3-feet from manhole (MH) rim, then the sewer was deemed deficient.
  - No surcharging (d/D>1) is allowed at shallow MHs which is defined as MHs where the distance between crown of pipe and MH rim is less than 3-feet.
- **Design Criteria:**
  - The City defines the acceptable d/D value of 0.92 for design of new sewers under design storm conditions and build out scenario.
  - The City's lift station should have sufficient firm capacity to pump the PWWF during the design storm with the largest pump out of service.
  - The City's force main and STEP should not exceed a maximum pipe velocity of 8 feet per second (fps) during the design storm.

ES.6.1 Gravity Collection System Evaluation

For each planning scenario, the associated PWWF was routed through the hydraulic model. The peak hydraulic grade line in manholes and gravity pipelines was compared to the established performance criteria. Under existing conditions, ten potential problem areas were identified where capacity is deficient to convey the PWWF. Three additional deficiency problem areas occur under 20-year (2045) conditions due to additional projected flows. Table ES.5 shows a summary of the pipe capacity improvements.

ES.6.2 STEP and Force Main System Evaluation

The evaluation of the City's wastewater collection system extended beyond gravity pipes to include the STEP system and force mains, with the force mains associated with lift stations incorporated into the hydraulic model. A primary performance criterion for both existing force mains and STEP mains was that their maximum pipe velocity should not exceed 8 fps during the design storm. Additionally, lift stations were assessed to ensure sufficient firm capacity to handle the PWWF from their tributary areas, meaning they could operate with the largest pump out of service. The hydraulic analysis revealed that the STEP system transmission main exceeds this velocity criterion under both existing and projected 2045 PWWF conditions, particularly in areas with steep downhill slopes like NW Parker Street and NW Lake Road. However, no practical improvement project was identified to address these high velocities because the STEP system operates under low pressure, and the steep downhill segments function hydraulically more like gravity mains than pressurized force main. As a result, improvements typically used to address high velocities in pressurized systems would not be practical in these locations. Table ES.5 shows a summary of the pipe capacity improvements.

ES.6.3 Lift Station Evaluation

The City's hydraulic model includes twelve of the City's 28 lift stations. The estimated current and future PWWFs were compared to the firm capacities of these modeled lift stations. Six of the modeled lift stations are considered deficient in the existing system scenario, and an additional three lift stations are identified as deficient under the 20-year conditions. Table ES.6 shows a summary of the lift stations' capacity improvements.

ES.6.4 General System Evaluation

The evaluation of the collection system also identified a need for general improvements to enhance overall system management, safety, and future planning capabilities. These general improvement projects are crucial for supporting current operations, improving accuracy in future evaluations, and informing subsequent capital improvement planning efforts. informing subsequent capital improvement planning efforts. Table ES.7 summarizes the recommended general improvements.

ES.6.5 Annual Repair and Replacement Evaluation

The City has established an Annual Repair and Replacement Program as a vital component of its CIP, dedicating $67.9 M over the 19-year planning horizon (2027 to 2045) with an average annual cost of approximately $3.6 M. These annual projects are critical for maintaining existing infrastructure, ensuring reliable service, and proactively addressing wear and tear across the entire wastewater collection and treatment system. These programs are essential for continuous system functionality, prolonging asset life,

and supporting the long-term goals of the General Sewer Plan. Table ES.8 shows a summary of the City's annual programs.

ES.6.6 Recommended Improvements

The collection system evaluation identified improvements needed to address existing deficiencies, accommodate projected 20-year demands, and support reliable system operation. The recommended improvements generally fall into the following categories:

- **Pipe Capacity Improvements:** Improvements to gravity sewers, force mains, and STEP transmission main where additional capacity is needed. Table ES.4 summarizes these pipe capacity improvements.
- **Lift Station Improvements:** Upgrades to pump capacity and redundancy at lift stations that do not meet existing or projected 20-year firm capacity requirements. Table ES.5 summarizes the recommended improvements for the lift stations identified as deficient.
- **General Improvements:** Improvements to support system monitoring, data collection, asset management, and ongoing system planning. Table ES.6 summarizes these recommended general improvements.

The recommended improvements include both short-term and long-term projects. Short-term improvements are generally intended to address existing system deficiencies or operational needs identified under current conditions and are recommended for implementation between 2027-2035. Long-term improvements are primarily associated with projected growth and are intended to accommodate increased demands through the 20-year planning horizon, with implementation recommended between 2036 and 2045. The timing of individual projects should be coordinated with system needs, development, and available funding and may be adjusted as conditions change. The recommended improvements are incorporated into the Capital Improvement Plan presented in Chapter 9.

Table ES.4 Recommended Pipe Capacity Improvement Projects

Project ID	Improvement Type	Location	Existing Size (inches)	Proposed Size (inches)	Length (feet)	Phase
P-01	Gravity	NW 6th Place West Upsize Improvements	8 8 8 12	12 15 18 18	814 179 386 86	Short-term
P-02	Gravity	NW 6th Place East Upsize Improvements	8 12	18 18	577 105	Short-term
P-03	Gravity	NW 6th Place Avenue West Upsize Improvements	12 12	18 21	333 2,302	Short-term
P-04	Gravity	NW 6th Place Avenue East Upsize Improvements	12 18 21 21 24 21	24 27 27 30 36 36	402 446 532 519 1,009 909	Long-term
P-05	Gravity	NW Fargo Street, NW 18th Loop, and NW 18th Avenue Upsize	8 8	12 15	1,736 1,008	Short-term

Project ID	Improvement Type	Location	Existing Size (inches)	Proposed Size (inches)	Length (feet)	Phase
P-06	Gravity	NE Garfield Street to NE 15th Avenue to NE Franklin Street to along the Creek Improvements	8 15 21 15	15 18 30 30	1,222 256 254 1,217	Long-term
P-07	Force Main	South Prune Hill Force Main Improvements	10	18	925	Short-term
P-08	Force Main	West Camas Lift Station Force Main Improvements	6	15	574	Short-term
P-09	Force Main	Main Lift Station Force Main Improvements	18	24	2,348	Long-term
P-10	Force Main	Leadbetter Road Lift Station Dual Force Main Improvements	-	10	6,500	Long-term
P-11	Gravity	Division Street Upsize	8 8 8	12 15 18	247 580 2,032	Short-term
P-12	Gravity	SE Everett Road to Leadbetter Rd Extension	-	8 12 18	2,031 692 6,036	Long-term
P-13	Gravity	SE 283rd Avenue to NE Woodburn Drive Extension	-	12	6,782	Long-term
S-01	STEP	NW Parker Street to NW Lake Road STEP Main Improvements	-	30	14,032	Long-term

Table ES.5 Recommended Lift Station Improvement Projects

Project ID	Location	Description	Phase
LS-01	Lower/South Prune Hill	Construct a new Lower/South Prune Hill LS with a pump capable of pumping 3.0 mgd of firm capacity to provide additional capacity and support future system needs. The station's firm capacity needs to convey more than double its current firm capacity from 0.86 mgd. Extensive upgrades to the station are recommended in the short term. An additional planning-level allowance of $150,000 was included for odor control improvements. The estimated cost is $5,381,000 and is planned for 2033.	Short-term
LS-02	West Camas	Construct a new West Camas LS with a pump capable of pumping 3.3 mgd of firm capacity to provide additional capacity and support future system needs. The LS is downstream of Lower/South Prune Hill LS, so this project should be implemented after the Lower/South Prune Hill LS Improvements (LS-01). An additional allowance of $100 per linear foot was included for asbestos cement pipe removal. The estimated cost is $5,204,000 and is planned for 2031.	Short-term
LS-03	Crown View	Construct a new Crown View LS with a pump capable of pumping 1.0 mgd of firm capacity to provide additional capacity and support future system needs. The LS is not able to serve existing system PWWF, nor 20-year and buildout PWWF. The station's firm capacity needs to convey more than triple its current firm capacity from 0.32 mgd. Extensive upgrades are recommended in the short-term. The estimated cost is $4,290,000 and is planned for 2034.	Short-term

Project ID	Location	Description	Phase
LS-04	Lacamas Creek	Replace the two existing pumps capable of pumping 2.13 mgd each to meet the required firm capacity. The LS receives more PWWF than its firm capacity during 20-year conditions (2.13 mgd vs 1.37 mgd firm capacity). Replacing the pumps in this station is recommended in the long-term. The estimated cost is $1,245,000 and is planned for 2045.	Long-term
LS-05	Main LS	Construct a new Main LS with pumps capable of pumping 21.0 MGD of firm capacity to provide additional capacity and support future system needs. An additional planning-level allowance of $150,000 was included for odor control improvements. The estimated cost is $10,640,000 and is planned for 2029.	Long-term
LS-06	Goodwin Road	Add a pump capable of pumping 0.49 mgd. The LS receives more PWWF than its firm capacity during the 20-year conditions (0.71 mgd vs 0.49 mgd firm capacity). Adding an additional third pump to the station is recommended in the long-term. The estimated cost is $502,000 and is planned for 2043.	Long-term
LS-07	232nd Avenue	Add a pump capable of pumping 0.53 mgd. The LS receives more PWWF than its firm capacity during existing and 20-year conditions (2.60 mgd vs 0.53 mgd firm capacity). Adding an additional third pump to the station is recommended in the long-term. The estimated cost is $502,000 and is planned for 2042.	Long-term
LS-08	Leadbetter Road	Add a pump capable of pumping 0.87 mgd. The LS receives more PWWF than its firm capacity during existing and 20-year conditions (3.63 mgd vs 0.87 mgd firm capacity). Activating the station's 8-inch dual force main and adding an additional third pump to the station is recommended in the long-term. The estimated cost is $2,379,000 and is planned for 2041.	Long-term
LS-09	Hills at Round Lake	Replace the two existing pumps with three new pumps, each capable of pumping 0.65 mgd to meet the required firm capacity. The LS receives more PWWF than its firm capacity during 20-year conditions (1.21 mgd vs 0.96 mgd firm capacity). Replacing the pumps in this station is recommended in the long-term. The estimated cost is $1,504,000 and is planned for 2044.	Long-term

Table ES.6 Recommended General Improvement Projects

Project ID	Project Name	Description	Phase
G-01	Basin 4-1-3 Pilot I/I Study	This program will investigate the source and magnitude of I/I of storm and groundwater into the wastewater system at locations where suspected high I/I is currently or is forecast to exceed conveyance and/or Lift Station capacity. Identifying and removing non-sewage flow where that would reduce surcharging such that costly capacity improvements might be avoided. The estimated cost is $200,00 and is planned for 2027.	Short-Term

Project ID	Project Name	Description	Phase
G-02	Basin 5-1-2 Flow Monitoring	This project is to install temporary flow meters in Basin 5-1-2 to capture flows from the Camas LS and Upper Prune Hill contributing areas separately. Both areas have pipe and LS capacity deficiencies and additional flow monitoring within this basin would help to understand if part of the basin is contributing a greater portion of I/I. This study should evaluate if projects within the basin have the potential to reduce I/I such that projects to increase hydraulic capacity within the system can be avoided. Reducing I/I has downstream benefits at the treatment plant as well. The estimated cost is $300,00 and is planned for 2027.	Short-Term
G-03	Geographic Information System (GIS)	This program will implement ongoing enhancements to the GIS, including asset mapping, data collection, database maintenance, and integration with utility management systems. Maintaining accurate and up-to-date spatial information will improve infrastructure planning, field operations, emergency response, and asset management while supporting informed decision-making and efficient delivery of utility services. The estimated cost is $250,00 and is planned for 2027.	Short-Term
G-04	Hydraulic Modeling	The City's collection system model is heavily skeletonized, only 28 percent of the City's collection system pipes are included. A full pipe or less skeletonized model is needed for a more robust evaluation of the system. In order to expand the model, accurate and updated GIS for the collection system should be developed. The estimated cost is $200,00 and is planned for 2029.	Short-Term
G-05	Electrical System Arc Flash Study	No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety. The estimated cost is $75,00 and is planned for 2027.	Short-Term
G-06	Hazardous Area Classification Study	To ensure regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code. The estimated cost is $50,00 and is planned for 2027.	Short-Term
G-07	Flood Risk Assessment	This project is a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience at the WWTF. The estimated cost is $100,00 and is planned for 2027.	
G-07	General Sewer Plan	2035 General Sewer Plan Update. The estimated cost is $700,00 and is planned for 2035.	Short-Term
		2045 General Sewer Plan Update. The estimated cost is $700,00 and is planned for 2045.	Long-Term

Table ES.7 Recommended Annual Maintenance Improvement Projects for Collection System

Project ID	Project Name	Description	Phase
R-01	Sewer Main R&R Program	This project includes miscellaneous improvements at the existing WWTF to address operational, maintenance, and reliability needs, with an estimated total cost of $20.4 M over the 19-year planning horizon	Annual
R-02	Miscellaneous Lift Station Projects	This program focuses on miscellaneous improvements at existing LSs, including pump and piping replacement, electrical upgrades, and wet well improvements, with an estimated total cost of $38,000,000 over the 19-year planning horizon	Annual

ES.7 Wastewater Treatment Facility

Chapter 7 summarizes efforts to identify shortfalls in WWTF capacity that will prevent the City from reliably treating and disposing of projected flow and loads in compliance with their NPDES permit at the end of the planning period (i.e., year 2045). To address the identified deficiencies, an alternatives analysis of the most viable improvement options was conducted, which resulted in the development of 25 projects to be incorporated into the GSP's capital improvement program (CIP).

The recommended WWTF improvement projects were prioritized based on the anticipated timing of the need for each improvement and categorized as short-term and long-term projects similar to the collection system projects. Because many of the recommended improvements are relatively smaller scale projects, their implementation timing is primarily based on when the improvement is needed to address existing operational or capacity needs, maintain reliable treatment, or accommodate projected increases in flow and loads. The 25 recommended WWTF projects with their respective priorities are summarized in Table ES.8. The annual WWTF miscellaneous projects are summarized in Table ES.9.

Table ES.8 Recommended WWTF Improvement Projects

Project ID	Description	Project Priority
TP-01	Replace existing Parshall Flume with a new, higher-capacity one to accommodate peak flow conditions and prevent influent wastewater spraying, including structural modifications.	Short-Term
TP-02	Construct a bypass around Primary Clarifiers No. 1 and 2 to route flows greater than the maximum day flow around the primary treatment process, including installation of a new 30-inch bypass pipeline.	Short-Term
TP-03	Construct a new Aeration Basin Influent Flow Splitter Box to improve flow distribution to the aeration basins, including new slide gates and piping.	Short-Term
TP-04	Replace existing screens and slide gates at the Plant Headworks to improve reliability and operation of the screening process.	Short-Term
TP-05	Relocate the internal recycle (IR) piping at the three existing aeration basins to the beginning of the Anoxic Selector to improve the treatment process and flow distribution.	Short-Term
TP-06	Modify baffle walls separating the anaerobic selectors within the existing aeration basins to improve flow distribution and maintain proper separation, including replacing plywood baffles with stainless steel.	Short-Term
TP-07	Demolish existing Secondary Clarifier No. 1 and construct a new one to match the size, slope, and criteria of Secondary Clarifier No. 3, improving reliability and performance.	Short-Term
TP-08	Replace the Return Activated Sludge (RAS) pumps for Secondary Clarifier No. 2 to match the size (1,400 gpm) of those serving Secondary Clarifier No. 3, improving pumping capacity.	Short-Term
TP-08	Replace the RAS pumps for Secondary Clarifier No. 2 to match the size (1,400 gpm) of those serving Secondary Clarifier No. 3, improving pumping capacity.	Short-Term
TP-09	Replace existing Plant Drain Lift Station No. 1 pumps and rehabilitate the wet well, addressing concrete corrosion and end-of-life equipment.	Short-Term
TP-10	Replace existing Plant Drain Lift Station No. 2 pumps and rehabilitate the wet well, addressing concrete corrosion and end-of-life equipment.	Short-Term
TP-11	Plantwide replacement of existing electrical conduit and support stands to improve the reliability and condition of the plant electrical infrastructure.	Short-Term

Project ID	Description	Project Priority
TP-12	Plantwide improvements to equipment enclosures and cable protection to enhance the reliability and security of the instrumentation and control system.	Short-Term
TP-13	Replace MCC-A and relocate associated electrical equipment to improve reliability and maintainability of the plant electrical system, allowing the Old Controls Building to be repurposed.	Short-Term
TP-14	Replace existing diffusers in the three aeration basins and add diffusers to one of the anoxic zones within each basin to function as swing zones, providing greater operational flexibility.	Short-Term
TP-15	Replace the two existing Disk Filtration Units with new units (6.0 mgd capacity) to improve filtration performance and operational reliability.	Short-Term
TP-16	Construct a new second UV disinfection channel outside the existing building to provide sufficient disinfection capacity for the entire plant effluent at peak hour flow (22.2 mgd).	Short-Term
TP-17	Replace the existing effluent transfer pumps with larger impellers, motors, and associated VFDs to provide sufficient capacity to pump the entire plant effluent flow (22.2 mgd) during high river conditions.	Short-Term
TP-18	Construct a second new plant outfall to the Columbia River to provide additional discharge capacity and improve reliability and flexibility.	Short-Term
TP-19	Construct a new electrical building west of the Digester complex to house electrical equipment serving the digester facilities, meeting hazardous area classification requirements.	Short-Term
TP-20	Construct a second Rotary Drum Thickener (RDT) for Waste Activated Sludge (WAS) thickening to provide redundancy and improve reliability.	Short-Term
TP-21	Construct a new Primary Clarifier No. 3 to improve primary treatment performance and provide additional process capacity.	Long-Term
TP-22	Construct a new Secondary Clarifier No. 4 to provide additional secondary treatment capacity and accommodate future growth.	Long-Term
TP-23	Replace the two existing 150-hp multistage centrifugal blowers with two new 150-hp high-speed turbo (HST) blowers to provide sufficient aeration capacity for future peak oxygen demands.	Short-Term
TP-24	Replace the existing sludge dryer with new sludge drying equipment to maintain reliable biosolids processing as the existing equipment approaches the end of its useful life.	Long-Term
TP-25	Replace the existing biofilters with new biofilters (biotrickling filters) to maintain reliable odor control as existing equipment approaches the end of useful life.	Long-Term

Table ES.9 Recommended Annual Maintenance Improvement Projects for WWTF

Project ID	Project Name	Description	Phase
R-03	Miscellaneous WWTF Projects	This program is dedicated to the replacement of wastewater pipelines constructed prior to the 1940s, with an estimated total cost of approximately $9.5 M over the 19-year planning horizon.	Annual

ES.8 Operations and Maintenance

Chapter 8 provides an overview of the City's wastewater utility organization, staffing, and operations and maintenance (O&M) program. The City has recently separated the water and sewer groups into two divisions. Staff work to provide effective and efficient service for utility rate payers through regular O&M activities on these systems.

ES.9 Capital Improvement Plan

The CIP presented in Chapter 9 includes projects needed to accommodate growth, repair and replace aged infrastructure, and attain level of service goals. As shown on Table ES.10, the CIP is organized and prioritized in two separate project categories: short-term (2027-2036) and long-term (2037-2045) periods. Projects are grouped into pipelines, LSs, STEP mains, annual rehabilitation and repair, treatment plant, and general types of infrastructure work. The total recommended CIP is estimated at $270.3 M. The CIP recommends budgeting $132.4 M in the short-term. The average annual short-term cost for all recommended projects is approximately $14.8 M per year from 2027 through 2035. The CIP recommends $137.8 M in the long-term with an average annual long-term cost of approximately $13.8 M per year from 2036 through 2045. The average annual cost over the 19-year planning horizon from 2027 through 2045 is $14.2 M. Table ES.11 presents the costs by project category and planning period.

Table ES.10 Capital Improvement Plan Summary(1)

Planning Period	Total Cost (M$)	Annual Cost (M$)
Short-term (2027 to 2036)	$132.4	$14.8
Long-term (2037 to 2045)	$137.8	$13.8
Total	**$270.3**	**$14.2**

Notes:
(1) Totals may not sum due to rounding.

Table ES.11 CIP Summary by Project Type(1)

Project Category	Total Capital Cost	Short-term (2027-2036)	Long-term (2037-2045)
Treatment Plant	$95,830,000	$51,280,000	$44,550,000
Gravity and Force Main	$39,570,000	$21,585,000	$17,980,000
STEP Main	$32,760,000	$0	$32,760,000
Lift Station	$31,310,000	$25,201,000	$6,109,000
General	$2,575,000	$1,875,000	$700,000
Annual Programs	$67,880,000	$32,154,000	$35,730,000

Notes:
(1) Totals may not sum due to rounding.

ES.10 Financial Analysis

[To be completed and included in next draft GSP.]

CHAPTER 1 INTRODUCTION

1.1 Introduction

The purpose of the City of Camas' (City) General Sewer Plan (GSP) is to present policies and an assessment of the system to recommend facility improvements. The GSP is intended to provide a road map for accommodating growth and maintaining a high level of service for existing customers. The existing system is aging and will continue to require investment to maintain a high level of service.

The GSP presents findings from evaluations of the existing sanitary sewer system which provides the groundwork for recommendations to resolve existing deficiencies and concerns, as well as accommodating growth. This chapter presents the objectives of this GSP, and a brief overview of the City's wastewater collection system. A list of abbreviations is provided in the Table of Contents to assist the reader in understanding the information presented in this GSP.

This GSP and recommended improvements were prepared in accordance with requirements of Washington Administrative Code (WAC) 173-240-050, which is administered by the Washington State Department of Ecology (Ecology) and meets the requirements of the Washington Growth Management Act (GMA).

This GSP addresses the following key issues:

- The need and timing of the replacement of older, deteriorating sanitary sewer facilities within large, neighborhood-size areas within the City.
- The evaluation of the City's collection system and treatment capacity to address both existing system deficiencies and future development, as well as plan for future potential development-driven deficiencies.
- The evaluation of sanitary sewer lift stations and force mains for removal, rehabilitation, and replacement.
- The City's infiltration and inflow (I/I) program to evaluate options and needs for I/I reduction.
- Implementation of recommended improvements by priority which maintains affordable rates for the system users.

1.2 Background and Goals

The City is located in Clark County, Washington near the border of Washington and Oregon. It is between the cities of Vancouver and Washougal along the Columbia River as shown in Figure 1.1. The City owns and operates most of the sewer collection system within the City limits and the Urban Growth Boundary (UGB). The collection system is a combination of gravity sewers, lift station, force mains, and septic tank effluent pump (STEP) systems. Wastewater is collected and treated by the City at the Camas Wastewater Treatment Facility (WWTF) and then discharged to the Columbia River.

The City completed its last General Sewer Plan in 2024. The GSP provides a recognized framework for making decisions about Camas's sanitary sewer service area which includes properties both inside the City and UGB limits. It is intended to aid decision-makers as well as users, including Public Works staff, City Council members, the Mayor, City staff, builders, developers, community groups, and other government agencies.

1.3 Referenced Documents

The following documents were referenced in the preparation of this GSP:

- City of Camas 2024 General Sewer Plan.
- Camas 2035 Comprehensive Plan and draft 2045 Comprehensive Plan
- Camas Code of Ordinances.
- Washington Administrative Code, Title 173. Defines the structure of general sewer plans.
- Criteria for Sewage Works Design (Ecology, 2008). Provides guidance for the design of municipal sewer systems and establishes minimum requirements in the State of Washington.
- Camas 2016 Water System Plan and draft 2026 Water System Plan (concurrent).

1.4 Washington State Requirements

The goals of this GSP include:

- Prepare the GSP in compliance with WAC Chapter 173-240-050.
- Meet the requirements of the Washington State Criteria for Sewage Works Design.

Each WAC requirement is detailed in Table 1.1 as well as in the specified location within the GSP.

Table 1.1 WAC GSP Requirements

Requirement	Location in GSP	Reference
Purpose and need for the proposed GSP	Chapter 1	WAC 173-240-050(3)(a)
Discussion of who will own, operate, and maintain the system	Chapter 2	WAC 173-240-050(3)(b)
Existing and proposed service boundaries	Chapter 4	WAC 173-240-050(3)(c)
Layout map including: ▪ Boundary lines of municipality or district and vicinity. ▪ Existing sewers and areas served by each. ▪ Proposed sewers and areas served by each. ▪ Existing and proposed pump stations and force mains. ▪ Topography and elevations of existing and proposed ground. ▪ Information on streams, lakes, other bodies of water, and discharges. ▪ Information on water systems.	 Figure 1.1 Figures 4.1 and 4.2 Figure 4.1 Figure 4.1 Figure 4.5 Figure 4.7 and 4.9 Figure 4.10	WAC 173-240-050(3)(d)(i) through WAC 173-240-050(3)(d)(vii)
Population trends and methods used to determine those trends	Chapter 3	WAC 173-240-050(3)(e)
Information on existing wastewater facilities in the area	Chapter 4, Chapter 7	WAC 173-240-050(3)(d)(vii)
Discussion of infiltration and inflow problems	Chapter 5	WAC 173-240-050(3)(g)
Discussion of the provisions for treatment and adequacy of treatment	Chapter 6, Chapter 7	WAC 173-240-050(3)(h)
Information on facilities producing industrial wastewater	Chapter 4	WAC 173-240-050(3)(i)

Requirement	Location in GSP	Reference
Information on existing wells or other water supply sources	Chapter 4	WAC 173-240-050(3)(j)
Discussion of alternatives evaluated, and alternatives chosen	Chapter 6, Chapter 7	WAC 173-240-050(3)(k)
Information on existing and proposed cost per service	Chapter 10	WAC 173-240-050(3)(l)
Statement regarding compliance with any adopted water quality management plan under the Federal Water Pollution Control Act	Appendix A	WAC 173-240-050(3)(m)
Statements regarding compliance with SEPA and, if applicable, NEPA	Appendix A	WAC 173-240-050(3)(n)

Notes:
NEPA - National Environmental Policy Act; SEPA - State Environmental Policy Act.

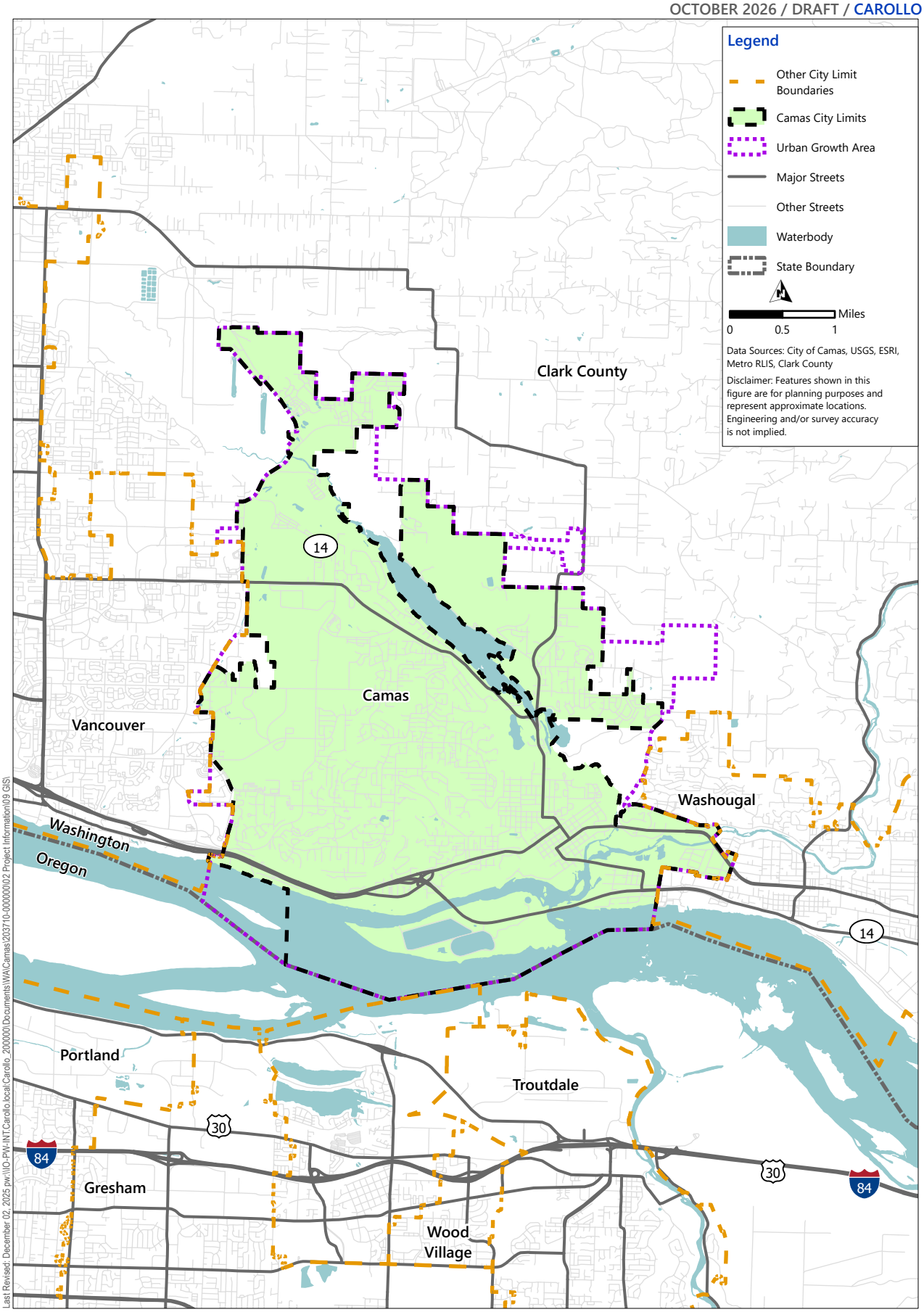


Figure 1.1 Vicinity Map
CITY OF CAMAS
GENERAL SEWER PLAN

1.5 Report Organization

This GSP contains 10 chapters, followed by appendices that provide supporting documentation for the information presented in the report. The chapters are briefly described below:

- **Chapter 1 - Introduction:** This chapter presents the need for this GSP and the objectives of the study. Lists of abbreviations and reference materials are also provided to assist the reader in understanding the information presented.
- **Chapter 2 - Policies and Criteria:** This chapter documents applicable regulations, summarizes City policies impacting long-term sewer system planning, and presents the City's design criteria which are relevant to sewer system evaluation and planning.
- **Chapter 3 - Basis of Planning:** This chapter presents an evaluation of historical wastewater flows and loads through the City's collection system and entering the WWTF. This chapter also establishes the WWTF's flow and load projections based upon future population growth for 2045 and build out.
- **Chapter 4 - Existing System:** This chapter describes the City's existing sewer collection system, adjacent sewer service areas, and WWTF.
- **Chapter 5 - Infiltration and Inflow Program:** This Chapter focuses on summarizing the City's efforts on I/I reduction from 2016 through 2024. It summarizes the amount of I/I for these years and specific projects completed to address I/I.
- **Chapter 6 - Collection System:** This chapter presents an evaluation of the available capacity of the existing system to convey current and future sewer flows. Recommendations are provided for improvement projects to address capacity deficiencies and level of service goals.
- **Chapter 7 - Wastewater Treatment Facility:** This chapter summarizes the WWTF Engineering report including condition of existing processes, capacity of existing processes and recommendations that will allow the City to reliably and cost-effectively serve their customers now and into the future.
- **Chapter 8 - Operations and Maintenance:** This chapter provides an overview of the City's Public Works organization, staffing, and operation and maintenance (O&M) program. This chapter documents existing practices and identifies changes that may improve system operation and maintenance.
- **Chapter 9 - Capital Improvement Plan:** This chapter describes the improvements necessary to resolve existing and future deficiencies and accommodate growth. The proposed improvements are also listed by priority and project type.
- **Chapter 10 - Financial Analysis:** This chapter evaluates the financial status of the City's wastewater utility and the ability to finance Capital Improvement Program (CIP) projects.

Appendices are included as follows:

- Appendix A - SEPA Checklist/Approvals.
- Appendix B - References.
- Appendix C - Demographic Projections.
- Appendix D - Camas Flow Monitoring Report 2025.
- Appendix E - Hydraulic Model Update Technical Memorandum.
- Appendix F - I/I Program Reports.

- Appendix G - Local Limits Program Reports.
- Appendix H - Wastewater Treatment Plant Permits.
- Appendix I - Evaluation of the Wastewater Treatment Facility Report.
- Appendix J - Reasonable Potential Analysis Project Memorandum.
- Appendix K - Condition Assessment of Camas Wastewater Treatment Facility Project Memorandum
- Appendix L - CIP Project Sheet.
- Appendix M - Financial Backup.

1.6 SEPA and Approval Process

A SEPA Checklist has been prepared for this GSP and is presented in Appendix A. It is anticipated that this proposed GSP will not have a probable significant adverse impact on the environment and that an environmental impact statement will not be required. However, many of the projects proposed herein will require SEPA checklists and an engineering determination will be made with each individual project.

1.7 Acknowledgements

Carollo Engineers and their team members would like to acknowledge and thank the following individuals for their efforts and assistance in completing this GSP. Their cooperation and courtesy in obtaining a variety of necessary information were valuable components in completing and producing this report:

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- Rob Charles, City of Camas, Utilities Manager.
- Kyle Stephens, WWTP Manager.
- Jacob Taylor, Lead WWTP Operator.
- Angelica Vazquez, Lab Analyst WWTP.
- Jay Martell, Sewer Maintenance Lead.
- Alan Peters, Community Development Director.
- Debra Brooks, Financial Analyst.
- Matthew Thorup, Assistance Finance Director.

CHAPTER 2 POLICIES AND CRITERIA

2.1 Introduction

The City is responsible for managing and operating its wastewater system in accordance with all local, state, and federal regulations. To best manage the wastewater system and comply with regulations, the City has adopted wastewater system policies and criteria. These policies guide the development and financing of the infrastructure required to provide wastewater service and document the City's commitments to current wastewater system customers as well as those considering service from the City. The following sections outline the City's policies and design criteria that are relevant to sewer system planning. Existing policies are listed in Table 2.2 through Table 2.5. Proposed new policies are also listed in each table. These policies and criteria will guide the planning process throughout this GSP. Once adopted by the City, they are implemented through updates to municipal code provisions, engineering standards, and utility review processes.

The policies and criteria are organized into the following categories:

- Table 2.1 - Service Policies and Extensions.
- Table 2.2 - Environmental Stewardship.
- Table 2.3 - Design Policies and Criteria.
- Table 2.4 - Wastewater Treatment Plant Redundancy and Reliability Requirements.
- Table 2.5 - Financial Policies.
- Table 2.6 - Regulatory Requirements.
- Table 2.7 - National Pollutant Discharge Elimination System (NPDES) Influent Design Criteria and Effluent Limits.

2.2 Sewer Service

Table 2.1 summarizes the existing policies regarding the wastewater service area and extension of sewer service to new customers. The City is committed to serving customers in its sewer service area in accordance with established policies. The current sewer service area includes approximately 7,600 acres within its corporate boundaries. The future service area has been defined as the City's Urban Growth Area (UGA) and is shown in Figure 2.1.

Table 2.1 Service Policies and Extensions

Subject	Policy	Source
Service Area	Where service is available, require connection to public water for domestic and irrigation needs and connection to sewer systems. Promote connection to sewer and water before system failure of private well or septic.	Camas 2045 Comprehensive Plan Policy PFS-4.2 (Appendix C)
Service Area	The City should be the sole provider of urban services, including water and sewer, within the UGA for sewer services and the Water Service Area for water. Require all new construction to connect to City systems.	Camas 2045 Comprehensive Plan Policy PFS-4.3 (Appendix C)
Service Area	Coordinate plans for providing public utility services in UGAs and rural areas with plans for transitioning undeveloped land to urban uses.	Camas 2045 Comprehensive Plan Policy PFS-4.5 (Appendix C)
Utility Extension	Do not extend utilities without annexation or commitments for annexation. Exceptions may be made in cases where human health is threatened. In areas where utilities presently extend beyond City limits, but are within UGAs, plan development jointly with the County. A joint development must be consistent with City standards.	Camas 2045 Comprehensive Plan Policy PFS-4.5 (Appendix C)
Utility Extension	Extend public sanitary sewer service, as required, throughout urban areas. Service may be provided outside urban areas to serve areas where imminent health hazards exist.	Camas 2045 Comprehensive Plan Policy PFS-4.14 (Appendix C)
Coordination with Other Agencies	Plan public utility services so that service provision maximizes efficiency and cost effectiveness and ensures concurrency. Coordinate with other entities to provide services within the urban area.	Camas 2045 Comprehensive Plan Policy PFS-4.6 (Appendix C)
System Policies	Maintain and improve City utility systems through preventative maintenance and regular assessments and improvements to meet regulatory standards.	Camas 2045 Comprehensive Plan Policy PFS-4.1 (Appendix C)
System Ownership	The sanitary sewage disposal system of the City, including the treatment plant and all other parts of such system and all additions and improvements thereto and extensions thereof, which may be made hereafter, shall be considered as a part of and belonging to the water works utility of the City. The cost of the construction and installation of the hereinafter provided additions, improvements and extensions and the cost of maintenance and operation of such system as improved shall be charged to the water works utility of the City, and any rates and charges which may be collected hereafter for sewage disposal service shall be paid into the "water and sewer revenue fund" of the City, to be hereafter created.	CMC 13.60.010
Ownership of System - Commercial and Industrial	All STEP systems serving commercial, industrial, and other nonresidential properties shall be owned by the owner of the subject property, except for the service box at the point where the STEP system connects to the City sanitary sewer system, which shall be owned by the City. The owner shall be responsible for maintaining all components of the STEP system and its ownership and shall be responsible for pumping the STEP tank as needed and for disposing of the waste in an approved manner. The owner shall further be responsible for paying all electrical costs associated with the operation of the STEP system.	CMC 13.62.060(B)
Ownership of System - Residential	After inspection and acceptance of an installed STEP system on residential property, the City shall be the owner of all components of the STEP system with the exception of the sewer line from the structure to the tank, which shall be owned by the property owner. The City will be responsible for maintaining the components of the STEP system owned by the City, and in addition will be responsible for pumping the STEP tank and disposing of waste material when required. The owner will be responsible for maintaining the sewer line connecting the tank to the structure on the subject property. The owner will further be responsible for paying for all electrical costs associated with the operation of the STEP system.	CMC 13.62.060(A)
Construction	On and after May 1, 1949, it shall be unlawful to construct any means of sewerage or excreta disposal such as septic tanks without having first obtained a permit from the City health officer or his authorized representative.	CMC 13.60.040
Sewer Lien and Ownership	The City shall have a lien against premises to which sewer service is available for delinquent and unpaid charges for sewer services, for penalties levied pursuant to Section 13.60.050(B), for unpaid connection charges, and for unpaid sewer system development charges. All such delinquent charges shall bear interest at the rate of eight percent per annum. Such lien shall be superior to all other liens and encumbrances except general taxes and local and special assessments.	CMC 13.60.055(A)
Connections	All property owners whose property abuts a street or alley in which there is a public sanitary sewer or which is within one hundred fifty feet of a public sanitary sewer may be required to connect their ~~private drains and~~ sewers to the City sanitary sewer system at the direction of the City Engineer. Those properties which abut a street or alley in which there is a public sanitary sewer or which are located within one hundred fifty feet of a public sanitary sewer, and which are located within a designated health hazard area or which pose a threat to the general health, shall be connected to the sanitary sewer. Such connection shall be in the most direct manner possible and with a separate connection for each residence or structure.	CMC 13.60.050(A) - suggest deleting stricken text
Connections	Use traditional gravity sewer systems (in lieu of STEP systems) to serve future customers and reduce maintenance and power costs.	Camas 2045 Comprehensive Plan Policy PFS-4.15 (Appendix C)
Prohibited Connection	Prohibit construction of new private wells and subsurface sewage disposal systems in new developments.	Camas 2045 Comprehensive Plan Policy PFS-4.3 (Appendix C)

Subject	Policy	Source
Application to Connect a STEP System	Any property owner seeking to connect their property to the sanitary sewer system of the City by means of a STEP system shall file an application with the public works department on a form provided by the City. The application shall contain the name and address of the owner, the location of the property to be connected to the sanitary sewer system, the nature of the structure to be constructed on the subject property, the proposed use of the subject property, the proposed location of the STEP system, the design of the STEP system, and such other information as the public works department may require. Upon receipt of any such application, the public works director, or their authorized designee, shall review the application and grant the same if he determines that the subject property is suitable for use of a STEP sanitary sewer system, and if the design, location and other information set forth in the application comply with the standards and specifications adopted by the City for STEP systems and the criteria set forth in this chapter.	CMC 13.62.030
Installation Responsibility of a STEP system	The individual owner shall be responsible for and shall pay for the installation of the STEP/ STE system, including but not limited to, service connection per CMC 13.64.050 if required, the tank, pump apparatus, control box, electrical wiring, conduit, plumbing from the structure to the tank, plumbing from the tank to the service box, excavation and backfill material. The City shall, prior to installation, determine the appropriate size tank.	CMC 13.62.040(A)
Sewer Responsibility	Sanitary sewers shall be provided to each lot at no cost to the City and designed in accordance with City standards: ▪ Detached units shall have their own sewer service and STEP or STEF or conventional gravity system as required. ▪ Duplex units may have up to two sewer services at the discretion of the engineering and public works departments. ▪ Multifamily units shall have one sewer lateral per building. ▪ Commercial or industrial units shall have privately owned and maintained sewer systems acceptable to the City.	CMC 17.19.040(C)
Right-of-Entry Agreement	Any owner seeking to connect their property to the sanitary sewer system of the City by means of a STEP system shall be required to execute a right-of-entry agreement authorizing the City and its employees to have access to the owner's property for the purpose of maintaining and inspecting the STEP system and appurtenances thereto. Such right-of-entry agreement shall be executed upon approval of an application for a STEP system.	CMC 13.62.050
Inspection	The superintendent and other duly authorized employees of the City bearing proper credentials and identification shall be permitted to enter upon all properties for the purpose of inspecting, observing, measuring, sampling, and testing sewer connections, operations, and facilities in accordance and to ensure compliance with the provisions of this chapter. No such entry or inspection shall be made without the consent of the owner or occupant of such building or premises unless the City employee shall have obtained a search warrant, or unless exigent circumstances exist that would justify an inspection and entry without obtaining a warrant.	CMC 13.68.030
Enforcement	It shall be the duty of the City health officer or their authorized agent to enforce the provisions of Sections 13.60.020 through 13.60.110 and in the performance of this duty the health officer or his duly authorized agent is authorized to enter at any reasonable hour any premises as may be necessary in the enforcement of Sections 13.60.020 through 13.60.110.	CMC 13.60.080
FOG and Capacity	Grease, oil and sand interceptors shall be provided, when in the opinion of the superintendent, they are necessary for the proper handling of liquid wastes containing grease in excessive amounts, or any flammable wastes, sand, and other harmful ingredients, except that such interceptors shall not be required for private living quarters. All interceptors shall be of a type and capacity approved by the superintendent and shall be located as to be readily and easily accessible for cleaning and inspection.	CMC 13.68.020(H)
Private System - Flush toilet	Every residence, place of business or other building or place where persons congregate, reside or are employed and which does not abut a street or alley in which there is a public sanitary sewer shall be provided with a private water-flush toilet by the owner or agent of the premises; said water-flush toilet system to be built or rebuilt, constructed and maintained in such a manner as to meet the requirements of construction and maintenance hereinafter described.	CMC 13.60.060

Notes:
CMC - Camas Code of Ordinances; FOG - fats, oil, and grease; STE - septic tank effluent; STEF - septic tank effluent filter.

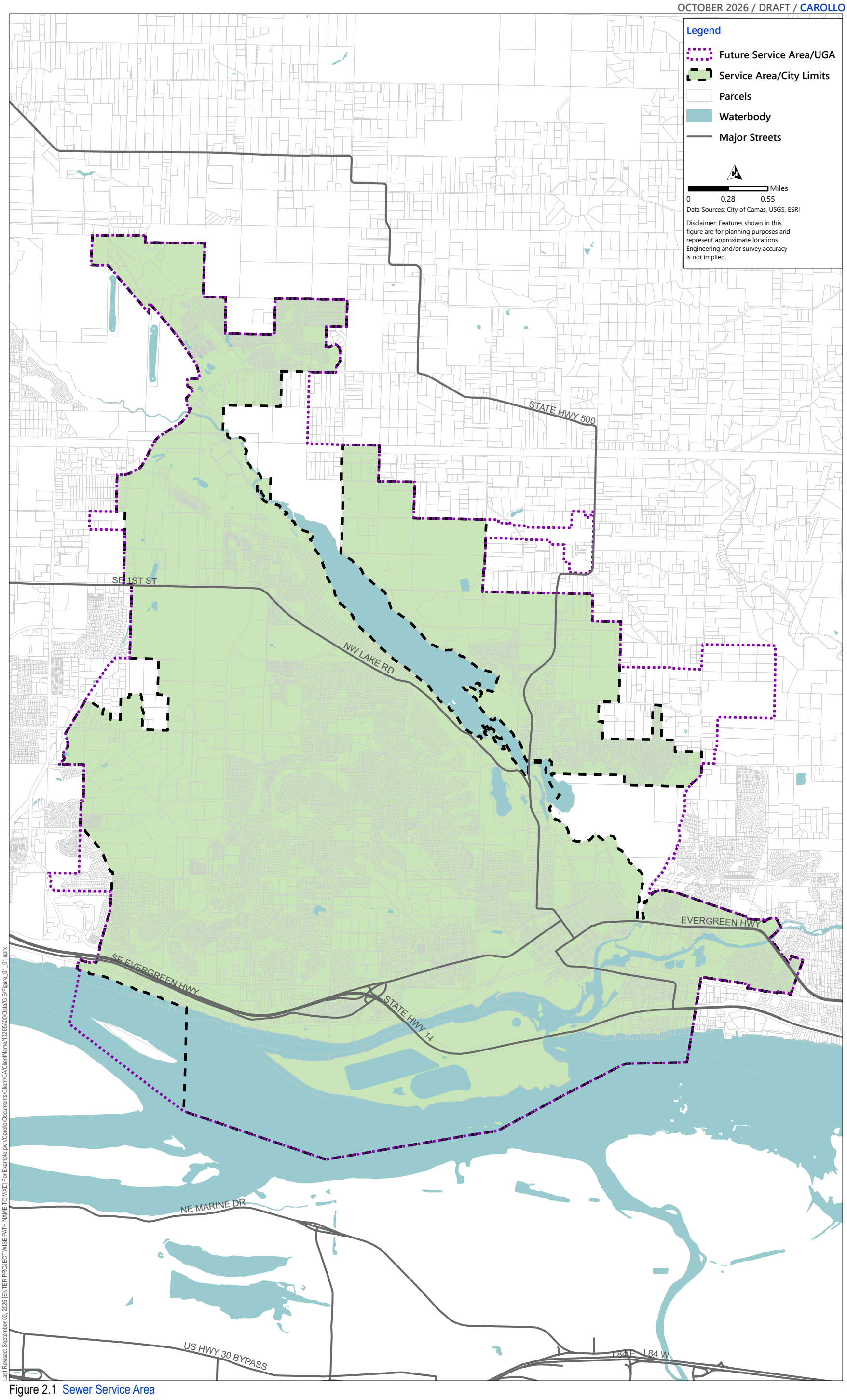


Figure 2.1 Sewer Service Area

2.2.1 Environmental Stewardship

The following section summarizes existing policies regarding environmental stewardship. Stormwater is included in the environmental stewardship because while the GSP focuses on the sanitary sewer, stormwater has a direct impact on sewer capacity, treatment efficiency, and environmental protection. Inflow and infiltration (I/I) or direct stormwater connections to the sanitary system increase flow that do not belong in the sewer, leading to capacity limitations and/or potential overflows. The inclusion of stormwater in this GSP emphasized that these flows should be managed through the stormwater system rather than the sanitary sewer, consistent with the regulatory requirements and best practices, unless otherwise stated.

Table 2.2 Environmental Stewardship Policies

Subject	Policy	Source
Minimizing Impacts of Utility Facility Siting and Operations	Minimize the effects on adjacent properties, the environment, and the visual quality of the community of siting, developing, operating, and maintaining facilities.	Camas 2045 Comprehensive Plan Policy PFS-4.29 (Appendix C)
Allowable Discharges (Stormwater)	Examples of allowable discharges include the following: ▪ Broken water mains. ▪ Diverted stream flows. ▪ Rising ground waters. ▪ Uncontaminated ground water infiltration, as defined in 40 CFR 35.2005(20). ▪ Uncontaminated pumped ground water. ▪ Foundation drains. ▪ Air conditioning condensation. ▪ Irrigation water from agricultural sources that is commingled with urban stormwater. ▪ Springs. ▪ Water from crawl space pumps. ▪ Footing drains. ▪ Flows from riparian habitats and wetlands. ▪ Discharges from emergency firefighting activities.	CMC 14.04.070
Conditional Discharges (Stormwater)	The following types of discharges shall not be considered illegal discharges for the purposes of this chapter if they meet the stated conditions, or unless the Director determines that the type of discharge, whether singly or in combination with others, is causing or is likely to cause pollution of surface water or groundwater: ▪ Potable water, including water from water line flushing, hyperchlorinated water line flushing, fire hydrant system flushing, and pipeline hydrostatic test water. Planned discharges shall be de-chlorinated to a concentration of 0.1 ppm or less, pH-adjusted, if necessary and in volumes and velocities controlled to prevent re-suspension of sediments in the stormwater system. ▪ Lawn watering and other irrigation runoff are permitted but shall be minimized. ▪ De-chlorinated swimming pool discharges. These discharges shall be de-chlorinated to a concentration of 0.1 ppm or less, pH-adjusted, if necessary and in volumes and velocities controlled to prevent re-suspension of sediments in the stormwater system. ▪ Street and sidewalk wash water, water used to control dust, and routine external building wash down that does not use detergents are permitted if the amount of street wash and dust control water used in minimized. At active construction sites street sweeping must be performed prior to washing the street. ▪ Non-stormwater discharges covered by another NPDES permit, provided, that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations; and provided, that written approval has been granted for any discharge to the storm drain system. ▪ Other non-stormwater discharges. The discharges shall be in compliance with the requirements of a SWPPP, reviewed and approved by the City, which addresses control of such discharges by applying AKART to prevent contaminants from entering surface or ground water.	CMC 14.04.080
Septic System Elimination (Sanitary Sewer)	Coordinate with Clark County to eliminate septic systems.	Camas 2045 Comprehensive Plan Policy PFS-4-16 (Appendix C)
Illicit Connections (Stormwater)	The following connections, both past, current, and future, to the stormwater system are expressly prohibited: ▪ The construction, use, maintenance, or continued existence of illicit connections to the storm drain system is prohibited. ▪ This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection. ▪ A person is considered to be in violation of this chapter if the person connects a line conveying sewage to the MS4 or allows such a connection to continue.	CMC 14.04.090
Wastewater Discharges (Sanitary Sewer)	Except as hereinafter provided, no person shall discharge or cause to be discharged any of the following described water or wastes to any public sewer: ▪ Any liquid or vapor having a temperature higher than 150 °F. ▪ Any water or waste which may contain more than 100 ppm by weight, of FOG. ▪ Any gasoline, benzene, naphtha, fuel oil, motor oil, lubricants or other flammable or explosive liquid, solid or gas. ▪ Any garbage that has not been properly shredded. ▪ Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, paunch manure, or any other solid or viscous substance capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewage works. ▪ Any waters or wastes having a pH lower than 5.5 or higher than 9.0 or having any other corrosive property capable of causing damage or hazard to structures, equipment, and personnel of the sewage works. ▪ Any waters or wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with any sewage treatment process, constitute a hazard to humans or animals, or create any hazard in the receiving waters of the sewage treatment plant. ▪ Any waters or wastes containing suspended solids of such character and quantity that unusual attention or expense is required to handle such materials at the sewage treatment plant. ▪ Any noxious or malodorous gas or substance capable of creating a public nuisance.	CMC 13.68.020(C)

Notes:
°F - degrees Fahrenheit; AKART - all known, available and reasonable methods of prevention, control and treatment; CFR - Code of Federal Regulations; MS4 - Municipal Separate Storm Sewer System; ppm - parts per million; SWPP - stormwater pollution prevention plan.

2.2.2 Design Criteria and Standards

The City's wastewater system design standards, design details, specifications, and construction standards are documented in the Camas Design Standards Manual (2019) available from this City's Public Works department website. Additional design requirements and recommendations applicable to the City's sewer system are found in the Ecology *Criteria for Sewage Works Design* book, also known as the Orange Book. Current design criteria policies are outlined in Table 2.3.

The following section summarizes the existing and proposed policies regarding system design. It is recommended that the proposed new policies listed below be adopted by the City. Within this GSP, the capacity limitations of the collection system are evaluated against the proposed new design criteria policies.

Table 2.3 Design Criteria Policies

Subject	Policy	Source
Design	▪ Sewer systems shall be designed and constructed to achieve total containment of sanitary wastes and maximum exclusion of I/I. No new combined sewers will be approved.	Orange Book Section C1-1.3
Sewer location	▪ Siting of public sanitary sewer mains and MHs shall be restricted to the public right-of-way and/or easement dedicated for this utility.	Orange Book SectionC1-1.5
Design Period	▪ Service laterals shall be designed for the ultimate development of the parcel being served. ▪ Collection sewers (that is, laterals and submains) shall be designed for the ultimate development of the tributary area. ▪ Selection of the design period for trunk and interceptor sewers shall be based on an evaluation of economic, functional, and other considerations.	Orange Book Section C1-3.2
Design Flows	▪ Sewer systems shall be designed on the basis of per capita flows for the design period in conjunction with a peaking factor or approved alternative methods. ▪ Generally, the sewers shall be designed to carry at least the peak hourly flow when operating at capacity. Peak hourly flow should be the design average daily flow in conjunction with a peaking factor.	Orange Book Section C1-3.3
Lift Station Design Criteria	▪ The firm capacity of a pumping station shall be equal to or greater than the peak hourly design flow. Because mechanical and electrical equipment is typically designed for a 20-year life, it is recommended that the peak design flow be based on a 20-year forecast or greater. ▪ The number of pumps selected shall allow the station to provide the peak design flow with the largest pump out of order. ▪ The station shall be designed to remain fully operational during the 100- year flood/wave event.	Orange Book Sections C2-1.2.1 C2-1.2.3 C2-1.1
Lift Station Pump	▪ Pumps should be designed for pumping sewage and capable of passing solids at least three inches in diameter. Pump suction and discharge should be four inches or greater.	Orange Book Section C2-1.2.4
Design Storm	▪ In accordance with all applicable federal, state, and local regulations, the City should design its wastewater system facilities to adequately and reliably convey peak hour flows associated with a Design Storm event without overflowing or discharging to any water bodies. The Design Storm is defined as a 20-year interval, 24-hour storm recorded at Portland International Airport rain gauge.	2024 General Sewer Plan

Subject	Policy	Source
Emergency Back-up Power	▪ All sewage pump stations should be designed with capability for emergency power in case the primary electrical feed is out of service. A portable engine generator unit that is plugged into a pigtail at the pump station commonly provides emergency power for small pump stations. Larger pump stations should have permanent engine generator units with automatic transfer switches to transfer the electrical feed from the primary to the standby unit when a power failure is detected by the instrumentation and control system.	Orange Book Section C2-1.8.3
Surcharging	▪ The City's design criteria require the depth of flow versus the diameter of the pipe (d/D) ratio to be equal to or less than 1 during the design storm (no surcharging).	2024 General Sewer Plan
Inflow/Infiltration	▪ Future development shall be designed for a peak inflow and infiltration rate of 1,000 gpad.	Proposed New Policy

Notes:
d/D - depth versus diameter; gpad - gallons per acre per day; MH - manhole.

2.2.2.1 Wastewater Treatment Plant Design Criteria

Ecology maintains requirements for hydraulic and loading capacities as well as the redundancy of treatment processes and equipment. These requirements are presented in the Orange Book, Ecology's guidelines for WWTF design (2008) and are derived from the Federal standards developed by the United States Environmental Protection Agency (USEPA).

Ecology's criteria for designation of WWTFs are divided into three reliability classes based on the nature of their receiving water. Corresponding redundancy and reliability requirements are presented in Table 2.4 based on Ecology's guidelines and Federal standards. These requirements are the basis of the capacity analysis.

Table 2.4 Wastewater Treatment Plant Redundancy and Reliability Requirements From Washington Criteria for Sewage Works Design (Ecology, 2008)

WWTF Component	Flow Criteria	Load Requirement	Class 1 Reliability Criteria
Plant Headworks Mechanical Screens Manual Bar Rack	Pass all flows	-	A backup screen designed for mechanical or manual screening must be provided
Primary Clarifiers	PHF + Recirculation	PHDL(1)	50% of flow with largest unit out of service
Aeration Basins	MWDF	MWDL	At-least two equal volume basins shall be provided
Aeration Systems (Blowers)	-	PHDL(2)	Enable design oxygen transfer to be maintained with the largest capacity unit out of service
Aeration Systems (Diffusers)	-	PHDL(2)	Air diffuser system for each aeration basin shall be able to provide the design oxygen transfer of the system with the largest section of diffusers taken out o
Secondary Clarifiers	PHF + Recirculation	PHDL(1)	75% of flow with largest unit out of service

WWTF Component	Flow Criteria	Load Requirement	Class 1 Reliability Criteria
Effluent Filters	Pass all flows	-	-
UV Channel	PHF (Hydraulic Considerations), MDDF (For Disinfection Requirements)	-	-
Effluent Pump Station	PIDF	-	Have capacity to handle peak flow with largest capacity pump out of service
Pumps (Internal Recycle, RAS, WAS, Thickened Sludge, Digester Heat Recirculation, Centrifuge Feed, Scum, in-plant lift stations, Septage etc.)	Peak flow as for appropriate process	-	A backup pump shall be provided for each set of pumps performing the same function
Sludge Digestion and Dewatering Equipment	-	MDDL(2)	-
Major yard piping	PIDF	-	Sized for peak flows and to allow bypassing of each unit process
Power source	-	-	Sufficient to operate all vital components during peak flow conditions, together with critical lighting and ventilation
Emergency power generator	-	-	Sufficient to operate all vital components during peak flow conditions, together with critical lighting and ventilation

Notes;
(1) TSS loading only.
(2) BOD_5 loading only.
MDDF - maximum daily design flow, MDDL - maximum daily design load; MMF - maximum monthly flow; MWD - maximum week design load; MWDF - maximum week design flow; PHDF - peak hour design flow. PHDL - peak hour design load; PHF - peak hour flow; PIDF - peak instantaneous design flow; RAS - return activated sludge; UV - ultraviolet; WAS - waste activated sludge.

2.2.3 Financial Policies

The City's financial policies support the operation of the wastewater utility. A summary of financial policies applicable to the GSP are outlined in Table 2.5.

2.2.4 Regulatory Requirements

The City's criteria is developed based on federal and state statues, regulations, and permits. These laws help to determine the design criteria for the City's collection, treatment, and disposal facilities. These regulatory requirements are outlined in Table 2.6.

Table 2.5 Financial Policies

Subject	Policy	Source
Connection – Required when	▪ There is imposed upon those property owners who are within the area served by the sanitary system and who refuse to connect to such sanitary sewer system a penalty in an amount equal to the charge that would have been made for sewer service if such property had been connected to the sanitary sewer system. Such penalties as provided herein shall accrue monthly until such property is connected to the sanitary sewer system. All penalties collected pursuant to this provision shall be considered revenue of the sanitary sewer system.	CMC 13.60.050(B)
Credits	▪ Those properties that have been disconnected from the City sewer system since January 1, 1972, shall receive a credit for the prior connection. The credit for the prior connection shall be in an amount equal to the sewer system development charge for the use classification of the prior connection. The sewer system development charge imposed under this chapter shall be the difference between the amount due under the present use classification less the amount that would have been assessed under the use classification for the prior connection, provided however, that the City shall not be required to reimburse the property owner in the event the credit exceeds the sewer system development charge for the new connection.	CMC 13.72.040(A)
Credits	▪ Those properties that are not presently connected to the City's sewer system but which have been assessed and paid a monthly penalty pursuant to Section 13.60.050(B) shall receive a credit against the sewer system development charge in an amount equal to the total monthly penalties paid prior to connection, provided however, that the City shall not be required to reimburse the property owner in the event the credit exceeds the sewer system development charge for the new connection.	CMC 13.72.040(B)
Lien	▪ The city shall have a lien against premises to which sewer service is available for delinquent and unpaid charges for sewer services, for penalties levied pursuant to Section 13.60.050(B), for unpaid connection charges, and for unpaid sewer system development charges. All such delinquent charges shall bear interest at the rate of eight percent per annum. Such lien shall be superior to all other liens and encumbrances except general taxes and local and special assessments. ▪ Notice of such sewage lien shall be provided in accordance with RCW 35.67.210, and such sewage lien may be foreclosed as provided by RCW 35.67.220 through 35.67.250.	CMC 13.60.055
Violation – Penalty	▪ Any person, firm or corporation who violates or refuses or fails to comply with any of the provisions of Sections 13.60.020 through 13.60.110 shall be guilty of a misdemeanor and shall be punished by a fine of not less than 25 dollars nor more than one hundred dollars or imprisoned in the City jail for a period of thirty days or by both such fine and prison term.	CMC 13.60.090
Violation – Each day a separate offense	▪ Every person, firm or corporation shall be deemed guilty of a separate offense for each and every day during any portion of which any violation of any provisions of Sections 13.60.020 through 13.60.110 is committed, continued, or permitted by such person, firm or corporation and shall be punishable therefore as provided by Sections 13.60.020 through 13.60.110.	CMC 13.60.100
Inflow Connection	▪ There is imposed upon those property owners who are within the area served by the sanitary system and who refuse to connect to such sanitary sewer system a penalty in an amount equal to the charge that would have been made for sewer service if such property had been connected to the sanitary sewer system. Such penalties as provided herein shall accrue monthly until such property is connected to the sanitary sewer system. All penalties collected pursuant to this provision shall be considered revenue of the sanitary sewer system.	CMC 13.60.050(B)
Installation Responsibility – Inspection fee	▪ The individual owner shall be responsible for and shall pay for the installation of the STEP/STE system, including but not limited to, service connection per CMC 13.64.050 if required, the tank, pump apparatus, control box, electrical wiring, conduit, plumbing from the structure to the tank, plumbing from the tank to the service box, excavation and backfill material. The city shall, prior to installation, determine the appropriate size tank. ▪ During and at the completion of installation, the STEP/STE system shall be inspected by the city to ensure that it has been properly installed. There shall be a fee as per the fee schedule established by the city council per resolution for inspection of the STEP system, which fee shall be collected by the building department at the time the permit for connection to the municipal sewer system is issued.	CMC 13.62.040
Ownership of system	▪ Residential. After inspection and acceptance of an installed STEP system on residential property, the city shall be the owner of all components of the STEP system with the exception of the sewer line from the structure to the tank, which shall be owned by the property owner. The city will be responsible for maintaining the components of the STEP system owned by the city, and in addition will be responsible for pumping the STEP tank and disposing of waste material when required. The owner will be responsible for maintaining the sewer line connecting the tank to the structure on the subject property. The owner will further be responsible for paying for all electrical costs associated with the operation of the STEP system. ▪ Commercial and Industrial. All STEP systems serving commercial, industrial, and other nonresidential properties shall be owned by the owner of the subject property, except for the service box at the point where the STEP system connects to the city sanitary sewer system, which shall be owned by the city. The owner shall be responsible for maintaining all components of the STEP system and its ownership, and shall be responsible for pumping the STEP tank as needed and for disposing of the waste in an approved manner. The owner shall further be responsible for paying all electrical costs associated with the operation of the STEP system.	CMC 13.62.060
Sewer Service Development	▪ Pursuant to the authority conferred upon cities and towns by RCW 35.92.020 and 35.92.025, the City Council of the City finds that property owners who seek to connect property to the sewer system of the City should be assessed a charge in order that such property shall bear its equitable share of the cost of the sewer system. The council further finds that the charge should be based upon the property owner's anticipated use of the sewer system as related to the historical cost of the sewer system and the projected cost of additions to the sewer system to meet new demand. That portion of the charge based upon the historical costs of the sewer system shall be measured by the undepreciated value of the sewer system and plant in service at the time the charge is imposed. That portion of the charge based upon the projected cost of future improvements shall be based upon appropriate studies by engineers and/or financial consultants. The charge imposed by this chapter shall be denominated as a "sewer system development charge" and shall be in addition to any sewer connection or permit fees imposed by other ordinances of the City.	CMC 13.72.010
Damage to STEP	▪ The cost of repairing any damage to a STEP system which has resulted from the negligence, gross negligence, or intentional acts of the owner shall be the responsibility of the owner. This responsibility includes any clogging which may result due to improper use of the STEP system by the owner.	CMC 13.62.070
Septage users	▪ There is imposed upon customers of the city of Camas water and sewer utility who have septic tanks or chemical toilets and reside within the city limits a service charge as per the fee schedule established by the city council per resolution when waste from the septic tank or chemical toilet is dumped into the city sanitary sewer system. ▪ Septic tank waste or chemical toilet waste generated outside of the city limits of Camas may not be dumped into the city sanitary sewer system.	CMC 13.64.040
Connection Charges for STEP	▪ Except as hereinafter provided, the connection charge for connecting a STEP/STE sewer system to the Camas municipal sewer system shall be the cost of materials, the costs of labor for City personnel at then prevailing rate for such personnel, and the amount of any fees or charges required to be paid to any third parties in order to make such connection. ▪ The connection charge for connecting a STEP/STE sewer system to the Camas municipal sanitary sewer system with a one-inch service line or less shall be as per the fee schedule established by the City Council per resolution, or the actual cost to the City calculated in accordance with subsection A of this section, whichever is greater. ▪ No connection charge will be assessed if a service line has already been installed connecting the subject property to the City sanitary sewer system.	CMC 13.64.050

Subject	Policy	Source
Sewer Volume Charges	The sewer volume charges for each residential customer from November 1 through February 28 shall be based upon that customer's actual water consumption during that period. The four billing cycles between November I through February 28 shall be the customer's "four billing cycle water consumption history." The sewer volume charges for each residential unit for the remainder of the year shall be based on the average water consumption in the previous "four billing cycle water consumption history." Zero water consumption in any of the four water consumption history billing periods shall not constitute a "complete four billing cycle water consumption history." ▪ Residential customers that have a "complete four billing cycle water consumption history" as specified above shall be charged the applicable inside city or outside city monthly sewer charge and volume charge as set forth in the chart in Section 13.64.010 above. ▪ Residential customers that do not have a "complete four billing cycle water consumption history" as specified above, shall be charged the applicable inside city or outside city monthly service charge set forth in Section 13.64.010 and a volume charge equivalent to seven hundred cubic feet of water usage as the monthly sewer billing rate. ▪ Residential customers may apply for a reduction in sewer rates when, due to a qualifying leak as defined in Section 13.44.030, the sewer charge is substantially increased. The amount of the reduction shall be calculated in the same manner as a water leak credit as set forth in Section 13.44.030.	CMC 13.64.060
Sewer Service Development Charge - Credits	▪ Development Credit: » A developer (as defined in CMC 3.88.030.K) shall be entitled to a credit against the applicable system development charge for the dedication of land or for the design or engineering or construction of an "eligible improvement". For purposes of this section, an eligible improvement shall mean an improvement or real property that is: required as a condition of development approval; identified in the general sewer plan or capital improvement plan; and included in the current system development charge calculation as being funded by system development charges. » The amount of the credit shall be the dollar amount assigned to the improvement or to the land in the system development charge calculation. Where only a portion of the improvement is constructed, or a portion of the land is dedicated, the amount of the credit shall be pro-rated. » Credits earned for one category of system development charge, e.g. water, may not be applied against a different system development charge, e.g. sewer. » Approval from the city council shall be required prior to the start of construction or dedication of any eligible improvement. "Approval" in the context of this subsection (4) shall be satisfied if the city requires the construction or dedication of the eligible improvement as a condition of approval for a land use application. If a developer wishes to construct an eligible improvement that is not otherwise a condition to an approved land use application, prior approval must be obtained from the city council. » No system development charge credit shall be granted until either the eligible improvements have been designed, engineered, or constructed by the developer, and such work has been accepted by the city; or until the land has been dedicated by the developer and such dedication has been accepted by the city. » If system development charges become due and payable prior to the developer becoming eligible for the issuance of credits as provided in section (5), the developer may apply to the public works director to defer collection of the charges until construction or dedication is completed. The public works director may condition deferral upon: • The developer posting a bond or other financial security satisfactory to the city in an amount equal to one hundred twenty-five percent (125%) of the deferred system development charges, which bond or other financial security shall be conditioned upon the developer either paying the deferred system development charges or completing construction or dedication within a specified time, • The withholding of an occupancy permit, or • Such other conditions acceptable to the city. » If the developer is dissatisfied with the decision of the community development director, the developer may seek to have that decision reviewed by the city council. » Upon acceptance of the eligible improvement, the developer may submit an application for the system development charge credit to the finance department on a form to be created by the finance department. After submission of the application and verification of entitlement thereto, the finance department shall issue a credit voucher to the developer specifying the amount of the system development charge credit and the type of credit. » The credit may, at the option of the developer, be applied all or in part to the system development charges owing for the developer's project. » To the extent the credit exceeds the amount of the system development charges owed by the developer, or the developer chooses not to apply the credit to the developer's project, the unused credit may be applied to a different project of the developer or to the project of a different developer. » Before the system development charge can be transferred to a different project or a different developer, the holder of the system development charge credit shall file with the finance department an application to transfer the credit on a form to be created by the finance department. The application shall identify the transferee, and the amount of the system development charge credit being transferred. The transfer application shall be accompanied by an administrative fee in an amount as may be set by resolution of the city council. » When credits are to be redeemed, the holder of the system development charge credit shall file an application for redemption on a form to be created by the finance department. Redemption shall be permitted only in increments equal to whole system development charge, or when redemption will exhaust the entire system development charge credit. The application for redemption shall be accompanied by an administrative fee in such amount as may be set by resolution of the city council. When system development charge credits are being redeemed, such redemption shall not allow for system development charge credits to be pro-rated among more than one residential lot in amounts that are less than the existing system development charge per lot. For example, where system development charges are five thousand dollars per residential lot and a developer wishes to redeem eleven thousand dollars worth of credits, the developer shall not be allowed to apply one thousand dollars per residential lot over eleven lots. The developer may apply five thousand dollars to two residential lots and the remaining one thousand dollars to one residential lot. » The finance department shall be responsible for maintaining appropriate records documenting the issuance, transfer, and redemption of system development charge credits. » Expiration of Credits. Any credits issued after the effective date of this ordinance shall expire and become null and void ten years from the date of approval of the original credit by the city council. Transfer of credits or partial use of credits shall in no event extend the expiration date of those credits.	CMC 13.72.040
Sewer Service Development Charge – Payment of Sewer System Development Charge	▪ The sewer system development charge owing under the provisions of this chapter shall be paid by the applicant at the time of issuance of the plumbing permit or building permit, whichever shall first occur, or as scheduled by a separate agreement with the city. ▪ No sewer service shall be furnished to the property of any person seeking to connect to the sewer system of the city until the sewer system development charge imposed by this chapter has been paid to the city treasurer or until such time as the city and the applicant have entered into a separate agreement providing for the payment of such sewer system development charge.	CMC 13.72.070
Sewer Service Development Charge – Revenue Disposition	▪ All revenues collected pursuant to this chapter shall be paid into the water and sewer capital reserve fund, and shall be used for the purpose of financing system improvements. Such revenues shall not be used to offset current operation or maintenance costs.	CMC 13.72.080

Subject	Policy	Source
Sewer Service Development Charge – Appeal	▪ Any applicant aggrieved by the amount of the sewer system development charge found by the engineer to be required under the provisions of this chapter, may appeal to the board of adjustment from such finding by filing a written notice of appeal with the city clerk within twenty days from the time such property owner is given notice of such amount. The chairman of the board of adjustment shall cause a notice of the time and place of hearing to be mailed to the applicant. At such hearing, the applicant shall be entitled to be heard and to introduce evidence on his own behalf. The board of adjustment shall thereupon ascertain the correct amount of the sewer system development charge, and the city clerk shall immediately notify the appellant thereof, by mail, which amount, together with the costs of appeal, if appellant is unsuccessful therein, must be paid within ten days after such notice is given. ▪ The chairman of the board of adjustment may, by subpoena, require the attendance at any appeal of any person, and may also require him to produce any pertinent books and records. Any person served with such subpoena shall appear at the time and place therein stated, and shall produce the books and records required, if any, and shall testify truthfully under oath administered by the chairman in charge of the hearing on appeal, as to any matter required of him pertinent to the appeal, and it is unlawful for him to fail or refuse to do so.	CMC 13.72.090

Notes:
(1) Some provisions of the Camas Municipal Code are not shown in this table because they are regulatory in nature (e.g., permit requirements, violation enforcement) rather than financial policy measures. For complete information, the Camas Municipal Code is available on the City's website.

Table 2.6 Regulatory Requirements

Subject	Policy
Federal Clean Water Act Condition S1	Condition S.1 of the City's permit requires the treatment plant effluent to meet limits for BOD_5, TSS, fecal coliform bacteria, pH, and total ammonia.
Federal Clean Water Act Condition S2	Condition S.2.lists monitoring requirements including influent and effluent flow, BOD_5, TSS, pH, temperature, total ammonia, fecal coliform, priority pollutant metals, oil and grease and cyanide. A program to address oil and grease is also required. The City must monitor twice per 5 years for effluent whole effluent toxicity and conduct quarterly and yearly priority pollutant monitoring of its influent and effluent in support of its industrial pretreatment program. Additionally, per the terms of the City's coverage under the Statewide Biosolids permit, the City must annually test its biosolids for pollutants and compliance with pathogen reduction and vector attraction reduction criteria.
Federal Clean Water Act Condition S4	Condition S.4.A specifies the WWTF design capacity for maximum month BOD_5 loading is 5,616 ppd and 6,405 ppd for TSS. The peak hour flow, dry weather monthly average, and maximum month average flow capacities for the WWTF are 11.09, 2.86 and 6.10 mgd, respectively. Condition S.4.B requires the City to prepare a plan to maintain adequate capacity when flows and loadings to the WWTF exceed 85% of design capacity for 3-consecutive months.
NEPA	The NEPA was established in 1969 and requires federal agencies to determine environmental impacts on all projects requiring federal permits or funding. Federally delegated activities such as NPDES permits or Section 401 Certification are considered state actions and do not require NEPA compliance. If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a FONSI is issued, otherwise an Environmental Assessment or EIS would be required. NEPA is not applicable to projects that do not include a federal component.
Federal Clean Air Act	The Federal Clean Air Act requires all wastewater facilities to plan to meet the air quality limitations of the region. The City falls in the jurisdiction of the SWCAA. The SWCAA is responsible for enforcing federal, state and local outdoor air quality standards and regulations in Clark, Cowlitz, Lewis, Skamania and Wahkiakum counties of southwest Washington state. The Camas generator is permitted by SWCAA.
State Water Pollution Control Act	The intent of the state Water Pollution Control Act is to "maintain the highest possible control standards to ensure the purity of all waters of the state consistent with public health and the enjoyment…the propagation and protection of wildlife, birds, game, fish and other aquatic life, and the industrial development of the state." Under the RCW 90.48 and the WAC 173-220, Ecology issues permits for wastewater treatment facilities and land application of wastewater under WAC 173-216.
Criteria for Sewage Works Design, Ecology	Ecology has published design criteria for collection systems and wastewater treatment plants. While these criteria are not legally binding, their use is strongly encouraged by Ecology since the criteria are used by the agency to review engineering reports for upgrading wastewater treatment systems. Commonly referred to as the "Orange Book," these design criteria primarily emphasize unit processes through secondary treatment, and also includes criteria for planning and design of wastewater collection systems. Any expansion or modification of the City collection system and/or WWTF plant will require continued conformance with Ecology criteria.
Certification of Operators of Wastewater Treatment Plants, WAC 173-230	Wastewater treatment plant operators are certified by the state Water and Wastewater Operators Certification Board. The operator assigned overall responsibility for operation of a wastewater treatment plant is defined by WAC 173-230 as the "operator in responsible charge." This individual must have state certification at or above the classification rating of the plant. The City WWTF is currently assigned a Class 4 rating and the operating staff assigned to the plant have the required certification. (One of the operators has a Class 4 certification; two have Class 3 certification, and one has Class 2 certification).
Surface-Water Quality Standards (WAC 173-201A)	In the State of Washington, WAC 173-201A establishes water quality standards for surface waters based on maintaining public health, recreational use and protection of fish, shellfish, and wildlife. Table 2.4 includes surface water criteria for many toxic substances, including ammonia, residual chlorine, several heavy metals, PCBs, and pesticides.
State Environmental Policy Act	WAC 173-220 requires a statement in all wastewater comprehensive plans regarding proposed projects in compliance with the SEPA, if applicable. The capital improvements proposed in this plan will fall under SEPA regulations. A SEPA checklist is included in Appendix A of this report for use in the environmental review for the project. In most cases a DNS is issued; however, if a project will have a probable significant adverse environmental impact an EIS will be required.
Accreditation of Environmental Laboratories (WAC 173-050)	The State of Washington established a requirement that all laboratories reporting data to comply with NPDES permits must be generated by an accredited laboratory. This accreditation program establishes specific tasks for QA/QC that are intended to ensure the integrity of laboratory procedures. Accreditation requirements must be met for any on-site laboratory or outside laboratory used to analyze samples. Only accredited laboratories may be used for analyses reported for compliance with NPDES permits. In planning for an on-site laboratory, staffing must be sufficient to allow for QA/QC procedures to be performed. The Camas WWTF lab is currently accredited for determination of the following parameters TSS, BOD_5, ammonia, dissolved oxygen, pH and fecal coliform.
Minimal Standards for Solid Waste Handling (WAC 173-304)	Grit and screenings are subject to the minimal standards for solids waste handling under WAC 173-308, and their disposal is regulated under the state solid waste regulations, WAC 173-304. Waste placed in a municipal solid waste landfill must not contain free liquids, nor exhibit any of the criteria of a hazardous waste as defined by WAC 173-303. To be placed in a municipal solid waste landfill, grit, screenings, and incinerator ash must pass the paint filter test. This test determines the amount of free liquids associated within the solids, and includes the TCLP test, which determines if the waste has hazardous characteristics.
Shoreline Management Act	The Shoreline Management Act of 1971 (RCW 90.58) establishes a broad policy giving preference to shoreline uses that protect water quality and the natural environment, depend on proximity to the water, and preserve or enhance public access to the water. The Shoreline Management Act jurisdiction extends to lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cfs or greater, marine waters, and an area inland 200 feet from the ordinary high-water mark. Projects are reviewed by local governments according to state guidelines and a local Shoreline Master Program. The Camas wastewater treatment plant and portions of the collection system are located within shoreline areas.

Notes:
BOD_5 - 5-day biochemical oxygen demand; cfs - cubic feet per second; DNS - determination of non-significance; FONSI - finding of no significant impact; mgd - million gallons per day; PCB - polychlorinated biphenyls; ppd - pounds per day; QA/QC - quality assurance and quality control; RCW - Revised Code of Washington; SWCAA - Southwest Clean Air Agency; TCLP - toxic characteristic leachate procedure; TSS - total suspended solids.

2.2.4.1 NPDES Permit

Table 2.7 presents a brief overview of relevant design criteria and effluent limitations contained in the City's WWTF NPDES Permit No. WA0020249. The City's current permit was issued July 1, 2025 and was effective as of August 1, 2025. This NPDES permit places limits on various water quality parameters, flow rates, and waste loading pertaining to the discharge of treated effluent from the WWTF.

Table 2.7 NPDES Influent Design Criteria and Effluent Limits

NPDES Influent Design Criteria and Effluent Limits		
NPDES Influent Design Criteria		
Parameter		**Value**
MMF		6.1 mgd
Monthly Average Dry Weather Flow		2.86 mgd
BOD_5 Max Month Loading		5,616 ppd
TSS Max Month Loading		8,011 ppd
NPDES Effluent Limits		
Parameter	**Average Monthly Limit**	**Average Weekly Limit**
BOD_5	▪ 20 mg/L ▪ 842 ppd ▪ 85% removal of influent	▪ 30 mg/L ▪ 1,264 ppd
TSS	▪ 20 mg/L ▪ 1,017 ppd ▪ 85% removal of influent	▪ 30 mg/L ▪ 1,525 ppd
Heat Load(1)	▪ 5.87×10^8 kcal/day	▪ N/A
Fecal Coliform Bacteria(2)	▪ 200 organisms/100 mL	▪ 400 organisms/100 mL
NH_3-N Summer(3)	▪ 20 mg/L	▪ 30 mg/L
NH_3-N Winter	▪ 7 mg/L	▪ 11 mg/L

Notes:
(1) Applicable only from June 1 – September 30.
(2) Geometric mean.
(3) Summer ammonia limits apply to the months of June through September.
kcal/day - kilocalories per day; mg/L - milligrams per liter; mL - milliliter; N/A - not applicable; NH_3-N - ammonia.

CHAPTER 3 BASIS OF PLANNING

3.1 Introduction

This chapter presents an evaluation of historical wastewater flows and loads through the City's collection system and entering the WWTF. This chapter establishes the WWTF's flow and load projections based upon planned development and future population growth through 2045.

The remainder of this Chapter is divided into four sections:

- Section 3.2 provides definitions for the wastewater flow terminology used in this chapter, as many of the terms are not commonly used outside of planning and design evaluations.
- Section 3.3 presents the collection system flow monitoring results, which are used to set a baseline for flow projections and development of the hydraulic model.
- Section 3.4 presents projected flows for the City's collection system, which are used in hydraulic modelling evaluations.
- Section 3.5 presents projected flows and loads for the WWTF, which are based on an evaluation of historical plant data. They are used in unit process capacity evaluations.

The collection system and WWTF projections were developed in conjunction with the City's *Draft 2045 Comprehensive Plan* updated and reflect the latest available land use and demographic information. While both analyses are based on the same overall growth projections, different methodologies and available data were used to develop the collection system and WWTF flow projections. The collection system was projected for both 2045 and buildout conditions, while the WWTF analysis was projected through 2045. The specific methodologies and data used to develop each projection are described in the applicable sections of this chapter.

3.2 Definitions

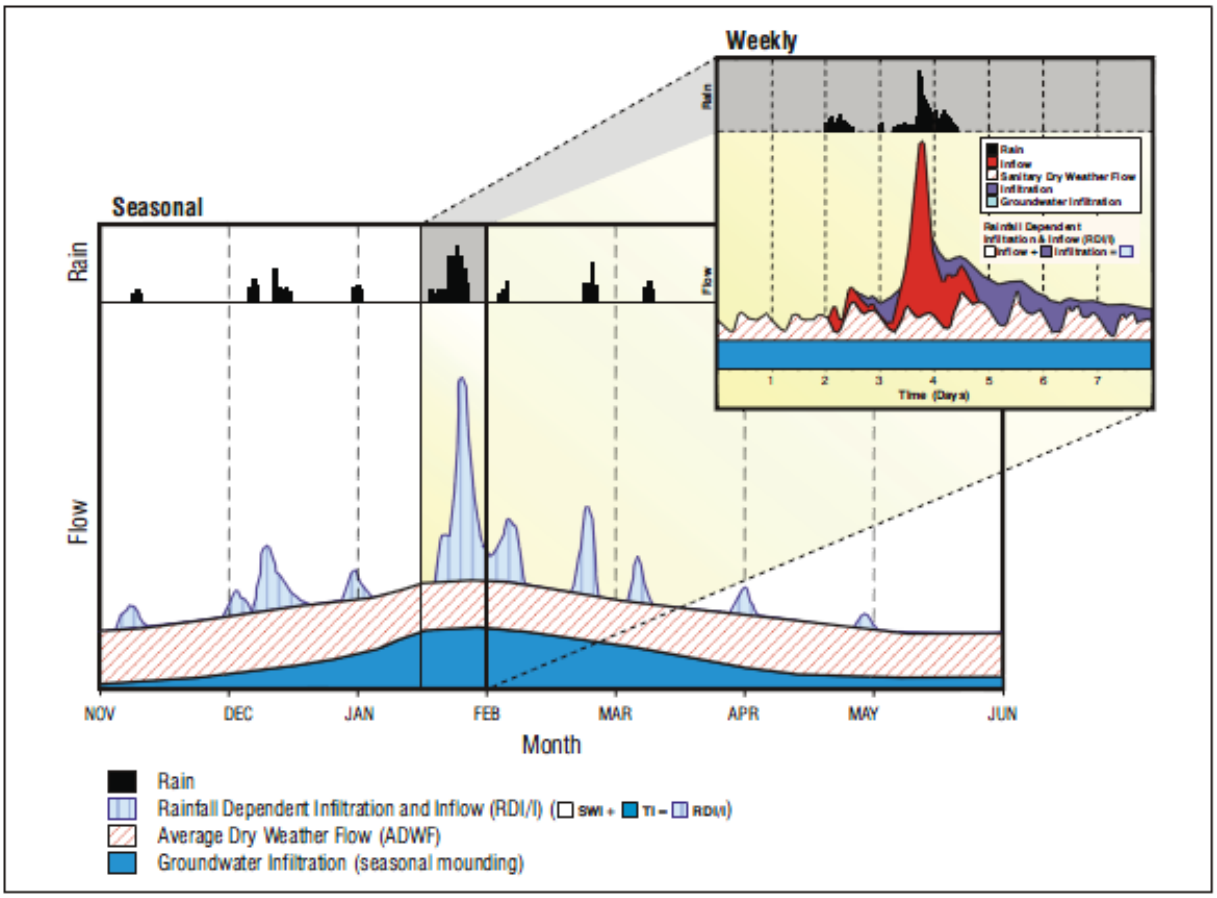
Wastewater flows are analyzed by separating dry weather flow (DWF) from wet weather flow (WWF) to establish base flows. These base flows identified during dry weather are then used as the basis to project both wet and dry weather flows. The different flow components for the sewer collection system are illustrated in Figure 3.1.

Due to the separate collection system and WWTF projections established, the following terminology was used to differentiate the various flow parameters:

- **Average Dry Weather Flow (ADWF)** establishes a similar flow parameter as influent dry weather flow (IDWF); ADWF was differentiated as it was based on a period of record for the collection system flows that differs from the IDWF.
- **Average Annual Flow/Load (AAF/AAL)** is the average flow or load that occurs over a calendar year. AAF and AAL were estimated based on the historical influent flow and concentration data from the City's WWTF.
- **Groundwater Infiltration (GWI)** in a sewer is the process where surrounding groundwater inadvertently enters into the sanitary sewer system through sewer pipes and manholes through

defects like cracks, porous joints, root intrusion, and structural failure. The ADWF used in this analysis includes both wastewater (WW) and GWI. Including the GWI component results in a higher flow basis for the projections and provides a conservative estimate of future wastewater flows.

- **Influent Dry Weather Flow (IDWF)** is the average daily flow during the two driest months of the year (July and August). The IDWF includes the base flow generated by the City's connections plus the dry weather GWI component. For the City, the IDWF was estimated throughout the service area based on the historical influent flow data from the WWTF.
- **Maximum Month Flow/Load (MMF/MML)** is the maximum 30-day running average influent flow observed at the WWTF during a calendar year. MMF and MML were estimated based on the historical influent flow and load data from the City's WWTF.
- **Peak Day Flow/Load (PDF/PDL)** is the maximum 24-hour average flow and load observed at the WWTF during a calendar year. PDF and PDL were estimated based on the historical influent flow and concentration data from the City's WWTF.
- **Peak Hour Flow (PHF)** is the highest hourly flow predicted to occur during the design storm. Rainfall derived inflow and infiltration (RDII) causes flows in the collection system to increase during wet-weather conditions. PHF is typically used for designing sewers and lift stations. Therefore, the PHF and the collection system "Design Flow" are synonymous and will be used interchangeably throughout this GSP.
- **Peak Wet Weather Flow (PWWF)** is the maximum one-minute flow rate predicted in the collection system during a wet weather event, resulting from the combination of DWF and RDII. The collection system model is simulated at one minute time steps, and PWWF represents the maximum modeled flow within one minute interval. PWWF represents the design condition used to evaluate the capacity of collection system facilities under wet weather conditions and is presented for existing and future planning scenarios. PWWF differs from PHF, which represents the highest hourly flow during the design storm.
- **Rainfall Dependent Infiltration and Inflow (RDII)** is the additional flow entering the sanitary sewer collection system as a direct result of rainfall events. RDII includes inflow, which enters the collection system quickly through direct connections such as roof drains, catch basins, and cross-connections with stormwater facilities, and infiltration, which enters more gradually through defects such as cracked pipes, faulty joints, and deteriorated manholes. RDII is added to the DWF to determine the total WWF used for capacity evaluations of collection system facilities.



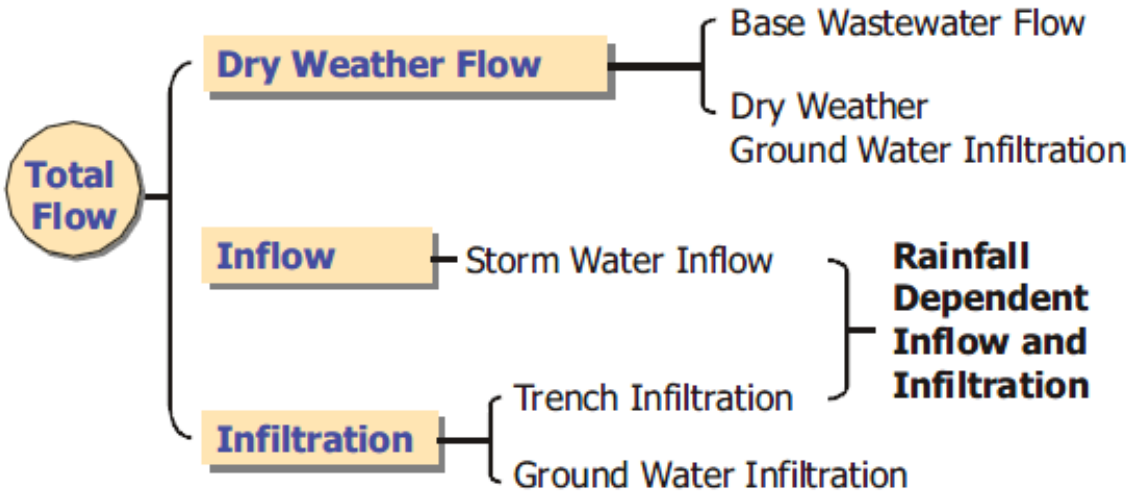


Figure 3.1 Typical Wastewater Flow Components

Note: This figure is not based on flow data specific to the City.

3.3 Collection System Flow Monitoring Results

As part of the project, ADS conducted a temporary flow monitoring program within the City's sanitary sewer collection system. The purposes of the Flow Monitoring Program were to collect data for correlating real collection system flows with the hydraulic model's predicted flows, evaluate the system's capacity, and estimate basin I/I. The temporary flow monitoring data was collected from January 15, 2025, to April 29, 2025. The "Camas Flow Monitoring Report 2025" prepared by ADS summarizes the flow monitoring program and was submitted to the City as a stand-alone report. The report is included as Appendix D.

3.3.1 Flow Monitoring Sites

Four sewer basins were monitored by ADS during the flow monitoring period, and three additional areas were evaluated using City supervisory control and data acquisition (SCADA) data. The additional areas included the STEP system, for which flows were estimated using WWTF influent data, and two North Shore areas upstream of Basin 4-1-3. Figure 3.2 provides a flow monitoring schematic showing the monitoring locations and connections between the monitored basins within the collection system. Figure 3.3 shows the flow monitoring basins. For additional information on the flow monitoring program and data analysis, see Appendix E - *Hydraulic Model Update* (Carollo, 2026).

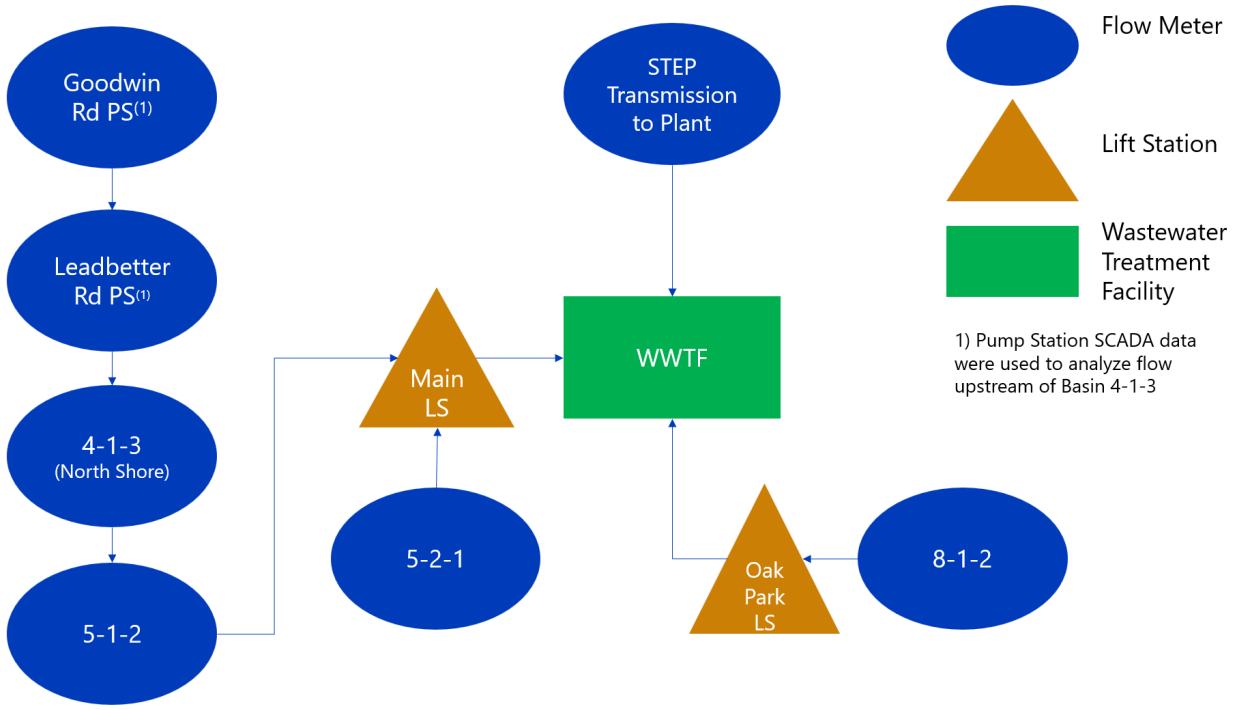


Figure 3.2 Flow Monitoring Schematic

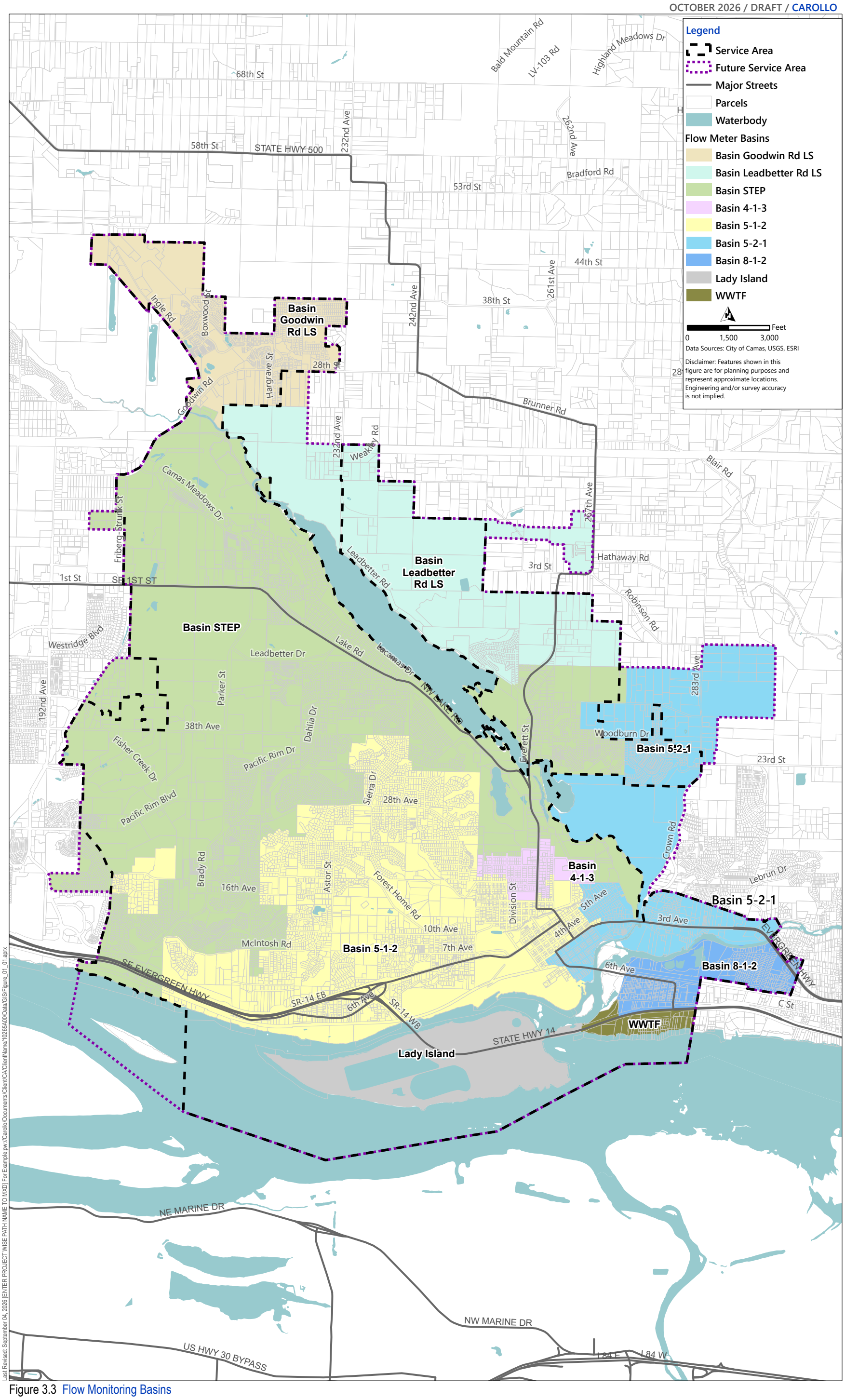


Figure 3.3 Flow Monitoring Basins

3.3.2 Average Dry Weather Flow Data

The ADWF projections are derived from land use category data and corresponding wastewater flow factors. This method assumes that areas with similar land uses, such as low-density residential parcels, produce equivalent quantities of wastewater flow on a per area basis. In this GSP, the resulting ADWF represents the base wastewater flow generated by the population and land uses within the service area. GWI is estimated separately and added to the wastewater flow for collection system modeling. System-wide flow projections can be compared with recorded flows from temporary collection system flow monitors, and WWTF influent data to evaluate reasonableness of the projections. This method of estimating base flows is consistent with the previous GSP.

3.3.2.1 ADWF Development

Existing ADWFs for each basin were estimated using data from the Camas flow monitoring report for each of the flow monitoring basins. ADWF was then developed using the dry days from the flow monitoring period based on the following set of minimum criteria, where all of the following criteria must be met:

- Less than 0.1 inch of rain in the previous day.
- Less than 0.4 inches of rain in the previous three days.
- Less than 1.0 inch of rain in the previous five days.
- In addition, those dry days that exhibited unusual flow patterns were not used to generate ADWF values for a basin.

Characteristic dry weather 24-hour diurnal flow patterns were developed for each basin from hourly data. The patterns represent the observed dry weather flow response for each basin and therefore include the combined effects of wastewater flow and GWI. GWI was considered separately during the flow estimation and modeling process; however, it was not removed from the monitored flow data prior to developing the diurnal patterns. The hourly flow data were also used to calibrate the hydraulic model to the observed DWFs during the flow monitoring period. Weekday and weekend flow patterns were developed separately to account for differences in daily flow characteristics. An example of the DWF diurnal patterns from one of the City's flow meters, Flow Meter 5-1-2 is shown in Figure 3.4. For more information regarding all of the City's flow meters, see Chapter 4 - Existing System.

Carollo calculated representative average weekday and weekend DWF levels and velocities at each monitoring site using the flow monitoring data provided by ADS. The meter data were aggregated from 15-minute to hourly intervals and used to develop representative weekday and weekend DWF patterns for model calibration. Further details on DWF development and mode calibration are provided in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

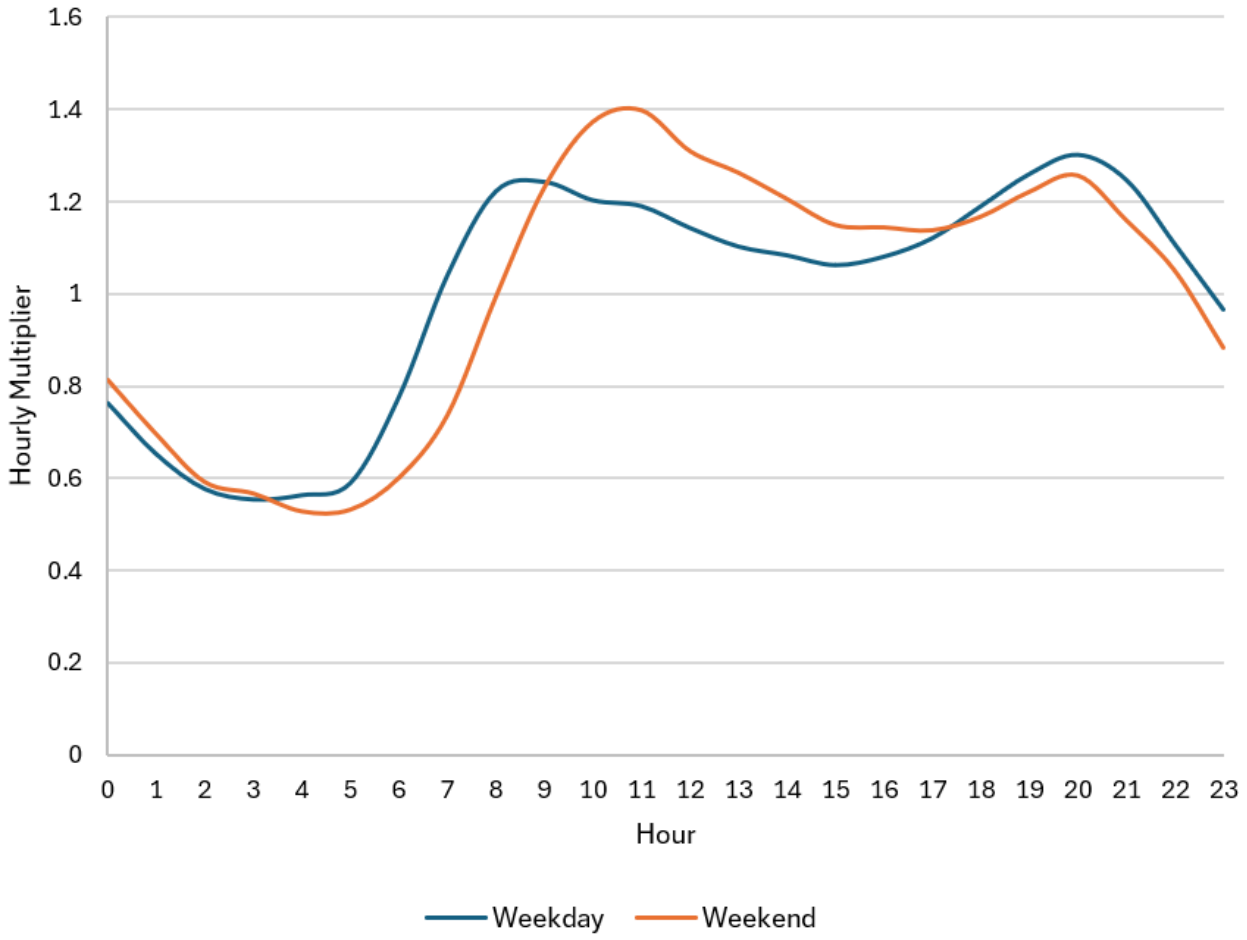


Figure 3.4 Typical Weekday vs Weekend Dry Weather Flow Variation (Meter 5-1-2)

3.3.3 Rainfall Data

An important part of the flow monitoring program was the collection and analysis of rainfall data. Rainfall events were screened based on a minimum rainfall intensity of 0.1 inches per hour within a 48-hour period. Back-to-back rainfall events were also considered to evaluated the cumulative rainfall depth and resulting I/I response in the collection system. Based on this screening, three significant rainfall events were selected for I/I analysis and hydraulic model calibration. Table 3.1 summarizes a range of events that occurred during the course of the flow monitoring period available and recorded at the ADS rain gauge for calibration. Further detail on the rainfall data and three storms used to calibrate the model can be found in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

Table 3.1 Identified Storm Events

Storm Event	Start Date	End Date	Total Event Rainfall (inch)	Total 24-hour Volume (inch)	Maximum Peak Intensity (inch/hour)
1	1/31/2025	2/5/2025	0.82	0.63	0.11
2	2/14/2025	2/19/2025	1.34	1.04	0.16
3	2/21/2025	2/25/2025	2.82	1.82	0.23
4	3/2/2025	3/5/2025	0.24	0.13	0.04
5	3/12/2025	3/19/2025	2.45	1.18	0.14
6	3/20/2025	4/1/2025	2.74	1.12	0.18
7	4/5/2025	4/9/2025	1.15	0.94	0.23

3.3.4 Wet Weather Flow Data

The flow monitoring data was also evaluated to determine how the collection system responds to wet weather events. As mentioned in Section 3.3.2, the flow monitoring program captured three main rainfall events. The rainfall event that occurred on February 23, 2025, was associated with the largest RDII response during the flow monitoring period and is the most appropriate to be used for RDII analysis.

Figure 3.5 shows an example of the wet weather response at Meter 5-1-2 during the February 23, 2025, rainfall event. This figure also illustrates the volume of RDII that entered the system from the collection system upstream of Meter 5-1-2. The grey line represents the ADWF, while the green line represents the measured flow during the storm event. As can be seen in the figure, the flow increased by 5 to 10 times ADWF due to RDII entering the system during the wet weather events.

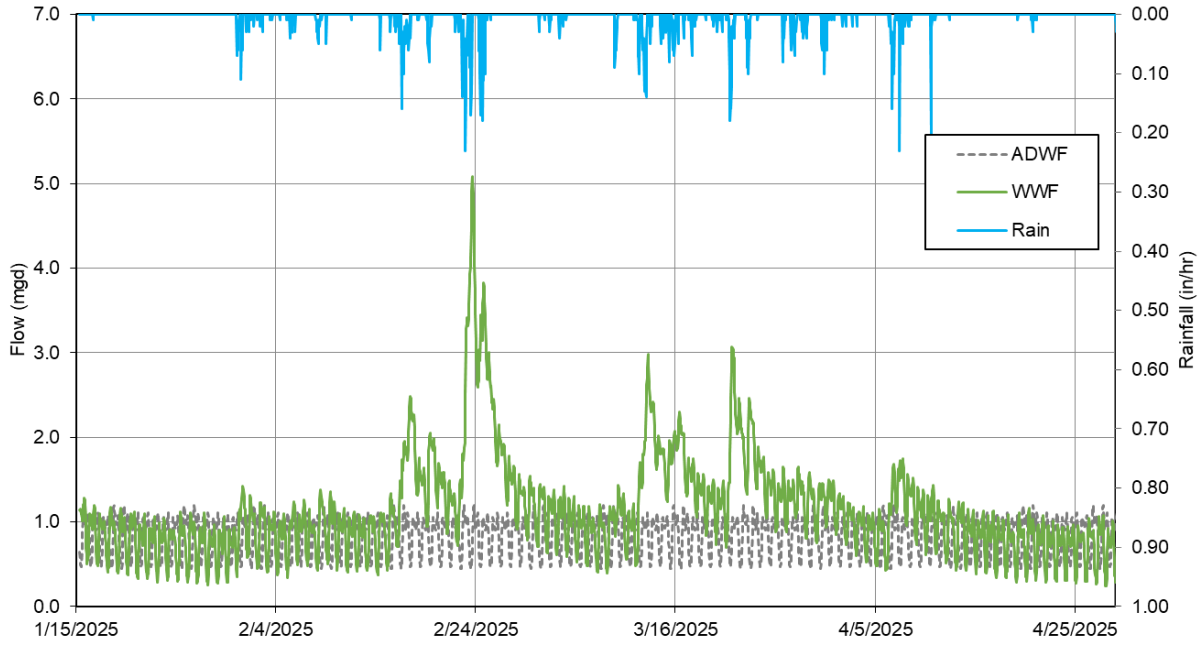


Figure 3.5 Example Wet Weather Response (Meter 5-1-2)

3.4 Collection System Flow Projections

Wastewater collection systems have several distinct flow sources based on the contributors in the service area:

1. Residential flow.
2. GWI.
3. Commercial and industrial flow.
4. RDII.

The flow from these sources have been grouped into these categories based on typical analytical procedures and the availability of information for each source. Residential flows include contributions from single family homes and multifamily units. Ecology issues discharge permits for the City's large industrial customers since the City does not have a pretreatment program in place. RDII is caused by rainfall events and includes contributions from connected impervious areas such as roof drains and catch basins (inflow), and groundwater (infiltration) leaking into the collection system. The sum of these components is the total flow through the collection system into the WWTF.

The flows throughout the collection system were estimated using the calibrated hydraulic model to predict dry and wet weather flows, as presented in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

3.4.1 Sewered Population

Population projections are determined from the *Draft Comprehensive Plan 2045* which are summarized by year in Table 3.2. The *Draft Comprehensive Plan 2045* is included in Appendix C - Demographic Projections.

Table 3.2 Population Summary

Year	Population Projections	Source
2023	29,352	(1)
2026	30,421	(2)
2045	37,080	(1)

Notes:
(1) City *Draft Comprehensive Plan 2045*.
(2) Assumes a growth rate of 1.2 percent per year based on the City *Draft Comprehensive Plan 2045*.

3.4.2 Land Use

Land use designations and regulations provide important information for evaluating sewer system capacity. Existing and future land use information is an integral component in projecting wastewater generation within the service area. The type of land use in an area will affect the volume and strength of the wastewater generated. Adequately estimating the generation of wastewater from various land use types is important in sizing collection system facilities.

The City has nine land use designations for parcels within the UGA in the *Draft 2045 Comprehensive Plan*, as shown in Figure 3.6 excluding water, which are categorized into the nine GSP designations. The land use designations used in this GSP align with those in the 2024 GSP which can be related back to the Comprehensive Plan designations. Area totals for each land use category are summarized by acreage in Table 3.3.

Table 3.3 Comprehensive Plan Land Use Summary

Comprehensive Plan Designation	General Sewer Plan Designation	Total Area (acres)(1)(3)
Residential Low	Single Family High	355
	Single Family Medium	2,398
	Single Family Low	972
Residential Medium	Multi Family Low	136
Residential High	Multi Family High	403
Mixed Use/Commercial	Commercial	1,251
Mixed Employment/Industrial	Industrial	2,048
Public Facility(2)	City	34
Parks and Open Space	Park/Open Space	1,687
	Total	**9,286**

Notes:
(1) Total area within each comprehensive plan designation within the urban growth boundary.
(2) The acreage for Public Facility is based on the City's GIS data because the Comprehensive Plan does not provide acreage or land use information for this designation.
(3) Totals may not match due to rounding.
GIS - geographic information system.

Maps of the City's existing and future land use within the future service area were developed with data provided by the City's Planning Department. Existing development information was taken from zoning data, and future land use is the preferred land use from the *Draft 2045 Comprehensive Plan*. Additional details on developing flows by land use type can be found in Appendix E - *Hydraulic Model Update* (Carollo, 2026).

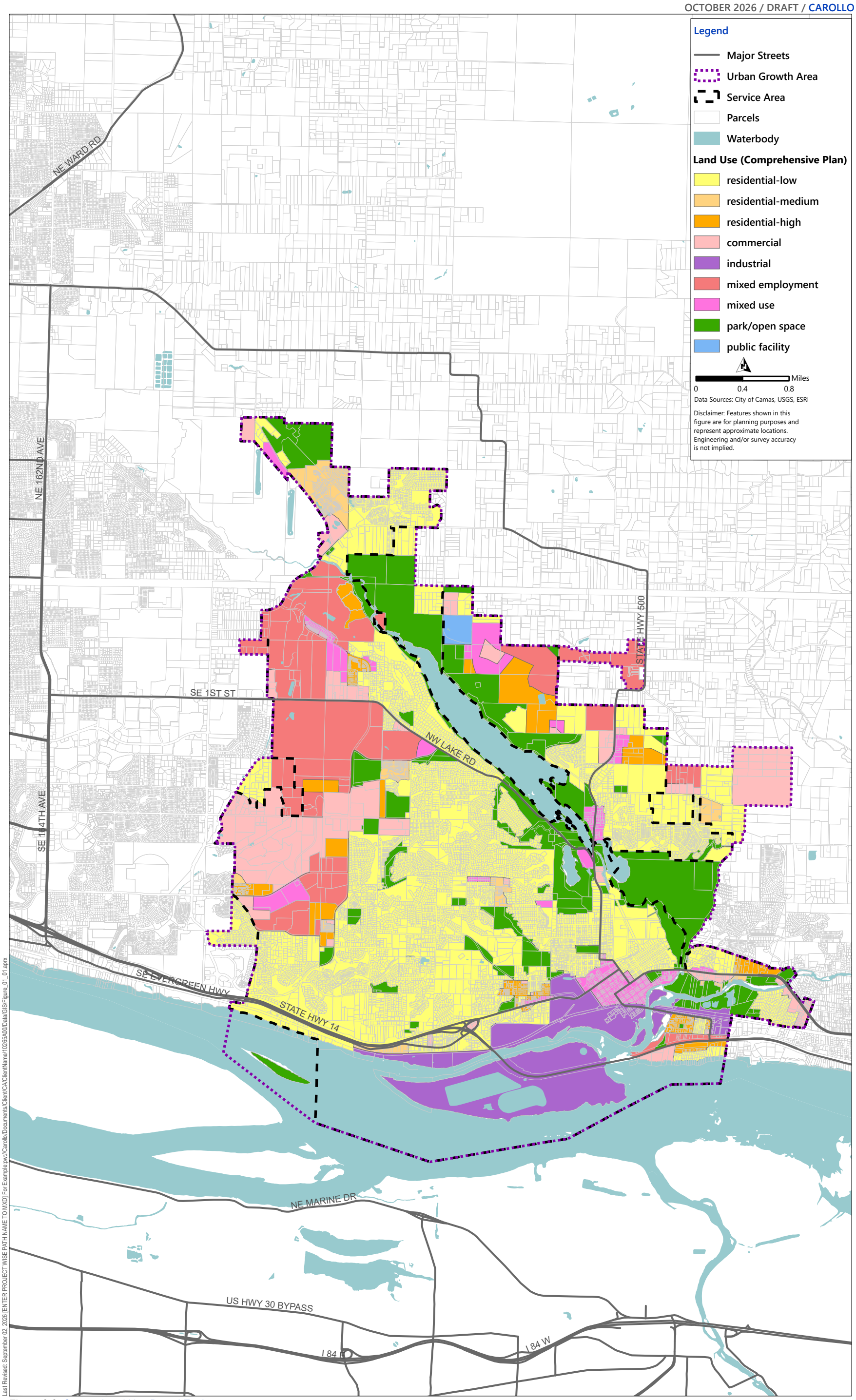


Figure 3.6 Current Land Use Based Zoning

3.4.3 Wastewater Flow Factors

In order to develop wastewater flow projections and allocate future flows to the collection system, relationships between land use and wastewater generation were developed. These relationships, called wastewater flow factors, are established based on the average wastewater flow generated for each existing land use type. The land use flow factors were established to project the estimated ADWF through future development of the City's wastewater collection system and project future flows within the Study Area boundary.

Average wastewater flow coefficients are volume rates, usually expressed in gpad, applied to either gross or net acres to calculate average day flow generated from a particular land use. A flow coefficient was developed for each of the land use classifications that were discussed previously. The flow coefficient provides a means to transform a land use category from acreage into wastewater flow. The resulting flow is then input into the appropriate sewer area in the sewer system model. Municipalities in the Pacific Northwest area, wastewater flow coefficients for residential areas typically range between 500 to 3,000 gpad, and commercial and industrial areas might range from 1,000 to 4,000 gpad, with typical values averaging approximately 1,500 gpad. Land uses designated as open space and parks are assumed to generate negligible amounts of sewage flow, and as a result have a flow coefficient of zero.

The wastewater flow coefficient developed for the City's STEP basin is lower than the typical residential flow coefficients discussed above. The STEP basin contains the majority of the City's population; however, wastewater flows from the basin are collected through a septic tank effluent pumping system rather than a conventional gravity collection system. Because there was no direct flow monitoring of the STEP basin, the basin wastewater flow was estimated by subtracting the flows measured in the other monitored basins from the total WWTF influent flow. The resulting STEP basin flow was then used to develop the basin-specific wastewater flow coefficient.

The lower coefficient is likely related to the operating characteristics of the STEP system. STEP tanks discharge wastewater through individual pumps that operate between defined pump-on and off levels. As a result, wastewater is discharged intermittently rather than a continuously, and the timing and volume of discharges are influenced by tank storage and pump cycling. The selected coefficient reflects the average wastewater flow estimated for the STEP basin and the observed operating characteristics of the STEP collection system.

3.4.3.1 Vacant Parcels

It is assumed that vacant parcels do not generate wastewater flows, therefore, are excluded from the development of wastewater flow factors. Large amounts of parcel area are only partially developed. Allowing a flow factor to represent the entire area of a parcel when the parcel is not fully developed would misrepresent flows and deflate the flow factors. For this reason, partially vacant parcels were determined through the maximum lot size for each zoning category, defined in the CMC 18.09.040. If a parcel exceeded that maximum area lot size, the area used for flow factor development was the maximum lot size of that zoning category. This assumption was performed for single family land use types and allowed for more realistic flow factors to be used.

3.4.3.2 Flow Factor Development

The coefficients are developed using the following procedure:

- Average flows for each flow metering tributary area were derived from the flow-monitoring data (see Section 4).
- The acres for each land use type contained in each flow-monitoring tributary area were calculated using GIS data.
- Preliminary coefficients for each land use type were assumed based on typical values, which can be estimated from the approximate number of dwelling units per acre, an assumed per capita wastewater generation rates, and/or the typical number of people per dwelling unit for each land use type.
- The flow factors for each meter basin were adjusted up or down (balanced) within a reasonable range (based on engineering judgment) until the calculated average flows from each basin matched what was measured during the flow monitoring period. Flow factors are developed using the field estimated ADWF excluding parks, open space, water, vacant, and the Top 2 large industrial users: Taiwan Semiconductor Manufacturing Co., also known as "TSMC" (formerly, WaferTech) and Analog Devices, Inc. (formerly known as Linear Technology, Inc.). If the flow coefficients produced average flows that were significantly different from the field measured flows, further investigation was conducted to verify that the tributary basins were delineated correctly and if the collection system configuration was correct.
- Once the flow factors for each of the five meters basins were balanced, a weighted average of the flow factors for each land use type was calculated based on the acreage contribution from each basin. The weighted average flow factors for each land use type represent wastewater generation by land use for the City as a whole and are used to project future wastewater flows.
- If the projected flow factor for an area is lower than its existing flow factor, the existing flow factor will be used to maintain a conservative estimate.

For example, flow meter 8-1-2 ADWF during the flow-monitoring period was approximately 0.12 mgd. The tributary service area upstream of this flow meter is developed with buildings falling into a variety of zoning categories, including commercial, industrial, multi-family high, and single-family medium. The preliminary flow factors were multiplied by the acreages for each land use designation and adjusted until the flows equaled 0.12 mgd. This process was repeated for each flow meter basin, and weighted flow factors were calculated for each land use category. The resulting basin-specific flow factors and system-wide weighted average flow factors are presented in Section 3.4.3.3.

3.4.3.3 Existing and Future Flow Factors

The existing wastewater flow factors developed for each flow monitoring basin are presented and each land use type is presented in Table 3.4. Column 2 of Table 3.4 presents the system-wide weighted average flow factors. For more information regarding the City's flow monitoring program, see Appendix E - *Hydraulic Model Update* (Carollo 2026).

Table 3.4 Basin-Specific Flow Factors by Land Use Classification Summary (in gpad)

Land Use Type[1]	Average[2]	Basin 5-2-1	Basin 8-1-2	Basin 5-1-2	Basin 4-1-3[3]	Basin STEP
Single Family Low	270	530	N/A	220	520	175
Single Family Medium	380	600	510	320	610	180
Single Family High	620	720	N/A	400	700	190
Multi-Family Low	730	770	N/A	610	800	220
Multi-Family High	750	800	800	700	800	250
Commercial	780	900	790	700	800	250
Industrial	800	950	800	800	800	150
City	700	N/A	N/A	N/A	700	N/A

Notes:
(1) Land use types such as open space, water, parks, and vacant lots are not included in this table as they are assumed to contribute zero flows.
(2) Weighted average flow factors exclude the STEP/WWTF, since this basin operates differently from the rest of the system and represents a septic tank effluent pumping basin rather than a gravity basin. This weighted average flow factors were used to project future flows.
(3) The Goodwin Road LS and Leadbetter Road LS basins were originally included within Basin 4-1-3 during development of the DWF calibration flow factors. As a result, separate DWF flow factors were not developed for these upstream basins after the original Basin 4-1-3 area was subdivided. Instead, the calibrated Basin 4-1-3 flow factors were applied to both the Leadbetter Road LS and Goodwin Road LS basins. The original Basin 4-1-3 area was later divided into three separate basins to better represent the significant upstream inflows identified in the ADS flow monitoring data, and SCADA data from the Leadbetter Road LS and Goodwin Road LS was used to redistribute flows during the wet weather event calibration.
(4) Land Use types shown as zero indicate that those land use categories were not present within the basin.
LS - lift station.

Land uses designated as open space and parks are not shown in Table 3.3 because they are assumed to generate negligible wastewater flow and therefore have a flow factor of zero. Table 3.3 summarizes the wastewater flow factors used to project dry weather flow. The weighted average flow factors shown in the table exclude the Basin STEP because it operates differently from the City's gravity collection system. The exclusion is due to the Basin STEP operating differently since solids are stored on-site and only the liquid effluent is pumped into the City's sewer system.

Basin-specific wastewater flow factors were applied to existing developed land use areas to estimate existing ADWF. For future conditions, the system-wide weighted average flow factors were applied to projected future land use areas to estimate future ADWF. Using the weighted average factors for future projections reflect wastewater generation patterns across the City as a whole, while the basin-specific factors better represent existing conditions within each monitored basin.

3.4.4 Industrial Customer Flows

The City currently has two major industrial customers which must submit industrial discharge monitoring reports to Ecology for various flows, constituents, and characteristics as a condition of their discharge permits. The collective AAF from these contributors is 0.97 mgd with a PDF of 1.1 mgd as shown in Table 3.5. These flows can represent a large portion of influent flows for the WWTF. Flow data was taken from Ecology's Permitting and Reporting Information System (PARIS) data from 2022 to 2025, as reported to and recorded on Ecology's Water Quality Permitting and Reporting Information System.

Table 3.5 Industrial Customer Flows

Industry	MDF (gpd)	PDF (gpd)	AAF (gpd)
TSMC Washington (formerly known Wafertech Industries)(1)	669,774	756,000	688,249
Analog Devices(2)	229,296	368,452	278,222
All Flows	**889,070**	**1,124,452**	**966,471**

Notes:
(1) Flows shown are data from 2025.
(2) Flows shown are data from 2024.
gpd - gallons per day; MDF - minimum daily flow.

Table 3.6 presents the projected flows for the existing, 2045, and buildout conditions. Flows for the two largest water users were estimated using their historical water consumption data and the medium growth projections. The projected water use was multiplied by 95 percent to account for the assumed water-to-sewer return ratio.

Table 3.6 Industrial Customer Projected Flows

Industry	Existing (mgd)	2045 (mgd)	Buildout (mgd)
TSMC Washington (formerly known Wafertech Industries)	0.739	0.884	1.058
Analog Devices	0.249	0.293	0.317
All Flows			

Notes:
(1) Projected sewer flows for the two largest users were developed using historical water consumption data and the medium projected growth scenario, which represents the average of the low and high projected growth scenarios.

3.4.5 Hydraulic Model Dry Weather Flow Projections

Developing an accurate estimate of the future quantity of wastewater generated at buildout of the collection system is an important step in sizing sewer system facilities for future scenarios. Wastewater flow factors, described in Section 3.4.3, and projected developed acreage for each planning period were used to develop wastewater flow projections based on future land use. The projected developed acreage was determined using the City's GIS development map to identify parcels that are currently under development, planned for development, or identified for future development. Parcels identified for development within the City limits were assumed to be developed by 2045 and were included in the corresponding planning period acreage. For buildout conditions beyond 2045, all parcels within the UGA were assumed to be developed and connected to the sewer system. Table 3.7 outlines the projected ADWFs for each flow monitoring basin for current, 2045, and buildout conditions. Figure 3.7 shows parcels and its projected planning growth between existing, 2045, and buildout conditions.

Table 3.7 ADWF for Hydraulic Modelling

Flow Meter Basin	Existing ADWF (mgd)	Projected 2045 ADWF (mgd)	Projected Buildout ADWF (mgd)
5-1-2	0.62	0.86	1.06
5-2-1	0.20	0.44	0.53
4-1-3	0.07	0.07	0.07
8-1-2	0.11	0.11	0.15
WWTF/STEP	1.70	3.00	4.39
Leadbetter Road LS	0.04	0.68	1.02
Goodwin Road LS	0.10	0.17	0.33
Total(1)	**2.85**	**5.32**	**7.55**

Notes:
(1) Totals may not sum due to rounding.

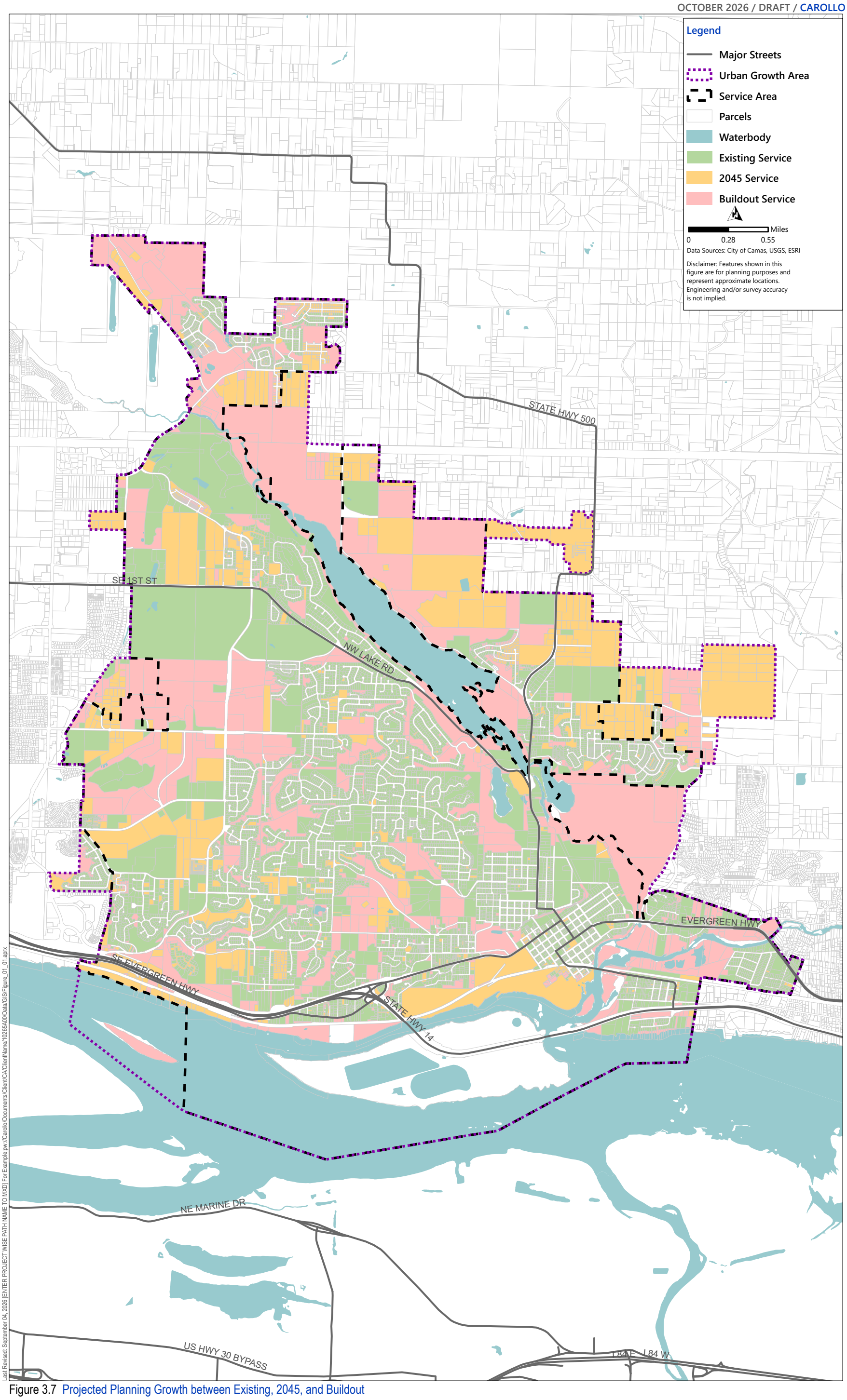


Figure 3.7 Projected Planning Growth between Existing, 2045, and Buildout

3.4.6 Design Storm

Design storms are rainfall events used to analyze the performance of a collection system during peak flows and volumes and have a specific recurrence interval and rainfall duration. The design storm is used for sizing projects. The National Oceanic and Atmospheric Administration (NOAA) publishes isopluvial (rainfall contour) maps[1] that approximate the total rainfall depth for a range of storm size recurrence intervals for standardized storm durations.

The first step in the development or selection of the design storm is to define its recurrence interval and rainfall duration. The recurrence interval is based on the probability that a given rainfall event will occur or be exceeded in any given year. For example, a "100-year storm" means there is a 1 in 100 chance that a storm as large as, or larger, than this event will occur at a specific location in any year. Duration is the length of time in which rainfall occurs.

Discrete storm events are defined as rainfall events separated by a minimum of 48 hours with no precipitation. A 20-year recurrence interval is recommended to match the pump station life cycle sizing in Ecology's Criteria for Sewage Works Design book (Orange Book); therefore, the collection system must also be able to convey a 20-year storm.

The NOAA information is based on older rainfall data and does not provide a hydrograph corresponding to the accumulated rainfall. To identify a suitable storm hydrograph, a statistical analysis of historical rainfall recorded by the City and nearby gauges were conducted. Approximately 20 years of rainfall records from the City's HYDRA Rainfall Network and 60 years of records from Portland International Airport were reviewed to identify a representative historical storm. The December 7, 2015, storm was selected because its rainfall pattern and 24-hour rainfall depth of 3.37 inches provided a reasonable match to the 10-year design rainfall identified by NOAA and was consistent with rainfall records from other regional gauges. Therefore, the December 7, 2015, rainfall pattern was used to develop the 10-year design storm hydrograph shown in Figure 3.8.

[1] Miller, J., R. Frederick, and R, Tracey. Precipitation-Frequency Atlas of the Western United States, Volume IX-Washington. Washington DC, NOAA 1973.

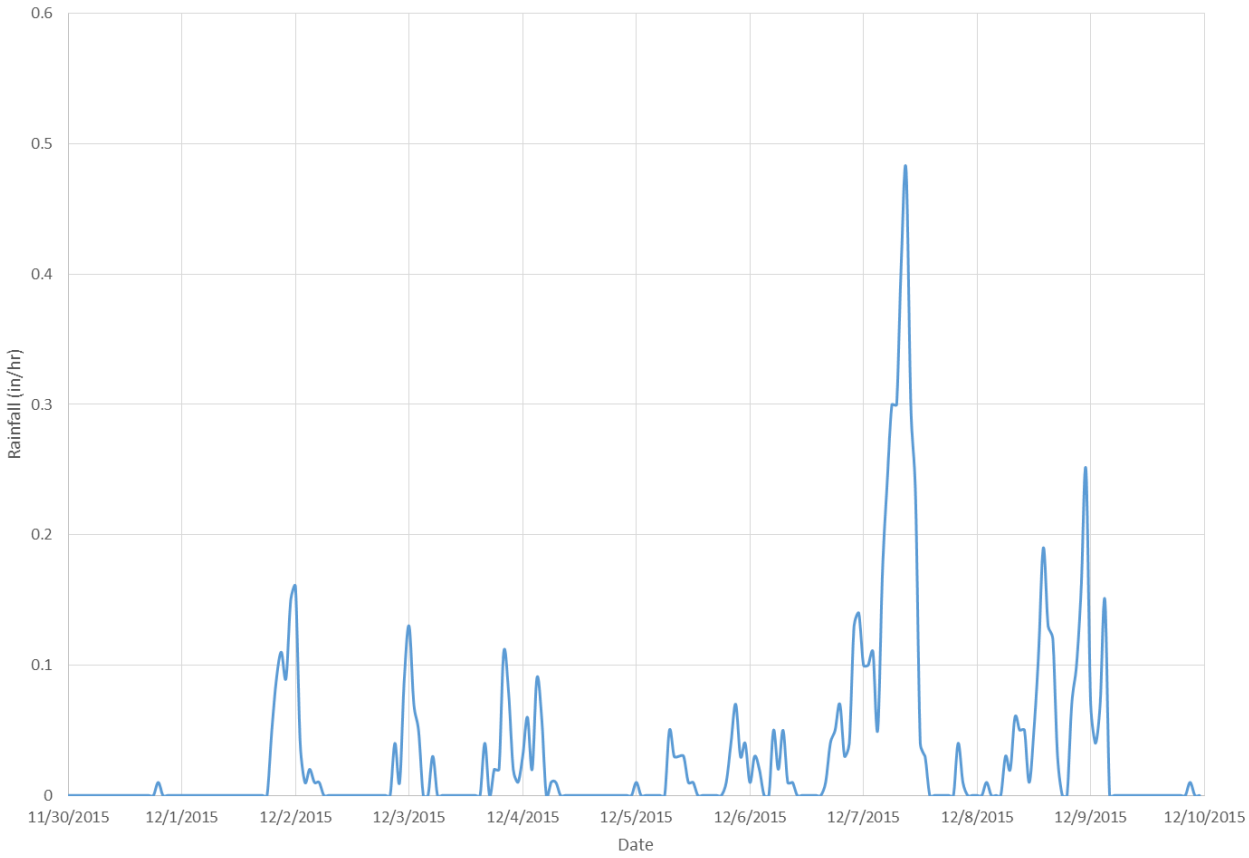


Figure 3.8 Design Storm Hyetograph

3.4.7 Hydraulic Model Wet Weather Flow Projections

The existing STEP Basin flow was estimated using WWTF influent flow data because the basin was not directly monitored. The estimated STEP Basin flow was calculated by subtracting the combined flow measured at the gravity flow monitoring meters from the total flow measured at the WWTF. This estimated flow was used to represent the STEP Basin contribution in the model.

To project future PWWF, I/I within the future service area was defined. No increase in I/I was assumed within the existing service area that are currently sewered parcels, based on the assumption that ongoing maintenance will offset system degradation over time. For future system conditions, additional undeveloped areas within the Urban Growth Boundary, including the Basin WWTF/STEP area and North Shore area were added to the model and assumed to contribute additional I/I to the system. These growth areas were assigned the calibrated I/I parameters from Basin 8-1-2, because Basin 8-1-2 exhibits a relatively low I/I response characteristic of newer infrastructure. This corresponded to an I/I flow rate of approximately 2,000 gpad.

Table 3.8 summarizes the projected PWWF's for each flow monitoring basin under existing, 2045, and buildout conditions. To evaluate the system's unconstrained peak flows, upstream pipes and pump stations were significantly upsized in the model to eliminate hydraulic restrictions; therefore, this is not equal to the actual peak influent flows to the WWTF.

Table 3.8 PWWF Flow Projections for Hydraulic Modelling

Flow Meter Basin	Existing PWWF (mgd)	2045 PWWF (mgd)	Buildout PWWF (mgd)
5-1-2	15.9	17.9	19.4
5-2-1	0.6	1.5	1.7
4-1-3	5.5	7.3	8.3
8-1-2	0.3	0.3	0.4
WWTF(2)	22.9	26.8	35.2
STEP(2)	6.1	7.1	13.7
Leadbetter Road LS	1.1	3.1	4.1
Goodwin Road LS	0.4	0.7	1.3

Notes:
(1) Flows shown are gross peak wet weather flow.
(2) WWTF flows represent measured influent flow at the wastewater treatment facility. STEP Basin flows were estimated by subtracting the combined flows measured at the gravity flow monitoring meters from the total WWTF influent flow.

3.4.8 Hydraulic Model Flow Projections Summary

Table 3.9 presents the total projected ADWF and PWWF for the three planning periods for the modeled portion of the system (gravity and STEP areas upstream of the gravity system). The table also includes the ratio of PWWF to ADWF, referred to as the peaking factor. The peaking factor decreases from 8.04 under existing conditions to 5.04 in 2045 and 4.67 at buildout. This decrease is primarily a result of wastewater flows increasing with projected growth while existing system I/I was held constant. No increase in I/I was assumed for the existing sewered area, based on the assumption that the City's ongoing annual maintenance program will help offset system degradation over time. Note that the flows presented in Table 3.9 are unconstrained flow which represent the maximum flow to the WWTF if all capacity deficiencies are addressed and bottlenecks are removed.

Table 3.9 Flow Projections Summary

Planning Horizon	ADWF (mgd)	PWWF (mgd)	Peaking Factor (PWWF:ADWF)
2025	2.85(1)	22.9	8.04
2045	5.32	26.8	5.04
Buildout	7.55	35.2	4.67

Notes:
(1) The ADWF value shown for 2025 represents ADWF during the flow monitoring period used for the hydraulic model calibration, not the historical dry weather influent flow to the treatment plant of 2.5 mgd.

3.5 Wastewater Treatment Facility Flow and Load Projections

The City's WWTF receives flows from the gravity collection system, septic tank effluent from the City's STEP system, and the septage receiving station.

The WWTF uses different flow parameters for designing and evaluating wastewater process capacity. The influent flow projections developed for the WWTF are consistent with the collection system flow projections and are summarized in Table 3.10. The 2045 PHF projection was developed by multiplying the

projected PDF of 19.3 mgd by a diurnal peaking factor of 3.6 recorded during a peak flow event in January 2024. This peaking factor is based on historical influent flow data and differs from the one presented in Table 3.9 which is a theoretical unconstrained flow.

Table 3.10 WWTF Influent Flow Projection

Flow Parameter	2025 Flow (mgd)	2045 Flow (mgd)
AAF	2.9	5.4
MMF	4.0	7.5
MDF	5.7	10.7
PHF	10.8	20.4
PIDF	11.8	22.2

Wastewater loading data is important for sizing several critical treatment processes. The wastewater loading components of principal interest are the BOD_5, the TSS, and total Kjeldahl nitrogen (TKN). Influent loading projections were developed based on historical influent flows and raw wastewater pollutant concentrations, typical septage and STEP system characteristics, population growth projections and industrial flow contributions. Historical values for BOD_5, TSS, and ammonia (NH_3) and projections to 2045 are detailed in Table 3.11 and Figure 3.9.

Table 3.11 Current and Projected WWTF Loads

Load Parameter	2025 Influent Load (ppd)	2045 Influent Load (ppd)
Sewered Population	30,056(1)	37,080(2)
BOD_5 (ppd)		
Average Annual	3,200	6,000
Maximum Month	4,000	7,500
Maximum Week	4,500	8,500
TSS (ppd)		
Average Annual	3,100	5,800
Maximum Month	3,900	7,300
Maximum Week	4,300	8,100
TKN (ppd) (3)		
Average Annual	1,300	2,500
Maximum Month	1,500	2,800
Maximum Week	1,600	3,000

Notes:
(1) Assuming a growth rate of 1.2 percent per year based on the Camas 2045 Comprehensive Plan.
(2) Sewered population is based on the Camas 2045 Comprehensive Plan.
(3) Influent TKN concentrations are not monitored by the WWTF. Influent TKN values were estimated, assuming an average ratio of NH_3:TKN of 0.7.

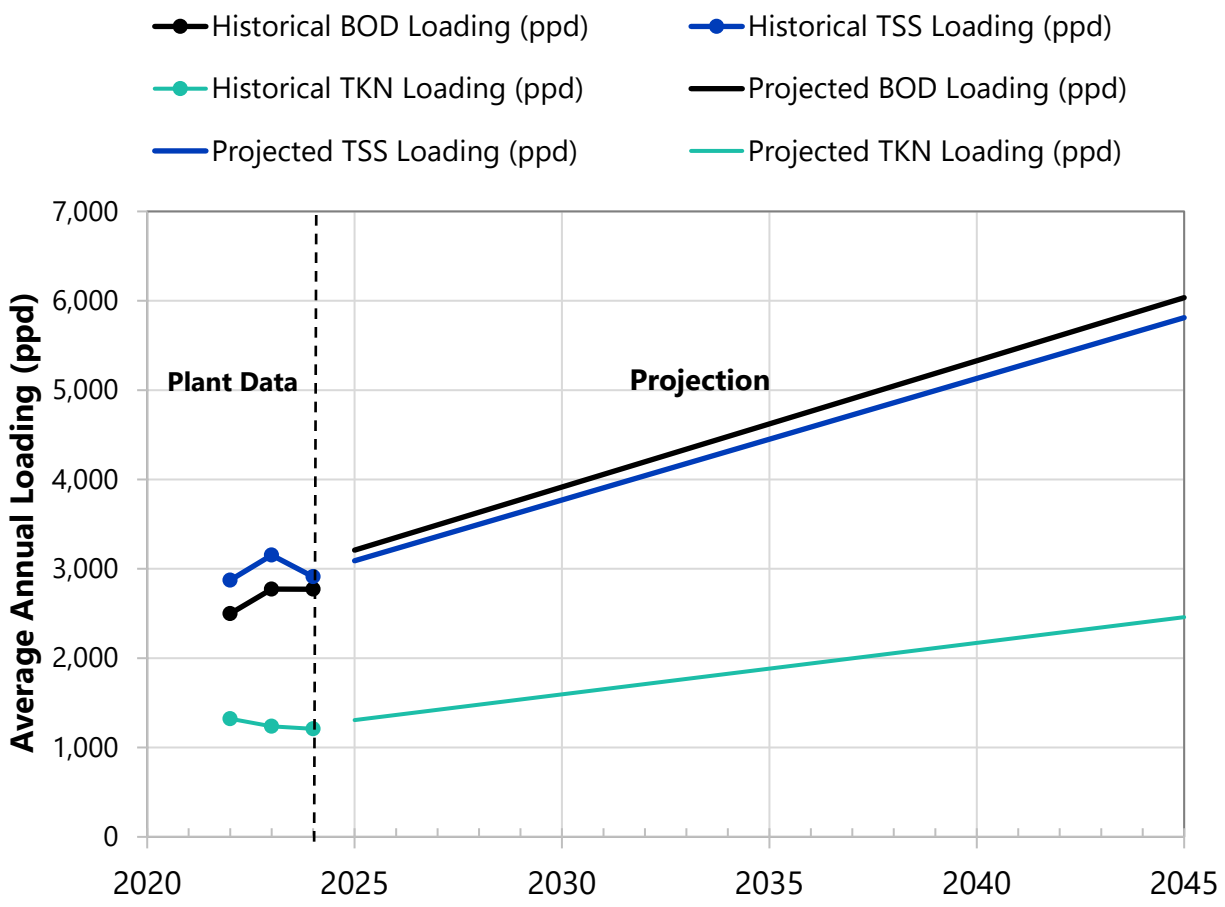


Figure 3.9 Current and Projected WWTF Average Annual Pollutant Loading

CHAPTER 4 EXISTING SYSTEM

4.1 Introduction

The purpose of a sewage collection system is to adequately convey sewage to locations where it can be treated and safely discharged. This chapter describes the City's existing sewer collection system, adjacent sewer service areas, and WWTF. The City's collection system utilizes both conventional gravity sewer with lift stations as well as STEP pumping stations, STEF, and septic tank effluent gravity systems (STEG) to convey wastewater to the WWTF. These systems are influenced by the natural environment, critical areas, and the service area which are summarized in this Chapter.

This chapter will serve as the framework on which to base the GSP, which was last updated in 2024. These considerations establish the basis of planning for the demographic and system analysis which will be the framework for identifying potential for development within the established service area. Consideration for the adequacy of the system to serve the anticipated development within the service area study boundaries is also reliant upon existing system characteristics.

4.2 Sewer Service Area

The City's service area is shown in Chapter 2 - Existing System in Figure 2.1. The service area contains approximately 7,600 acres. The current service area includes the City limits, and the future service area extends to the UGA which totals 9,300 acres. Adjacent sewer systems include City of Vancouver, the Discovery Clean Water Alliance (CWA), and City of Washougal. These systems are described in greater detail in Section 4.5.

4.3 Collection System

The City's sewer system is comprised of four major facility types:

1. Conventional Gravity Sewer.
2. STE Systems - Includes STEP mains less than 21-inches in diameter, STEF, and STEG.
3. STEP Transmission Mains - Includes STEP mains 21-inches in diameter and above.
4. LSs with Force Mains.

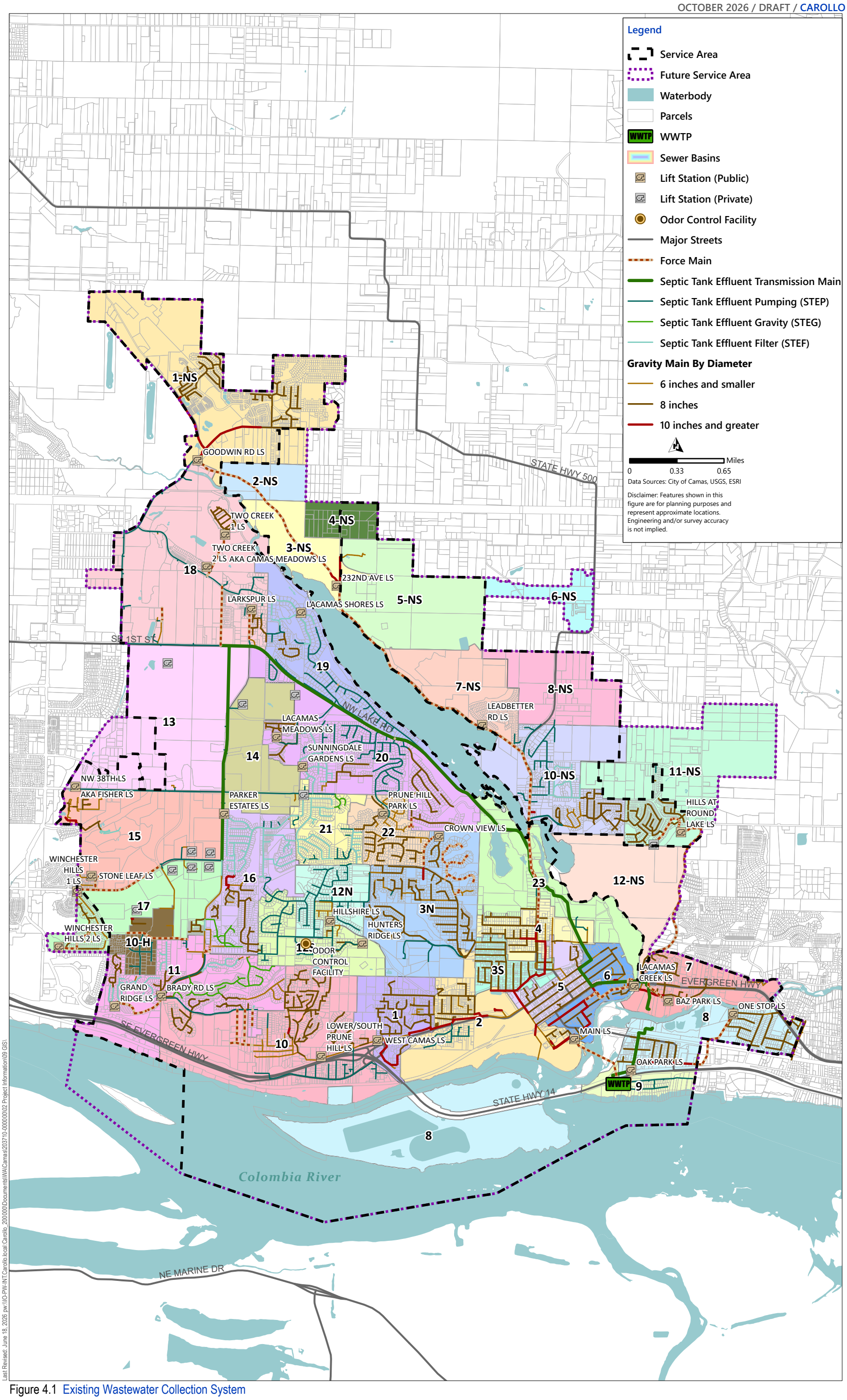
The conventional gravity sewer system is the most common sewer conveyance method in the region and relies on a downward slope throughout the profile to convey flow to a WWTF or intermediate lift station. In addition to the conventional gravity sewer system and lift station, three STE systems are utilized in the City's collection system: STEF, STEG, and STEP, which are explained in further detail in Section 4.3.2. There are 28 lift stations that are located within the service area which convey sewage and STE for treatment where gravity sewers are not effective, as well as one separate remote odor control station. Properties within the sewer service area outside of the gravity sewer portion of the City's collection system use on-site septic tank systems which provide some wastewater treatment, solids settling, and digestion. Similar to lift stations, STEP systems allow service where gravity systems may not be effective, or which were originally located outside the boundaries of a public sewer system service area.

Figure 4.1 and Table 4.1 summarize the City's pipe infrastructure by sewer type, based on data from the City's GIS database. Some pipe segments appear disconnected in Figure 4.1 due to gaps or missing information in the GIS records. As previously noted, the infrastructure is predominantly gravity sewer (405,500 feet) while the STE systems account for 290,019 feet. Figure 4.2 shows the direction of flow through the collection system.

Table 4.1 Summary of Pipe Infrastructure by Type

Sewer Type	Pipe Length (feet)	Pipe Length (miles)
Gravity Main	405,499	76.8
Force Main(1)	65,218	12.4
STEP Transmission Main	20,449	3.9
STEP Main	191,742	36.3
STEF Main	63,524	12.0
STEG Main	14,304	2.7
Total	**760,736**	**144.1**

Notes:
(1) Force main pipe length was determined by incorporating both existing GIS data and newly drawn force main segments identified in the North Shore area.



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Figure 4.1 Existing Wastewater Collection System
CITY OF CAMAS
GENERAL SEWER PLAN

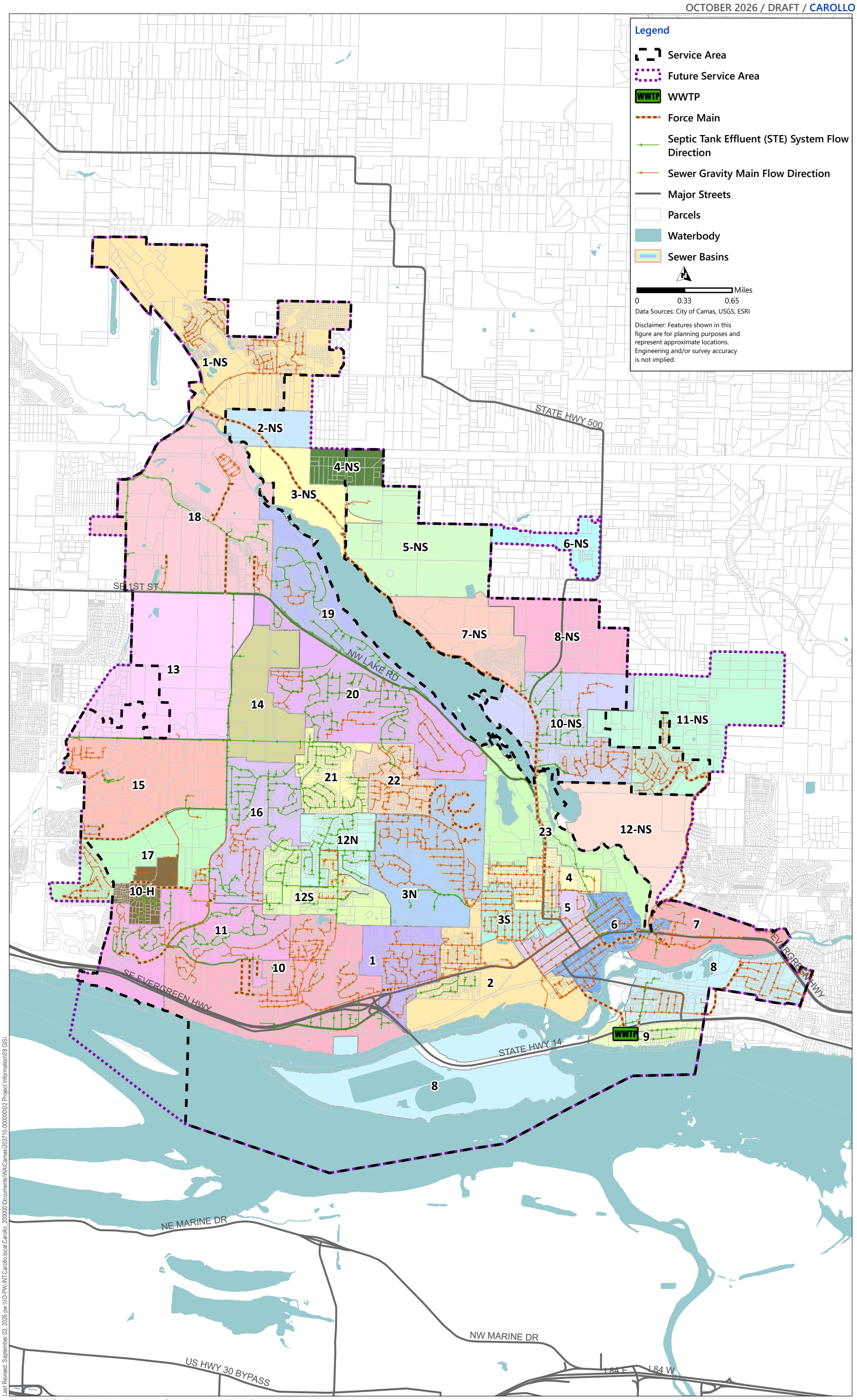


Figure 4.2 Existing Wastewater System with Flow Direction

4.3.1 Gravity System

Portions of the system served by conventional gravity sewers date from its beginning in the 1920's and includes the following basins identified in Figure 4.1: Downtown, Oak Park, Parkers Landing, basins along the Columbia River and State Route (SR) 14, and portions of Prune Hill (Basin 2, 3S, 4, 5, 6, 8, 10, and 11). The North Shore area is and will continue to be served by conventional gravity sewers. A new transmission main for the North Shore was constructed in December 2018.

The earliest portions of the gravity sewer system were constructed with vitrified clay pipe (VCP). Much of this VCP was later replaced with cast iron, concrete, and eventually polyvinyl chloride (PVC). Therefore, the relative age of sanitary sewer can be identified by the material type. The system utilizes a pipe diameter ranging from 4 inch to 24-inch segments where the majority of the system is 8 inches or less in diameter. A summary of pipe infrastructure by diameter is shown in Table 4.2.

Table 4.2 Summary of Gravity Sewer Infrastructure by Size

Pipe Diameter (inches)	Pipe Length (feet)	Pipe Length (miles)
8 inches and below	295,393	55.9
10	9,809	1.9
12	13,769	2.6
15	2,365	0.4
18	2,772	0.5
20	259.1	0.0
21	2,345	0.4
24	370.9	0.1
Other	976	0.2
Unknown(1)	77,441	14.7
Total(2)	**405,500**	**76.8**

Notes:
(1) Pipes with unknown diameter also include segments where the diameter field is null.
(2) Totals may not exactly match due to rounding.

4.3.2 STE Systems

Starting in 1985, the City required new customers in the western portion of the service area to be served using the STE system. Due to the City's topography and shallow bedrock, the STE systems allowed the City to serve areas without the costly installation of gravity sewers. The three STE systems address site specific challenges within the City's collection system. STEP systems consist of a septic tank equipped with a pump at the outlet to convey effluent flows to the STEP transmission main, rather than an on-site drain field. STEG systems consist of a septic tank with an outlet that conveys effluent flows by gravity to the STE transmission main. STEF systems utilize a siphon to convey effluent flows to the STE transmission main. Figure 4.1 shows the STEF, STEG, and STEP systems and STE transmission mains within the City's conventional gravity collection system.

The City owns and maintains the residential STE systems described above. The City pumps out the septage from the STE systems on a 5 to 7-year cycle. Commercial and Industrial systems are owned and maintained by the property owner. The City receives and treats septage from all systems at the WWTF. STE system pipes are shown on Figure 4.1 designated as STEP, STEF or STEG.

Table 4.3 Summary of STE Infrastructure by Size

Pipe Diameter (inches)	Pipe Length (feet)	Pipe Length (miles)
8 inches and below	215,383	40.8
10	23,111	4.4
12	4,586	0.9
18	2,535	0.5
20	2,932	0.6
24	3,338	0.6
Unknown(1)	17,111	3.2
Total(2)	**21,024**	**4.0**

Notes:
(1) Pipes with unknown diameter also include segments where the diameter field is null.
(2) Totals may not exactly match due to rounding.

4.3.3 STEP Transmission Main

The STEP transmission main is a transmission main that conveys STE system flows and major industrial dischargers to the WWTF. The pressurized transmission main is shown in Figure 4.1; the STEP transmission main is approximately 34,402 linear feet in length and is 21-inches to 24-inches in diameter. The transmission main conveys flow directly to the WWTF and does not receive flows from other sewer systems.

4.3.4 Lift Stations

The City currently operates 28 LS whose characteristics are summarized in Table 4.4. Of these 28 lift stations, 13 serve the gravity system and 15 serve the STE systems. Lift stations are identified in Figure 4.1. There are approximately 65,218 feet, or 12.4 miles, of force main associated with the lift station ranging from 4-inches to 18-inches in diameter. The majority of lift stations serve relatively small service areas and have capacities of less than 500 gallons per minute (gpm). The North Shore is served by three lift stations: Goodwin LS, 232nd Avenue LS, and Leadbetter LS which were installed in December 2018. The Main LS, with a capacity of 7,700 gpm, conveys the majority of the gravity system to the WWTF through an 18-inch diameter force main under Lacamas Creek.

4.3.5 Odor Control Station

The City operates two odor control stations located at 325 NE 23rd Avenue in Basin 23 and 2806 NW 18th Avenue in Basin 12. The stations' purpose within the collection system is to mitigate nuisance odors associated with the collection system. These facilities help improve air quality near sewer facilities and reduce potential impacts on nearby residents and businesses. The stations are not designed to provide flow conveyance or pumping capacity.

Table 4.4 Summary of Lift Stations

Lift Station		Location	Basin Number	STE or RAW	Number of Pumps	Pump Motor Size (HP)	Pump Capacity (gpm, each)	Total Station Capacity (gpm, 1 standby)	TDH (feet)
1	232nd Avenue	Near 618 NE 232nd Avenue	3-NS	RAW	2(1)	15.2	365	365	87
2	Baz Park	1906 NE 3rd Loop	7	RAW	2	7.5	488	488	38
3	Brady Road	919 NW Brady Road	11	STE	2	35	511	511	60
4	Camas Meadows	6902 NW Morgan Way	20	STE	2	35	221	221	222
5	Crown View	3222 NW Ivy Lane	3N	RAW	2	20	222	222	124
6	Fisher (NW 38th Ave)	5870 NW 38th Avenue	13	STE	2	23	126	126	206
7	Goodwin Rd	2305 NE Goodwin Road	1-NS	RAW	2(1)	15.2	300	300	94
8	Grand Ridge	843 NW Grande Ridge Road	11	STE	2	11	133	133	160
9	Hills at Round Lake	1960 NE Tanoak Drive	11-NS	STE	2	11	256.9	256.9	93.2
10	Hillshire	2303 NW Artz Court	12S	RAW	2	10	175	175	70.1
11	Hunters Ridge	2021 NW 17th Avenue	12S	RAW	2	23	152	152	174
12	Lacamas Creek	1641 NE 3rd Avenue	6	RAW	2(1)	25	950	950	67
13	Lacamas Meadows	3263 NE 45th Avenue	20	STE	2	23	173	173	203
14	Lacamas Shores	6230 NW El Rey Drive	19	STE	2	23	195	195	168
15	Larkspur	6162 NW Larkspur Street	18	STE	2	23	264	264	154
16	Leadbetter Rd	1050 SE Leadbetter Road	7-NS	RAW	2(1)	26.6	605	605	111
17	Lower (aka South) Prune Hill	2381 NW 6th Place	10	RAW	2	10	600	600	39
18	Main Station	480 SE 3rd Avenue	6	RAW	3	125	3850	7700	85
19	Oak Park	907 SE Polk Street	8	RAW	2	10	350	350	57
20	One Stop	200 SE Yale Street	8	RAW	2	5	231	231	36.2
21	Parker Estates	3436 NW Parker Street	16	STE	2	20	339	339	103
22	Prune Hill Park	3403 NW Sierra Drive	22	STE	2	7.5	350	350	53
23	Stone Leaf	5713 NW 26th Avenue	15	STE	2	23	423	423	81.2
24	Sunningdale Gardens	4043 NW Dahlia Loop	20	STE	2	10	260	260	63
25	Two Creeks	7402 NW Morgan Way	18	STE	2	10	166	166	70.7
26	West Camas	1625 NW 6th Place	1	RAW	2	30	1000	1000	74
27	Winchester Hills 1	19617 SE 34th Street	17	STE	2	6.5	97.9	97.9	66.7
28	Winchester Hills 2	19320 SE 42nd Circle	17	STE	2	5	125	125	65

Notes:
(1) Two pumps installed; space for a third pump.
HARL - Hills at Round Lake; HP - horsepower.

4.4 Drainage Basins

This section summarizes the previously discussed system elements in the context of the drainage basins in the City's sewer service area. The attributes of the 23 flow basins are summarized in Table 4.5.

Table 4.5 Drainage Basin Attributes

Drainage Basin No.	Flow Meter Basin	Area (acres)	Connected Acreage	No. of LS	Miles of Sewer			
					Total STE	Gravity	Force Main	Total[1]
1	5-1-2	169	80.3	1	-	3.8	0.09	3.9
2	5-1-2	341	65.2	0	0.95	3.8	-	4.7
3N	5-1-2	398	231.5	1	1.00	6.4	0.94	8.3
3S	5-1-2	91	57.1	0	-	3.2	-	3.2
4	4-1-3	117	82.4	0	0.94	3.2	0.11	3.4
5	5-1-2	99	56.0	0	0.04	3.4	-	3.5
6	5-2-1	128	68.1	2	0.49	3.8	0.73	5.5
7	5-2-1	174	66.5	1	0.23	2.2	0.15	2.8
8	8-1-2	477	120.7	2	0.53	5.0	0.37	6.4
9	8-1-2	87	30.3	0	0.83	0.1	0.50	1.5
10	5-1-2	622	241.2	1	2.27	7.0	0.63	9.8
10-H	5-1-2	78	60.7	0	0.72	0.2	0.43	1.4
11	5-2-1	394	182.1	2	5.23	3.6	0.65	9.6
12N	WWTF/STEP	134	92.6	0	3.52	0.0	-	3.2
12S	5-1-2	192	96.8	2	2.44	1.3	-	4.1
13	WWTF/STEP	557	285.2	1	1.45	0.0	0.00	2.0
14	WWTF/STEP	235	92.2	0	1.04	0.1	-	1.5
15	WWTF/STEP	383	126.3	1	1.92	1.7	0.39	4.0
16	WWTF/STEP	274	129.5	1	4.68	2.5	0.00	7.5
17	WWTF/STEP	254	84.5	2	0.20	2.9	0.66	3.7
18	WWTF/STEP	671	345.8	3	3.88	1.9	1.21	7.0
19	WWTF/STEP	267	181.4	1	5.60	0.5	0.00	5.1
20	WWTF/STEP	461	213.7	2	7.21	4.2	0.02	14.6
21	WWTF/STEP	139	86.1	0	3.74	-	-	3.7
22	WWTF/STEP	128	86.0	1	0.27	3.4	0.26	3.9
23	WWTF/STEP	295	60.9	1	1.18	0.7	0.02	4.5
1-NS	Goodwin Road	615	89.3	1	0.03	5.8	-	5.9
2-NS	Leadbetter Road	90	0.0	0	-	-	-	-
3-NS	Leadbetter Road	157	0.0	1	-	2.9	0.46	3.3
4-NS	Leadbetter Road	79	0.0	0	-	-	-	-
5-NS	Leadbetter Road	364	34.0	0	-	1.6	-	1.6

Drainage Basin No.	Flow Meter Basin	Area (acres)	Connected Acreage	No. of LS	Miles of Sewer			
					Total STE	Gravity	Force Main	Total[1]
6-NS	Leadbetter Road	83	0.0	0	0.00	-	-	-
7-NS	Leadbetter Road	215	14.2	1	0.09	2.1	0.57	2.8
8-NS	Leadbetter Road	93	36.7	0	-	-	-	-
9-NS	Leadbetter Road	119	0.0	0	-	-	-	-
10-NS	WWTF/STEP	345	193.4	0	4.38	3.4	1.33	9.3
11-NS	5-2-1	500	65.1	1	0.05	3.0	0.52	3.6
12-NS	5-2-1	270	0.0	0	-	0.2	3.75	4.0
				Total[1]	**54.9**	**76.8**	**12.4**	**144.1**

Notes:
(1) Totals may not match exactly due to rounding.

4.5 Wastewater Treatment Facility

The City's WWTF is located along the Columbia River in the southeastern portion of its sewer service area. The WWTF was originally constructed in 1972 and has had several modifications since that time. The first major upgrade and expansion of liquid stream processes was completed in February of 2000. A subsequent Phase 2A upgrade, primarily addressing solids treatment, including anaerobic digesters and sludge drying facilities, was completed in 2012. Phase 2B, completed in 2014, improved blower controls, added a third secondary clarifier, new effluent filters, and digester gas treatment facilities. The WWTF will soon undergo a significant upgrade project to replace the internal mechanism of the two primary clarifiers, new sludge degritting system, install second dewatering centrifuge, new septage receiving and screening equipment, replacement of two of the multi-stage centrifugal blowers with high-speed turbo blowers and associated controls modification, new emergency generator, and new UV disinfection system to increase the efficiency of plant equipment.

The facility process flow diagram is shown in Figure 4.2. An aerial view of the WWTF with each unit process and building identified is shown in Figure 4.3. The liquid stream treatment begins with climbing bar screens at the plant headworks to remove larger material which is washed, compacted, and disposed of at a landfill. Primary solids-liquid separation occurs in two circular primary clarifiers with the primary effluent discharging to a splitter box where it is combined with RAS from the secondary clarifiers (SC) and split between three aeration basins (AB), where biomass is aerated to promote biological oxidation and improve water quality. Secondary treatment in the ABs consists of influent channel selector zones followed by two anoxic and three aerobic zones to remove carbonaceous material and reduce ammonia concentrations. Magnesium hydroxide ($Mg(OH)_2$) is added at the SC splitter box to provide supplemental alkalinity.

Mixed liquor from the three ABs is combined and split between three secondary clarifiers. The three clarifiers provide separation of the biomass from the secondary treatment processes (termed activated sludge) and discharge of liquid effluent to two mechanical disc filters. UV disinfection is provided in an open channel system with four banks of UV lamps prior to discharge to the outfall in the Columbia River. One of the SCs is not used due to its flat bottom.

The effluent either flows by gravity or is pumped to the outfall via the three effluent pumps, which are operated in a two duty and one standby configuration. Transitions between gravity and pumped effluent

flow are performed automatically when the pumps are placed in "auto" mode. When the Columbia River level rises, gravity effluent discharge is stopped by closing the flap gate in the effluent manhole. The existing outfall is a 36-inch corrugated metal pipe (CMP) and extends approximately 850 feet south into the Columbia River channel. The diffuser portion of the outfall is located along the outer 150 feet of the pipe and is equipped with 16 vertical risers, each oriented vertically with rubber Tideflex check valve-type nozzles. The vertical risers discharge effluent perpendicular to the flow of the Columbia River.

Solids from the primary clarifiers are first conveyed to two hydro-cyclones and a classifier for degritting then thickened in the gravity thickener. Thickened primary sludge (TPS) is then pumped to anaerobic digesters. Solids from the secondary clarifiers are moved by a sludge-scraper mechanism to a wet well and then withdrawn by pumps. The settled solids (RAS) are pumped back to the aeration basin splitter box. Excess activated sludge wasted (WAS) from all three secondary clarifiers is sent to a storage tank and thickened in a rotary drum thickener. Thickened primary and secondary solids are then combined in anaerobic digesters for stabilization, reduction of volatile solids, and production of biogas. Dewatering of the digested sludge is accomplished through a centrifuge and then conveyed to a belt dryer, which evaporates most of the remaining water content in the biosolids. The dewatered and dried biosolids are dried to achieve Class A and are hauled off-site for land application.

Odors are controlled at the plant through unit-specific odor control ductwork. Air from the digesters and sludge holding tank is filtered through a hydrogen sulfide (H_2S) scrubber with a bark media bed. Other orders from the process (centrifuge room, grit room, influent channel, etc.) are blown through a biofilter bed located to the west of the dryer building.

The unit capacity for each major component at the WWTF is summarized in Table 4.6.

Table 4.6 Unit Process Capacity

Unit	Number of Units	Design Criteria[1]
Bar Screens		
Climbing Bar Screens	2	▪ Perforation Size: 1/4 inches (6 mm)
Manual Coarse Bar Screen (Bypass)	1	▪ Bar Spacing: 3/4 inches (19 mm)
Primary Clarifiers	2	▪ Diameter: 60 feet (each) ▪ Depth: 10 feet ▪ Volume: 211,500 gallons (each)
Aeration Basins	3	▪ Volume: 100,800 ft^3 (each)
Aerobic	3	▪ Total Volume: 176,400 ft^3
Anoxic	2	▪ Total Volume: 108,360 ft^3
Selector (SAx)	3	▪ SAx-1 Volume: 2,700 ft^3 ▪ SAx-2 Volume: 1,600 ft^3 ▪ SAx-3 Volume: 4,500 ft^3 ▪ SAx-4 Volume: 9,000 ft^3

Unit	Number of Units	Design Criteria[1]
Secondary Clarifiers		
SC No. 1	1	▪ Diameter: 75 feet ▪ Depth: 13 feet ▪ Volume: 424,000 gallons
SC No.2	1	▪ Diameter: 75 feet ▪ Depth: 17 feet ▪ Volume: 461,800 gallons
SC No.3	1	▪ Diameter: 75 feet ▪ Depth: 14 feet ▪ Volume: 462,700 gallons
Effluent Disc Filters	2	▪ Capacity: 3.0 mgd (each)
UV Disinfection[1]	4	▪ Peak Day Process Flow: 10.04 mgd
Hydrocyclones	2	▪ Capacity: 220 gpm
Gravity Thickener	1	▪ Diameter: 30 feet ▪ Depth: 10 feet
Anaerobic Digesters	2	▪ Volume: 24,500 ft^3 (each)
Centrifuge	1	▪ Capacity: 130 gpm
Rotary Screen Thickener	1	▪ Capacity: 100-300 gpm

Notes:
ft^3 - cubic feet; mm - millimeter.

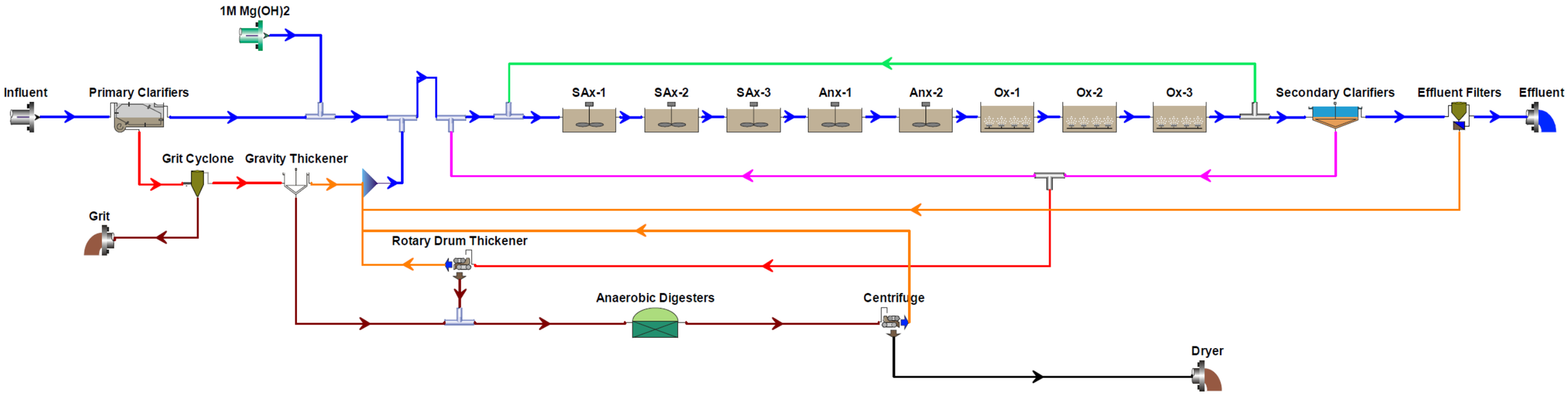


Figure 4.3 BioWin Process Flow Diagram



Figure 4.4 WWTF Aerial Image with Site Plan

4.5.1 Recent Plant Upgrades

Several upgrades have taken place at the WWTF since the previous GSP (Carollo, 2024), which have improved the plant's efficiency and reliability:

- WWTP UV Disinfection Improvements (HDR TO4):
  - Replacement of the primary sludge grit classifiers.
  - Install a second dewatering centrifuge.
  - Increase in the septage receiving capacity with new screen.
  - Replacement of two of the multi-stage centrifugal blowers with high-speed turbo blowers and associated controls modification to have two turbo blowers operate in tandem with two centrifugal blowers.
  - Replacement of the internal mechanisms in the primary clarifiers with all 316 stainless steel (SS).
  - Replacing the UV disinfection system with new UV equipment and controls.
  - Moving the electrical generator out of the Equipment Building.

Additionally, the plant recently had the channels in the headworks structure rehabilitated (recoated) due to extensive damage to the concrete from H_2S.

4.5.2 Plant Flows

The WWTF receives influent flows from the Main and Oak Park pump stations and a septage truck unloading station. STEP flows in the collection system are conveyed to the plant and intersect the Main line just before the influent structure. The combined flow from the STEP system, the pump stations, and septage truck unloading station are measured by a Parshall flume. The combined flow measured by the Parshall flume is recorded as the WWTF influent flow.

The WWTF has a three-year AAF of 2.73 mgd from the collection system with approximately 33 percent of the AAF from industrial users. This relatively high percentage of industrial users increases the influent ammonia concentrations but decreases the TSS and biochemical oxygen demand (BOD) concentrations resulting in a high nitrogen and low carbon influent compared to a typical municipal facility. The previously described STEP and STEF system contributes nearly 60 percent of the average day dry weather influent flows (which includes the 33 percent of flow from industrial users) also contributes to unique influent characteristics when brought into the facility due to an estimated 35 percent reduction of BOD in the 5-day test (BOD_5) and a 60 percent reduction of TSS in the septic tank.

Although septic tank solids are also returned to the facility through septic delivery, these solids also have reduced BOD_5 and TSS loadings due to the nearly five-year detention time. NPDES effluent discharge limitations, prohibitions, and requirements are similar to other municipal facilities with standard 30/30 monthly TSS and BOD concentration limits with a mandatory 85 percent reduction in each. However, the WWTF has ammonia limits of 20 mg/L (NH_3 as N) in the summer and 7 mg/L (NH_3 as N) in the winter.

4.5.3 NPDES Violations

The current NPDES permit became effective on August 1, 2025, and will expire on July 31, 2030. From 2019 to 2024 the plant had eight permit violations all involving reported low effluent pH values which were caused by default readings during the cleaning and calibration of the effluent pH probe. The WWTF has a minimum effluent pH requirement of 6.0; however, the probe defaults to a value of 3.0 when being cleaned. As the low readings were caused by instrumentation error and not actual effluent violations, there was no enforcement action necessary.

4.6 Adjacent Sewer Service Areas

Four sewer service areas with their own WWTFs are within a 20-mile radius of the Camas WWTF. All of the facilities listed in Table 4.7 have Columbia River outfalls. Distances vary from the closest, Washougal WWTF, approximately 3.5 miles away, to the farthest, Salmon Creek WWTF, approximately 20 miles away.

Table 4.7 Adjacent Service Areas WWTFs

Facility/Service Area	MMF (mgd)	Biological Treatment Process	Disinfection	Biosolids
Salmon Creek (Clark County)	10.3	Aeration Basins	UV	Land Applied
Marine Park (Vancouver)	16.1	Aeration Basins	UV	Incinerated
Westside (Vancouver)	28.3	Aeration Basins	UV	Incinerated
Washougal	2.2	Oxidation Ditch	UV	Lagoon

All of these nearby treatment facilities utilize activated sludge treatment processes and UV disinfection; however, the greatest variation in treatment can be seen in the processing of biosolids. Salmon Creek WWTF operates similarly to Camas through the land application of biosolids. Marine Park and Westside incinerate solids produced at those City of Vancouver facilities.

4.6.1 City of Vancouver

The City of Vancouver currently uses 716 miles of sanitary sewer and forty-one pump stations to convey sewage to Vancouver's Marine Park and Westside WWTFs. Vancouver's collection system is divided into three basins currently: the Westside Basin, Eastside Basin, and Diversion Basin. Wastewater generated in the Eastside Basin is conveyed to and treated exclusively at the Marine Park facility. Diversion Basin wastewater is conveyed to and treated at either the Marine Park or Westside WWTF. Westside Basin sewage is conveyed to and treated exclusively at the Westside Treatment Facility.

The largest nearby treatment facility is Westside in Vancouver at 28.3 mgd average annual flow. Altogether, Marine Park and Westside WWTFs serve 200,000 residents per 2025 census data. Currently, Marine Park does not treat its solids on-site and instead conveys them to Westside through a force main and gravity sewer. Once at Westside, a fluidized bed furnace incinerates scum and solids from the primary and secondary clarifiers at both plants.

4.6.2 City of Washougal

The City of Washougal currently operates fourteen LS throughout the City and conveys sewage through more than 1.5 miles of force mains to the Washougal Treatment Plant. The treatment plant consists of an oxidation ditch followed by a secondary clarifier and UV disinfection. Similar to other plants in the region, effluent is discharged to the Columbia River.

4.6.3 Clark County

Clark County formed the Discovery CWA in January 2013 to provide framework for regional wastewater collection. The CWA serves unincorporated Clark County, the City of Battle Ground, the City of Ridgefield, and Clark Regional Wastewater District.

Nearby Salmon Creek WWTF is part of the CWA and serves approximately 100,000 residents. Although the average annual flow is typically between 8-10 mgd, the plant has the capacity to treat up to 15 mgd. Future expansion is underway to improve the Columbia River outfall as well as increase capacity to 17.5 mgd. Odor control will be built as well due to odorous air present particularly during the summer and early fall.

4.7 Natural Environment and Critical Areas

Topics considered to describe the existing system's natural environment include topography, soils and geology, and climate including rainfall. Critical areas within the natural environment highlight the connection between the sewer system and these characteristics. Critical areas include wetlands, critical aquifer recharge areas (CARA), geologically hazardous areas, frequently flooded areas, and fish and wildlife habitat conservation areas.

4.7.1 Natural Environment

Relatively steep topography with slow to moderate infiltration rates comprise a majority of the City's geography. The City enjoys moderate temperatures between the average high of 62°F and average low of 37°F. Heavy rainfall, characteristic of the Pacific Northwest region, provides an average annual precipitation of 50 inches while snowfall is not typically heavy, annually averaging 9 inches.

4.7.1.1 Topographical Characteristics

As shown in Figure 4.4, elevation ranges from slightly above sea level (20 feet) to greater than 750 feet in the City. Steep slopes comprise a large portion of the landscape which range from 5 to 15 percent. A relatively flat plateau is present at the most central portion of the City near Prune Hill while the older, denser zones lie along the Columbia River. Similarly, the UGA was developed on a steep slope with a plateau at 470 feet elevation residing just outside of the City Limits.

4.7.1.2 Soils and Geology

According to the National Resources Conservation Service, Clark County is approximately 5 percent cinebar stony silt loam with 30 to 70 percent slopes. However, the City has a much higher percentage of Lauren gravelly loam from 0 to 8 percent slopes and Hesson Clay loam from 0 to 8 percent slopes. These soil types are categorized as hydrological soil groups B and C, respectively, which indicate slow to moderate infiltration rates when wet with a slow to moderate rate of water transmission. This indicates moderate runoff coefficients for the region. Additional details on the soil groups are available in Figure 4.6.

4.7.1.3 Climate

The City's climate is characterized by a combination of rainfall, wind, and temperature patterns for the nearby region. The average high temperature is 62°F and the average low is 37°F. The temperature is known to vary from 36°F to 84°F throughout the year with a warm season from June to September. Altogether, summers last approximately three months with warm weather and winters are cold with the heaviest rainfall occurring in late November or early December.

Historical precipitation data was gathered from Airport Way No.2 Rain Gage (Station 111) of the City of Portland HYDRA Rainfall Network and a rain gauge installed by ADS. The average three and a half-year rainfall patterns indicate the November through February period average 5 inches per month or more with a peak in January at approximately 10.1 inches. The maximum annual rainfall occurred in 2022 at 54.61 inches total which is 12.3 percent greater than the 2022-2025 average. The driest month of the year is typically July with less than one inch of rainfall recorded between 2022 and 2024. The average annual rainfall patterns are detailed in Table 4.8. Average annual snowfall is 9 inches, and average annual precipitation is approximately 50 inches.

Table 4.8 City of Portland Airport Way 2 Pump Station (Hydra 111) Precipitation 2022-2025

Year	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec	**Annual**
2022	7.25	3.28	5.69	7.1	5.77	4.47	0.3	0	0.28	4.27	7.16	9.04	**54.61**
2023	3.84	2.64	5.84	6.54	0.96	1.3	0.04	0.57	1.97	2.81	6.95	9.33	**42.79**
2024	10.1	5.25	4.08	2.38	3.61	1.5	0.11	0.76	1.77	3.71	8.51	7.55	**49.33**
2025(1)	3.48	5.91	5.95	1.85	-	-	-	-	-	-	-	-	**17.19**
Average	**6.17**	**4.27**	**5.39**	**4.47**	**3.45**	**2.42**	**0.15**	**0.44**	**1.34**	**3.60**	**7.54**	**8.64**	**47.87**
Minimum	**3.48**	**2.64**	**4.08**	**1.85**	**0.96**	**1.3**	**0.04**	**0**	**0.28**	**2.81**	**6.95**	**7.55**	**31.94**
Maximum	**10.1**	**5.91**	**5.95**	**7.1**	**5.77**	**4.47**	**0.3**	**0.76**	**1.97**	**4.27**	**8.51**	**9.33**	**64.44**

Notes:
(1) Rain Gauge data obtained from Camas Flow Monitoring 2025 by ADS dated May 28, 2025.

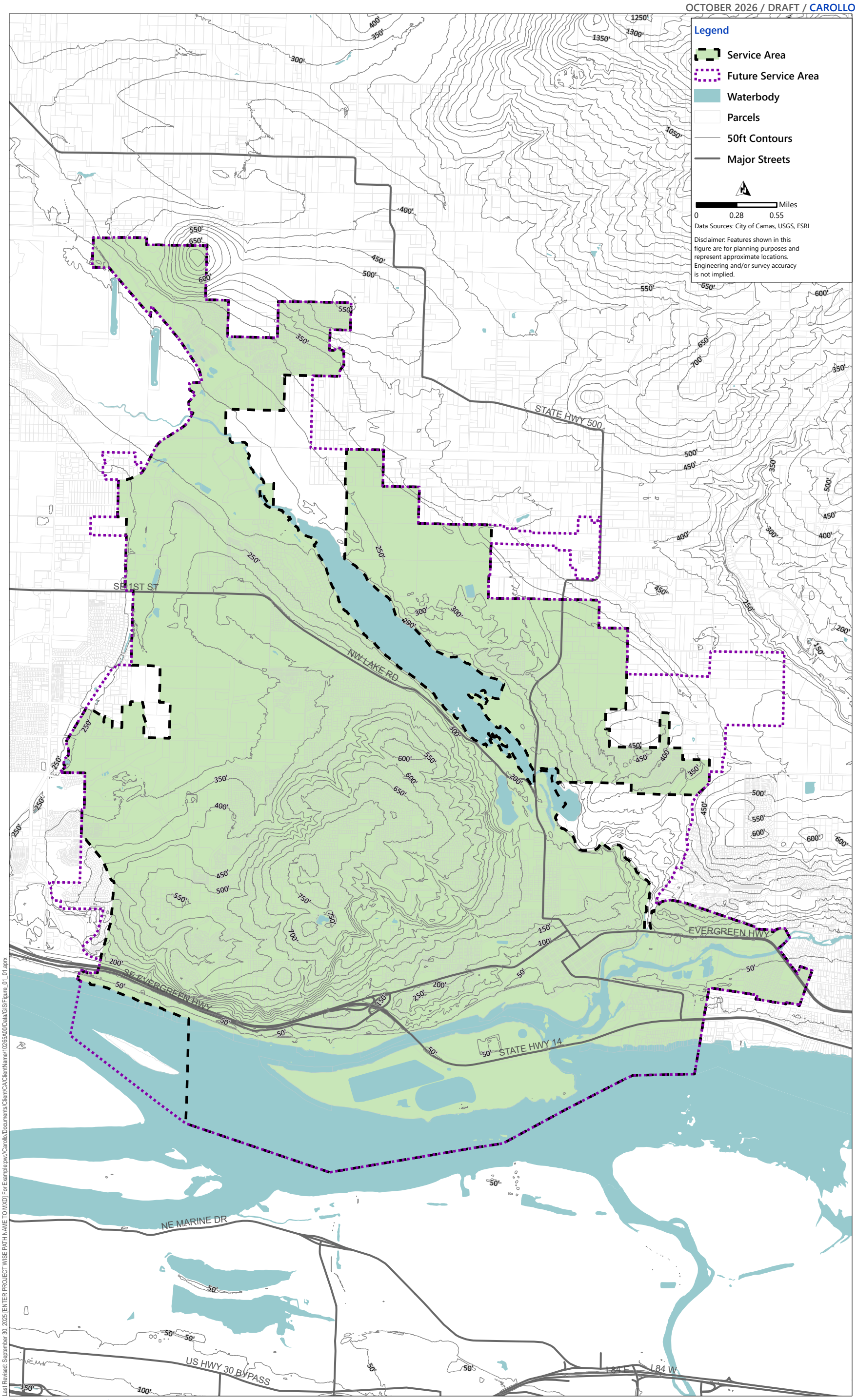


Figure 4.5 Topography

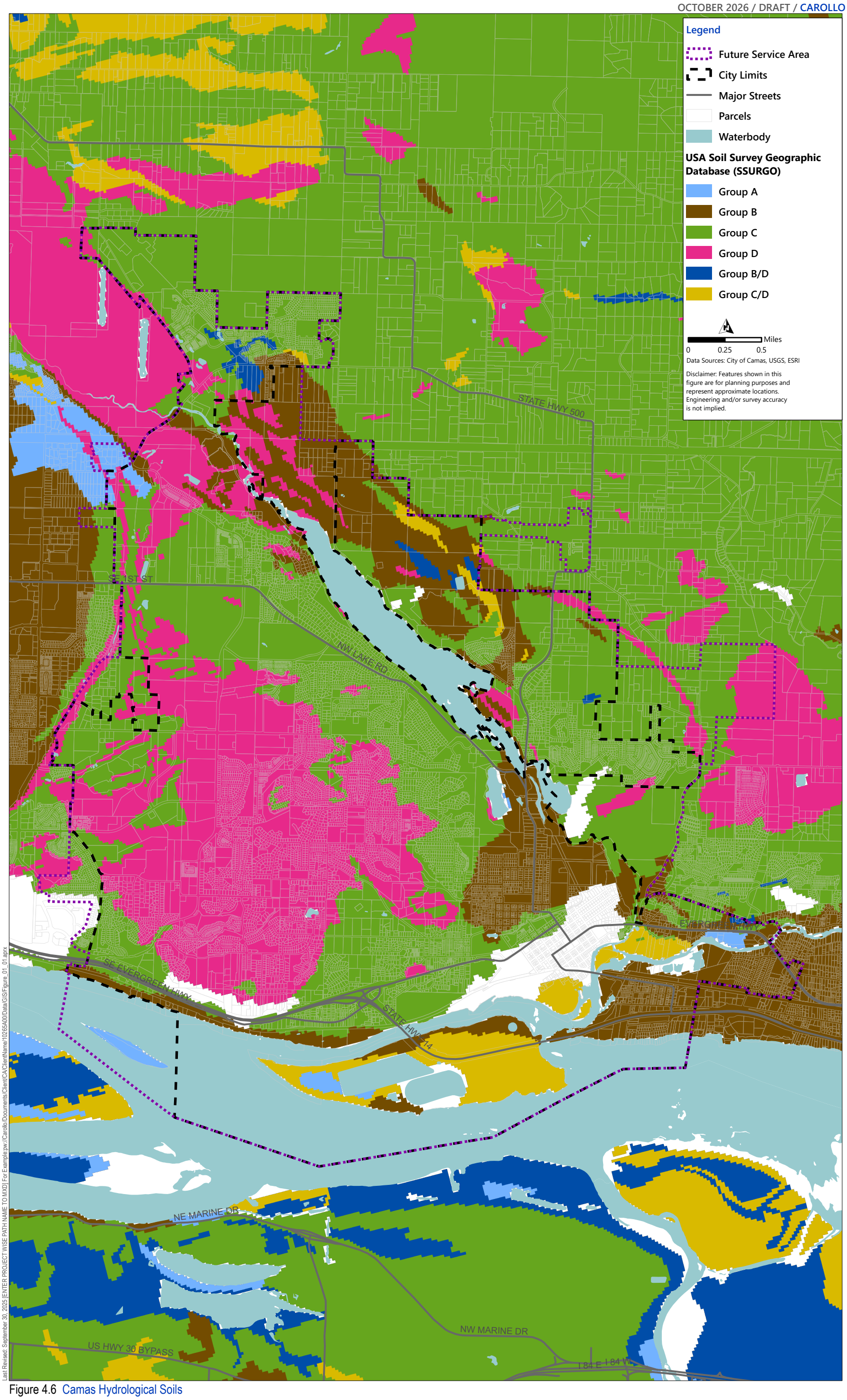


Figure 4.6 Camas Hydrological Soils

4.7.2 Critical Areas

Critical areas define crucial components for planning in an area including protected lands, e.g., wetlands, CARAs, and conservation areas, as well as areas with greater risk to its inhabitants, e.g., frequently flooded areas and geologically hazardous areas. Identifying these areas allows for the mitigation of unnecessary risk or harm to protected lands; additionally, policies in the City's *Draft 2045 Comprehensive Plan* (Camas, 2025) outline goals to protect and restore these sites.

4.7.2.1 Wetlands

Ecology currently rates wetlands based upon several key factors including their 'ability to be replaced, sensitivity to disturbances, rarity, functional performance, and importance in biodiversity' (Ecology, 2006). These levels include categories I-IV with a Category I wetland requiring the greatest protection. As defined by the wetland rating system, Category I wetlands have valuable biodiversity and hydrogeomorphic functionality in pollutant removal, stormwater storage, and even buffering natural disasters.

Within the City, there are >1,200 acres of recognized wetland which are protected by several local, state, and federal ordinances and laws including the Growth Management Act, Critical Areas Ordinance, CWAs, and CMC 16.53.050. These regulations entail the study of a wetland's functionality and that adverse impacts be avoided or reduced. Figure 4.7 illustrates the City's wetlands delineated using reports filed with the city and published data.

4.7.2.2 Critical Aquifer Recharge Areas

The majority of raw water supply for the City is provided by groundwater resources. This critical resource is protected by the CARA ordinance and the CMC. CMC 16.55.070 focuses on Aquifer Recharge Areas and required reports for proposed activities.

CARAs are located in multiple regions of the City and surrounding areas. Currently, two wellhead-protected areas are within the City limits with the southernmost protected area extending beyond the UGA. Figure 4.8 shows these regions in relation to wells which serve more than 20 people.

4.7.2.3 Frequently Flooded Areas

Frequently flooded areas are defined as regions with >1 percent chance of flooding per year. These regions are near surface water bodies which include Lacamas Lake, Columbia River, Washougal River, Jones Creek, Boulder Creek, Round Leaf Lake, and Fallen Leaf Lake, as shown in Figure 4.8. Due to low elevations, portions of the southeastern region of the City are located within the 100-and 500-year Federal Emergency Management Agency floodplain. Construction regulations focus on decreasing flood hazards of the structure which are detailed in a critical area report.

4.7.2.4 Geologically Hazardous Areas

Geologically hazardous areas are typically defined by the possibility of natural disasters including earthquakes and volcanic activity. These hazard potentials are then increased by the presence of steep slopes prone to landslide, particular soil groups prone to liquefaction, and other circumstances which have the potential to compound emergency scenarios. The United State currently operates on a Category 1-4 system to determine building code stringency as it pertains to natural disasters where Category 4 is the most stringent. The City is rated as a Category 4, which indicates a high potential for landslides and other events.

In the Clark County Code Chapter 40.430, Clark County defines three types of geologic hazard areas which include seismic, landslide, and steep slope. The county's Geologic Hazard regulation requires developers to have a Geologic Hazard Area Study completed on any property which is identified in a hazard area.

4.7.2.5 Fish and Wildlife Habitat Conservation Areas

As defined in the City's *Draft 2045 Comprehensive Plan*, one of the primary plans for the City is to protect "Key aquatic habitats in Camas include the Columbia and Washougal Rivers, Lacamas Creek, Camas Slough, Lacamas Lake, and various streams, ponds, and wetlands, all often bordered by riparian zones" (Camas, 2025). Multiple threatened species have been found to inhabit or pass through the region, and regulations are currently in place to prevent harm to any habitat including WAC 365-190-130. These regions are defined as Fish and Wildlife Habitat Conservation Areas which are protected.

Regulations include completing a habitat assessment before construction. These regulations impact any proposed sanitary sewer pipelines or lift stations in order to protect the fish and wildlife habitat.

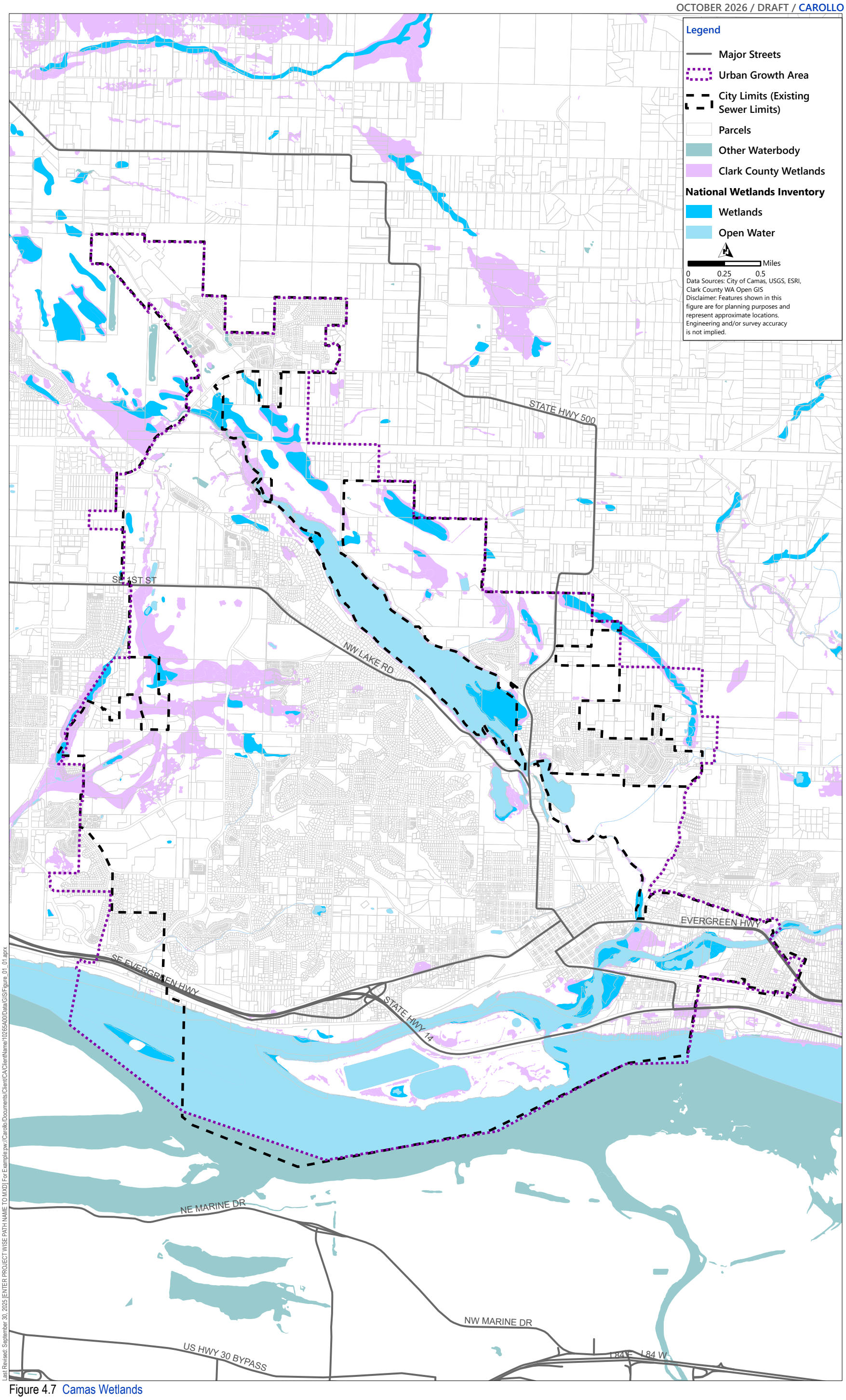


Figure 4.7 Camas Wetlands

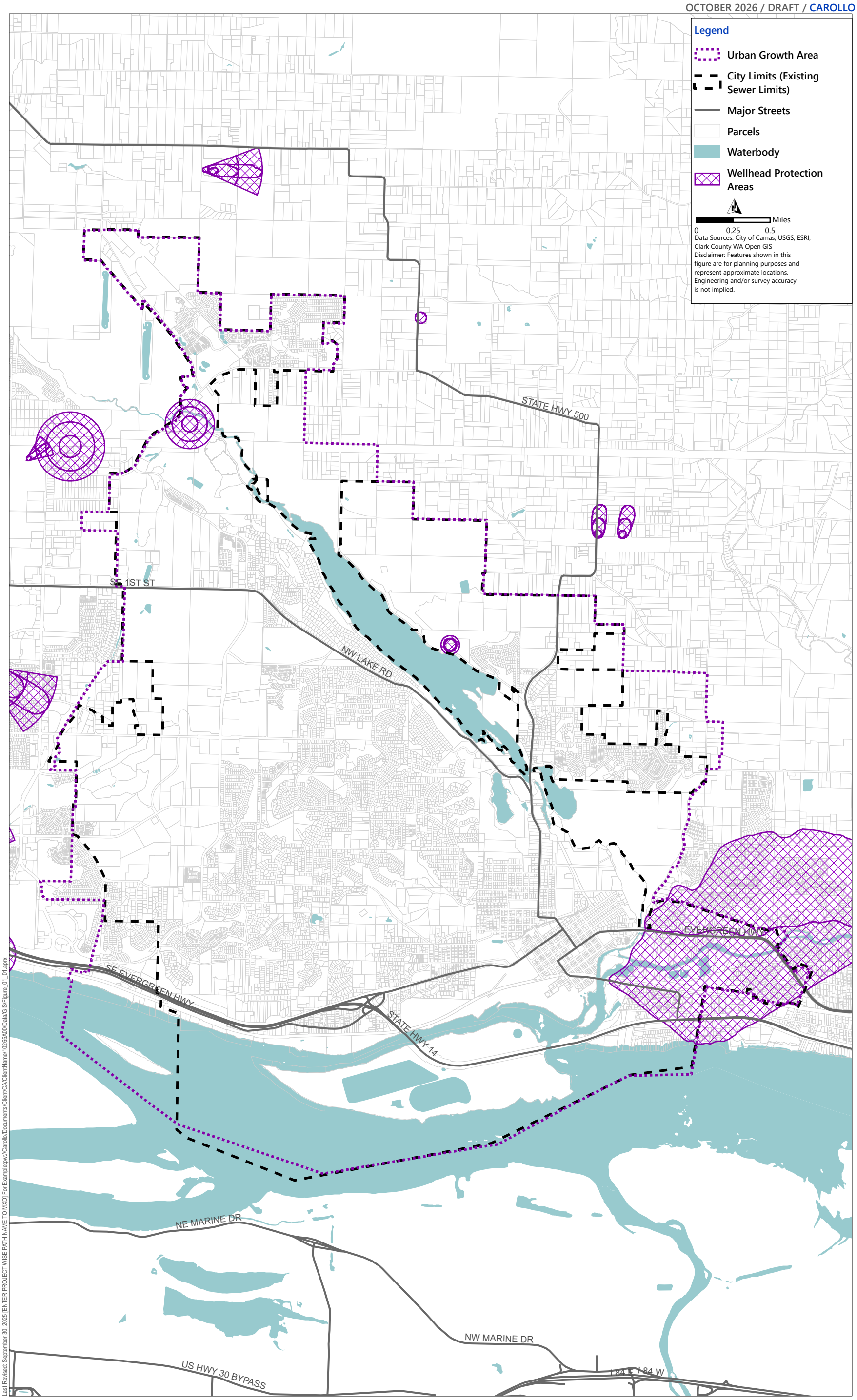


Figure 4.8 Camas Critical Aquifer Recharge Areas

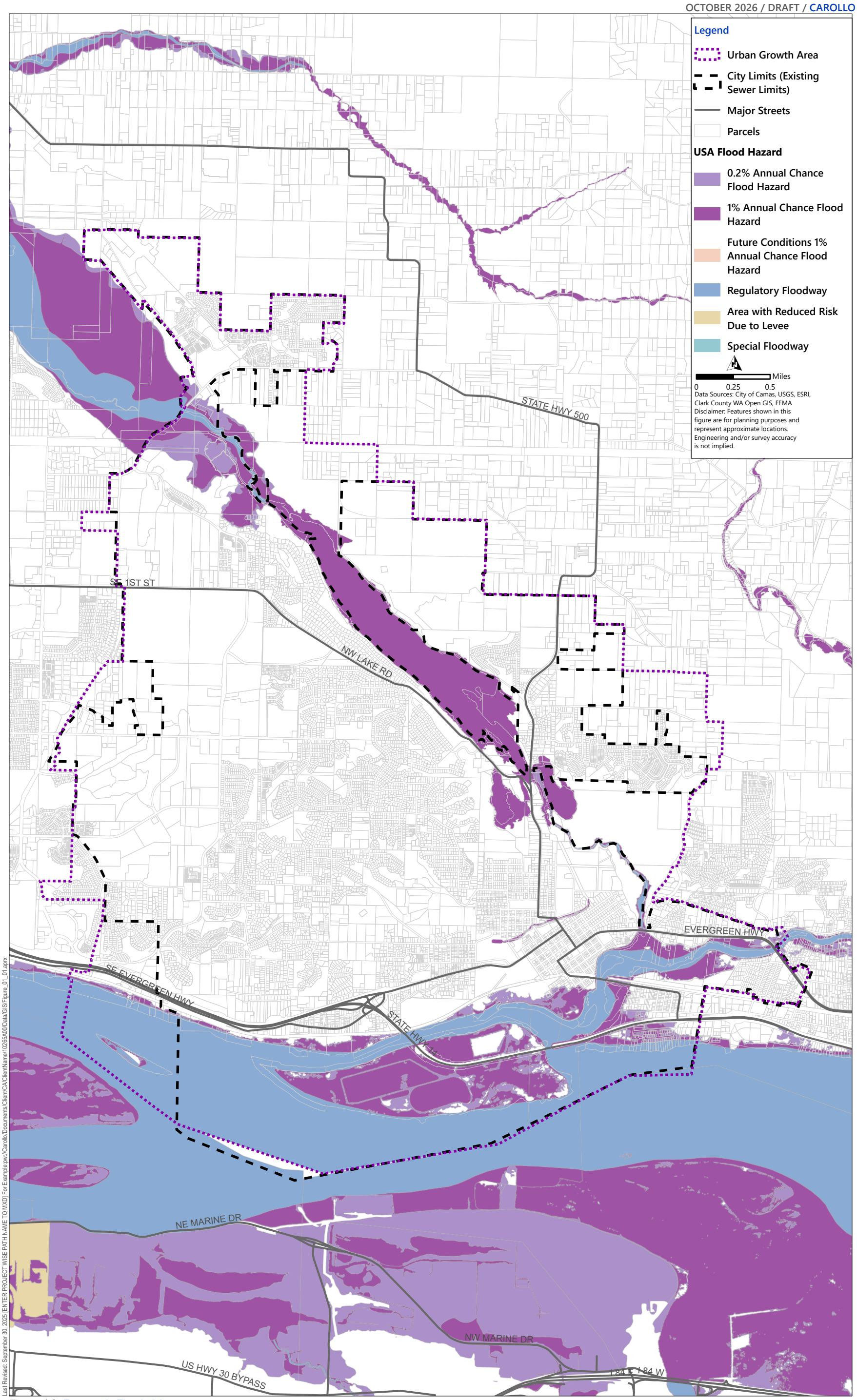


Figure 4.9 Frequently Flooded Areas

4.8 Water System

The City owns and operates a multi-source municipal water system, shown in Figure 4.10, which uses ground water and surface water to supply, treat, store, and distribute potable water to residential and commercial customers. The City currently obtains its water from 10 groundwater wells and two surface water resources. The wellhead protection areas are regulated to prevent leakage from the sanitary sewer system from infiltrating a well; these areas are shown in Figure 4.11.

The surface water resources include the Jones Creek Intake constructed in 1913 and the Boulder Creek Intake constructed in 1931. Surface water sources may be operated between November 1st and May 15th. Seasonal raw water from the Boulder and Jones Creek intakes is conveyed to the recently constructed slow sand filtration treatment plant (SSF Plant) where the water is filtered prior to chemical treatment and discharge to the distribution system. The SSF Plant has the capacity to treat the entire permitted flow of 1,570 gpm from the City's surface water sources. The surface water sources have lower operating expenses than groundwater sources. The ten groundwater wells are located in the 343 Zone excluding Well 9 which is located in the 544 Zone.

The City currently maintains and operates seven storage facilities with a combined total capacity of 9.95 million gallons (MG) including Butler Reservoir (1.2 MG), Gregg Reservoir (0.1 MG), Lacamas Reservoir (2.0 MG), 18th Avenue Reservoir (2.0 MG), Lower Prune Hill Reservoir No. 2 (1.5 MG), and the Upper Prune Hill Reservoirs (3.15 MG). This capacity is available for normal and emergency conditions, such as fire suppression. Ten booster pump stations are used to move water between pressure zones. Table 4.9 lists the booster pump stations and their capacities.

Table 4.9 Booster Pump Stations

Booster Pump Station	Capacity (gpm)
Butler	1,400
New Gregg	3,500
Forest Home	1,000
Lower Prune Hill	2,750
Lacamas	2,500
Angelo	4,000
Upper Prune Hill	4,300
Crown Road	2,400
Francis Road	80
Green Mountain Estate	1,840

The City owns over 159 miles of pipelines in its water transmission and distribution system compared to only 87.5 miles of collection system. Approximately 43 percent of the pipeline is Ductile Iron followed by Cast Iron at 14 percent. Additionally, the distribution system includes numerous meters, isolation valves, and hydrants. Two emergency interties are available with the City of Washougal. These interties provide water from the City to the City of Washougal under low pressure conditions. The City's intertie with Vancouver is located at the intersection of SE Columbia Palisades Drive and SE Brady Road. Additionally, the City has an agreement for emergency use of two fire hydrants located at SE 1st and Friberg for firefighting purposes.

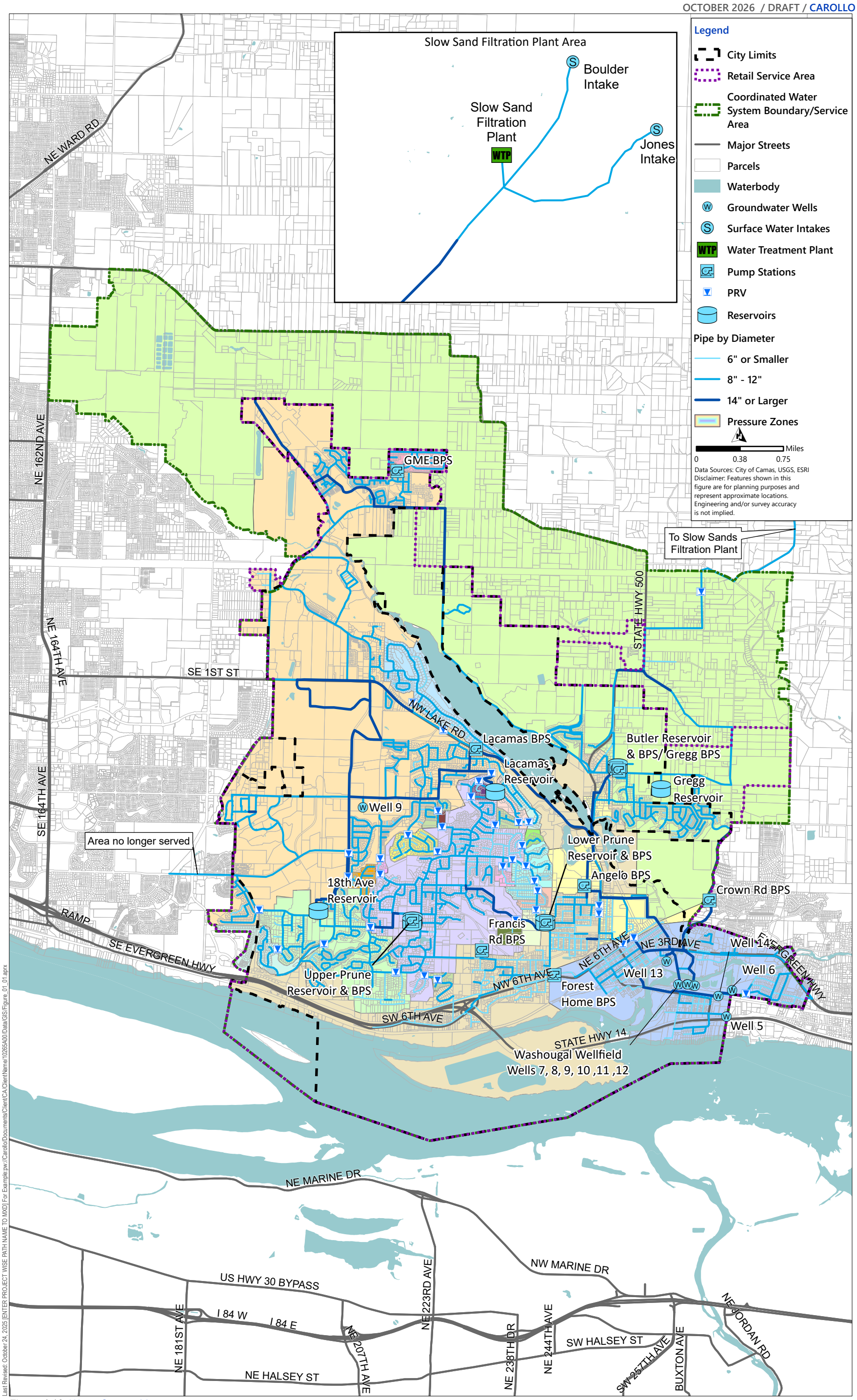
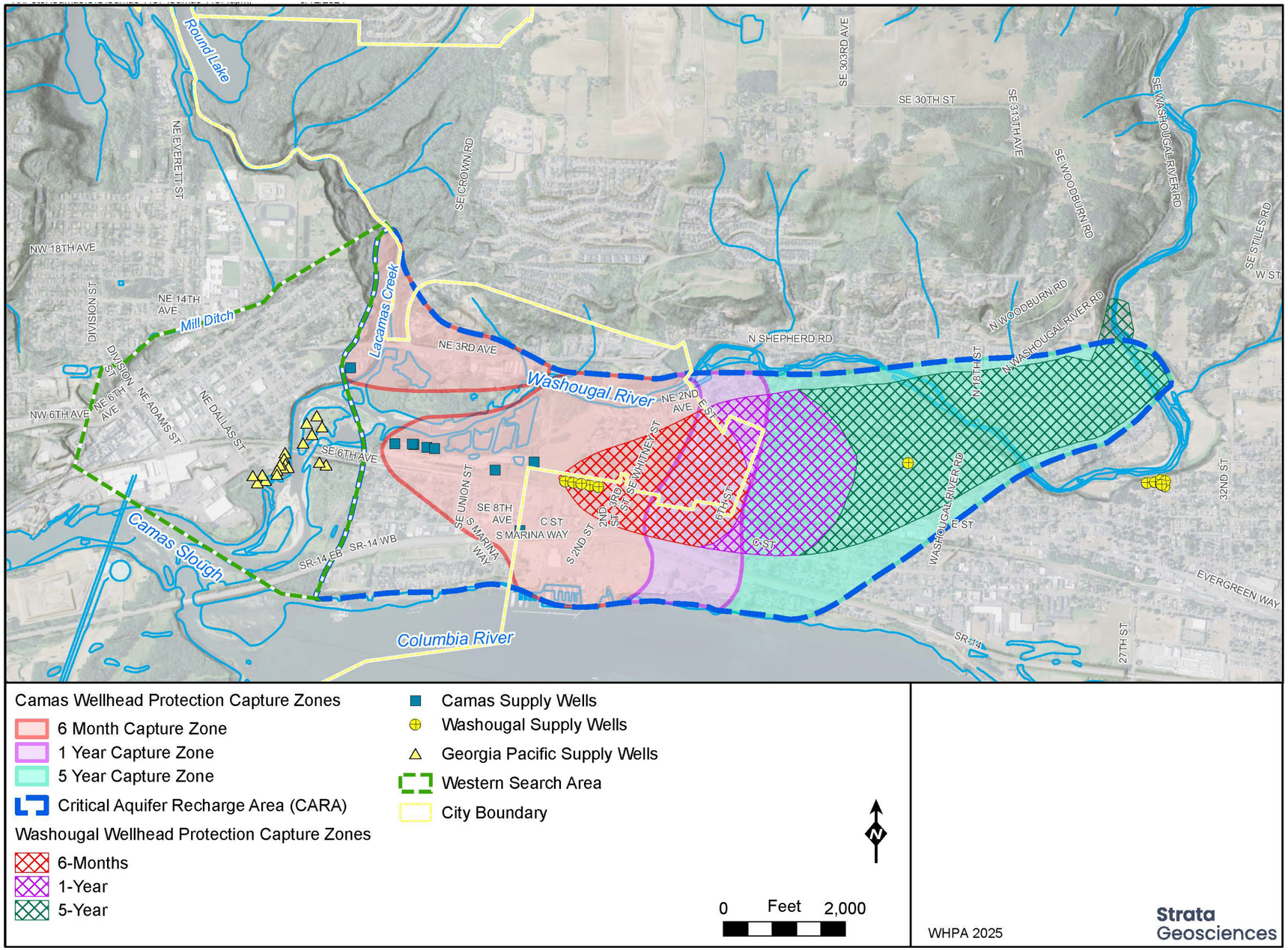


Figure 4.10 Water System Map



Source: City Of Camas Wellhead Protection Plan Update, Strata Geosciences, LLC, July 2026

Figure 4.11 Wellhead Protection Capture Zones

CHAPTER 5 INFLOW/INFILTRATION PROGRAM

5.1 Introduction

Infiltration and inflow (I/I) consist of two components which may combine or act independently to increase flow volume and peak flows in the sewer system. If too much I/I enters the sewer system such that the sewer system is operating at or above its capacity, sanitary sewer overflows could occur. More diluted waste can also be difficult to treat if using percent removal criteria as the basis. Proper attention to the lower than typical biological solids loading under these conditions is warranted in the design and operation of the WWTF. The definitions of infiltration and inflow are described below:

- **Infiltration:** Infiltration is defined as stormwater or groundwater flows that enter the sewer system by percolating through the soil and then through defects in pipelines, MHs, and joints. Examples of infiltration entry points are cracks in pipelines, misaligned joints, and root penetration. Due to this process, infiltration may be seen hours after a storm has occurred.
- **Inflow:** Inflow may be seen immediately after or during the storm. Inflow occurs when stormwater enters the sewer system via storm drain cross connections, leaky MH covers, or cleanouts. Examples of inflow entry points are roof drains and downspout connections, leaky MH covers, and illegal storm drain connections. Gross pipeline or system structural defects can be severe enough to allow storm or groundwater to enter the system rapidly and exhibit response time characteristics that could be categorized as inflow.

Key adverse effects of I/I on wastewater collection and treatment facilities include:

- Surcharging of sewer MHs.
- Sewage backups in facilities.
- Hydraulic overloading of unit processes at the WWTF.
- Reduced treatment efficiency at the WWTF due to dilute concentrations.
- Prematurely reaching capacity for collection systems and/or WWTF components.

This Chapter focuses on summarizing the City's efforts on I/I reduction from 2016 through 2024 and the quantifiable, positive improvement that has been accomplished in reducing I/I. It summarizes the amount of I/I for these years and specific projects completed to address I/I. This chapter also discusses recommendations for future I/I activities.

5.2 Historical I/I Control Efforts

The City has conducted I/I studies since 1977. The City has spent more than $4.55 million (M) in collection system I/I work and $750,000 on wastewater treatment facility improvements to address I/I flows.

The 1977 I/I Report attributed approximately 2.6 mgd to infiltration and 2.1 mgd to inflow. Major infiltration sources identified included roof and foundation drains, catch basins and multi-hole MH covers. By 1987, a sealing project was underway for individual sewer services.

In 1994, a consultant wrote a memorandum stating that estimated I/I entering the system was 3.54 mgd and the major source was likely faulty service connections. It was concluded that a more cost-effective alternative to reducing I/I would be to increase treatment capacity.

In 1997, a Facility Plan determined the City had excessive I/I based on USEPA criteria, and an 8-year sewer system rehabilitation program began based on monitored basins with the highest risk of I/I. During this study, a peak I/I flow of 3.4 mgd was determined.

In 2007, excessive inflow was determined at 62 gallons per capita day (gpcd) for infiltration and 383 gpcd for inflow. This is based on the USEPA criteria for excessive I/I to be 120 gpcd for infiltration and 275 gpcd for inflow. A total of 26 collection system projects were identified to address capacity and condition issues, 18 of which would reduce I/I.

In 2016, the City commissioned an evaluation of the collection system to document existing infiltration and inflow as a condition of their new stormwater permit. This evaluation utilized pump station run time, WWTF flow, and precipitation records to identify basins that were yielding high I/I values. This provided data to confirm the basins with high I/I, which were 3S, 3N, 4, and 10 (shown in Figure 4.1). Then smoke testing, manhole inspection, and closed-circuit television (CCTV) inspection were used to identify specific locations within these basins to determine source of I/I. The results of the 2016 I/I Study were used to plan and prioritize projects in order to reduce I/I.

In 2020, the City commissioned a follow-up study to document the reduction in I/I achieved by implementing the recommendations of the 2016 evaluation. The specific objectives of the 2020 study included:

1. Comparing the I/I with that measured in previous flow monitoring efforts completed for the 2016 I/I Study to assess the efficacy of rehabilitation efforts.
2. Identifying areas of the City where the I/I related peaking factor exceeds 3.4:1.
3. Identifying additional areas of high I/I in order to identify new areas for rehabilitation.

The 2020 Study demonstrated that since 2016, the City has observed a reduction in peak WWTF flows and high flow events, even though the population of the City and the extent of the sewer system have both increased over this time. Additionally, the City's WWTF no longer experiences excessive infiltration or inflow as defined by the USEPA, which is examined below in Section 5.7.3.

5.3 Required I/I Reporting

Special condition S.4.E of the 2015 Camas WWTF NPDES permit required the City to conduct a study of inflow sources and annual analysis of I/I using the Ecology Information Manual for Treatment Plant Operators. Special Condition S.4.E has been removed in the 2025 Camas WWTF NPDES permit and the City is no longer required to conduct annual I/I reporting. However, for completeness, this section summarizes the I/I Reporting completed through 2024 under the previous permit. Special condition S.4.E indicates the Annual I/I Report included:

1. Average monthly flow and total precipitation for each month for the past year.
2. Maximum monthly and peak hourly hydraulic design capacity for the plant.
3. Design population equivalent for the treatment plant and population served by the facility for the past year.

4. The amount of I/I for each year since the base year and the percentage of maximum monthly design capacity each year's I/I represents.
5. Percent increase or reduction in I/I for each year after the base year I/I.
6. Additional lengths of sewer lines added to the collection system for the past year.

The Annual I/I reports for 2021 through 2025 and the City's I/I Program are provided in Appendix F and summarized throughout this chapter. Values in this Chapter are based on numbers that were reported in the Annual Reports. It is recommended that the City continue to calculate and monitor these I/I values although it is not required in the NPDES permit. Please note that the City is updating their treatment plant capacity and values may change after completion.

5.4 Calculated I/I at the WWTF

Special condition S4.E.3 of the 2015 NPDES permit states that the annual period for the required I/I reporting is May 1st through April 30th. WWTF flow records are utilized to characterize I/I in the collection system. Table 5.1 shows the calculated I/I at the WWTF based on the annual I/I reports. The 2016 Annual Report selected May 2011-April 2012 to be the base year to compare future I/I against. This base year was selected because it represents the 20-year median rainfall. The average 12-month rainfall in Camas from the 20-year period of 1997 to 2017 was approximately 46.4 inches, and from May 2011 to April 2012 the rainfall was approximately 47.6 inches, which was the 50th percentile of all 20, 12-month totals and only 1.2 inches more than the 20-year average. Additionally, using 2011 to 2012 as the selected base year incorporates the City's recent growth. Per permit requirements, the I/I was compared with maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Facility. Additionally, I/I was compared with the previous year. The fluctuations seen in I/I in Table 5.1 are largely due to variations in rainfall. Reductions in I/I from specific projects are presented in further sections.

Table 5.1 Annual Report Calculated I/I at the WWTF(1)

Year	Calculated I/I (mgd)	I/I as Percent of Design Capacity	I/I Percent Increase/Decrease
2011	1.511	25%	N/A
2012	2.340	38%	+55%
2013	0.591	10%	-75%
2014	0.985	16%	+67%
2015	2.277	37%	+131%
2016	1.920	31%	-16%
2017	1.021	17%	-47%
2018	1.052	17%	+3%
2019	1.541	25%	+47%
2020	1.334	22%	-13%
2021	1.400	23%	+5%
2022	1.264	21%	-16%
2023	2.266	37%	+79%
2024	1.734	28%	-23%

Notes:
(1) Values presented in this table are obtained from annual I/I reports.

5.5 Field Investigation

Several evaluations were conducted to determine areas of excessive I/I. Field investigation methods include flow monitoring and analysis, smoke testing, MH inspection, and video inspection.

5.5.1 Flow Monitoring and Analysis

Under the City's 2015 NPDES permit, the City was required to:

- Quantify the level of inflow from each collection system basin or sub-basin in order to identify areas exceeding a peak day to monthly average peaking factor of 3.4:1 during the design rainfall event.
- Prioritize the list of projects to most cost-effectively reduce the level of inflow to a peaking factor of 3.4:1 or less.

While the current permit does not include these requirements, this section summarizes the analyses carried out to date. The analysis for flow monitoring includes evaluation of WWTF flow data, pump station run-time data, and collection system flow monitoring data. As part of this GSP, ADS conducted a wet-weather analysis to assess RDII attributed to each of the 4 monitored tributary areas. During the flow monitoring period there were 5 storm events captured. A storm is defined as a rain event with at least 0.8 inch of rain with no rain interruption of more than 12 hours. Captured storm volumes ranged from 1.15 inches (April 6, 2025) to 2.84 inches (February 21, 2025). The storm event on February 21, 2025 has roughly a 2-year, 24-hour return frequency. Gross I/I is calculated for each storm and each flow meter tributary area as the difference between the actual recorded flow minus the ADF weekend and weekday pattern. Wet weather responses are normalized according to basin size in order to properly characterize relative I/I performance among the basins evaluated. As a general rule, basins may be considered to yield excessive RDII if such normalized values are much greater than 5. Two of the 4 metered basins evaluated, Basin 4-1-3 and Basin 5-1-2 (shown in Figure 3.3), slightly exceeded this value with 6.0 percent and 7.1 percent rainfall ingress, respectively. The highest RDII is attributed to Basin 5-1-2 that encompasses Basin 3N, 3S, and 10 consistent with previous studies.

The highest-ranking storm event identified occurred on February 21, 2025 with 2.84 inches rainfall and 6.664 mgd total WWTF influent flow on February 23, 2025, followed by March 11, 2025 at 2.47 inches rainfall and 4.820 mgd total WWTF influent flow of March 13, 2025. Crown View, South Prune Hill, Hillshire and Baz Park lift stations were identified to exceed the peaking factor criterion of 3.4:1.

Based on the ADS flow monitoring and pump station I/I evaluation, Basins 10, 12S, 22, and 4 which are tributary to these lift stations are recommended for further flow assessment. Basins are shown in Figure 4.2 in Chapter 4.

5.5.2 Video Inspection

Until 2023, the City contracted with specialist firms to perform regular CCTV inspections of its gravity sewer system. In 2024, the City purchased a CCTV van to perform inspections in-house. The inspections identify structural and operational defects, such as broken pipes, cracks, grease, roots, sag, separated and offset joints, and other problems. Several structural defects identified in CCTV inspections were repaired when identified. Other defects may be addressed through increased preventative maintenance, repair, or monitoring. The results are being used to develop a list of projects which the City incorporated into their ongoing repair and replacement program.

5.6 Completed I/I Projects

Completed I/I projects are shown in Table 5.2. These projects have cost the City in excess of $6.5M over the past decade.

Table 5.2 Completed I/I Projects

Year	Basin	Project Title	Description	Project Cost[1]
2026	1,10	6th Pl Emergency	Replaced collapsed pipe on 6th Pl east of NW Sierra St to West Camas PS wet well. Two contracts (emergency) and full replacement of approx. 200 LF gravity pipe.	$100,431 $125,348
2026	1,10	Design-South Prune Hill trunkline replacement	Design and construct replacement of South trunk line from West Camas PS along 6th P to NW 2nd (cross country) then to NW View Ridge vicinity.	RR funds future
2025	14	Prune Hill Park PS	Rehab wet well, valve vault, electrical, etc.	$876,393
2023	14	Lacamas Shores PS	Rehab pump station controls and electrical system.	$120,000
2023	13	Sunningdale Garden PS	Rehab wet well, valve vault, piping, and electrical system.	$415,286
2022	3S	NW 14th Street Improvements	Replaced 22 LF gravity pipe at intersection of NW 14th and NW Benton and repaired manhole.	$10,000
2021	6,7	Lacamas Creek PS Improvements	Demolished existing Lacamas Creek PS and constructed two new satellite stations Lacamas Creek and Baz Park. Replaced existing force main and gravity main and lined existing manholes.	$3,217,664
2019	10	View Ridge Court Sewer Replacement	Replacement of sewers.	$370,000[3]
2018	3S	Mill Ditch Repair	Replaced section of sewer line between Dallas Street and Birch Street.	$417,105[2]
2018	3S	Mill Ditch Repair	Rehabilitate or replace 15-inch CONC from MH 3-2-6 to 3-1-1 (1,370 feet).	
2017	4	NE Dallas Street Sewer Replacements	Replacement of several sewer pipes.	$129,000[3]
2017	4	NE Adams Street Sewer Replacements	Replacement of several sewer pipes.	$100,000[3]
2017	4	Everett and Franklin Sewer Replacement	Replacement of sewer line from 19th and Franklin to Everett and Everett to 21st.	$352,000[3]
2016	4	Franklin Street Sewer Improvement	Replaced sewer line between MH 4-1-1 and MH 4-1-4.	$952,883[2]

Notes:
(1) Cost values reflect actual construction costs at the time of completion.
(2) Value from the 2017 Annual Report.
(3) Value from the I/I Follow-Up Study.

5.7 Planned I/I Projects

The City will continue to address I/I throughout the collection system through their ongoing repair and replacement program. Based on replacing all gravity and STEP mains installed prior to 1940 by the end of the planning horizon (2045), the City's annual pipeline repair and replacement program is $1,100,000 annually.

It is also recommended the City investigate sources of I/I in flow meter basins 5-1-2 (specifically upstream of Crown View LS and South Prune Hill LS) and 4-1-3 (downtown), as these basins exhibit high I/I and have potential to reduce or eliminate downstream capacity projects (discussed in Chapter 6 and Chapter 9). Priority basins were historically 3N, 3S, and 4. Based on the 2025 flow monitoring and potential for I/I reduction to reduce or eliminate capacity-related improvement projects identified in this GSP, current priority basins are 22, 10, 12S, and 4.

Flow monitoring basin 5-1-2 contains two sewer pathways. To the north, sewer basins 12N and 22 flow through 3N which in turn flows through 3S. To the south, sewer basin 12S flows south to basin 10 and then east through basin 1 and then 2. It is recommended that the City conduct flow monitoring within Basin 5-1-2 to assess where in the basin the I/I is generated, what the sources of I/I are, and if projects to reduce I/I can be cost effective alternatives to capacity projects in these areas (discussed in Chapter 6 and Chapter 9) and in the downstream system. A combination of night-time reconnaissance, flow monitoring, and CCTV inspection is recommended.

Basin 4-1-3 is a smaller basin which overlaps with sewer basin 4. In this area, it is recommended that the City identify sources of I/I in the basin, implement I/I reduction projects, and perform post-construction flow monitoring to quantify the impact of the projects in I/I. Results from the I/I pilot study can be used to estimate potential I/I reduction from similar projects in other areas, for example Basin 5-1-2.

It is recommended that both the Basin 5-1-2 Flow Monitoring and the Basin 4-1-3 Pilot I/I Study be completed in 2027 prior to design and construction of the capacity projects in these basins and downstream of these basins in order to evaluate if I/I projects are cost-effective and can eliminate or reduce the need for the capacity projects.

Table 5.3 presents the planning projects and project costs. These projects are included in the annual program and general projects of the Capital Improvement Plan presented in Chapter 9. Capital improvements from these studies would be paid for from ongoing rehabilitation and replacement budgets.

Table 5.3 Planned I/I Projects

Year	Basin	Project Title	Description	Project Cost
Ongoing	N/A	Gravity and STEP Main Repair and Replacement	Ongoing repair and replacement of gravity mains at end of useful life	$1,100,000/year
2027	10,1,2,12N, 12S,22,3N, 3S	Basin 5-1-2 Flow Monitoring	Install temporary flow meters in Basin 5-1-2 to separately monitor flows from the area along 6th Avenue and the area of Upper Prune Hill to identify areas contributing high I/I.	$300,000
2027	4	Basin 4-1-3 Pilot I/I Study	Investigate the source and magnitude of I/I. Identify opportunities to reduce non-sewage flow and measure the impact of I/I reduction projects in the area. Information from the pilot study should be used to assess cost of I/I reduction vs capacity improvements.	$200,000

CHAPTER 6 COLLECTION SYSTEM

6.1 Introduction

The City's customer base continues to increase through system expansion. With this growth, some of the City's sewer infrastructure may reach conveyance capacity. This chapter presents an evaluation of the available capacity of the existing system to convey current and future sewer flows. The City's collection system is broken up between gravity mains and STEP systems that flow to the treatment plant separately.

Using the City's updated sewer model, major pipes and lift stations in the modeled collection system were evaluated for meeting established capacity criteria. The modeled collection system is primarily gravity sewers that are 8-inch or larger where data is available and the trunk of the STEP system. The model represent a skeletonized version of the system. An overview of the modeled collection system is shown in Figure 6.1. The system was calibrated with seven flow basins of which four are flow meters installed by ADS during the 2025 flow monitoring study, two are lift station SCADA data, and one is the wastewater treatment facility SCADA data which helped calibrate the STEP basin system by subtracting the gravity collection system to isolate the STEP basin system. The model was delineated into seven flow monitoring basins with similar diurnal patterns and wet weather flow parameters, also shown in Figure 6.1. Additional details on the model used to evaluate the collection system can be found in Appendix E - Hydraulic Model Development. This chapter identifies recommended projects to address capacity deficiencies and to serve future users.

6.2 Evaluation Criteria

Defining performance criteria is a critical step in the master planning process because it sets metrics by which the collection system infrastructure will be evaluated to meet service goals set by the City. Sewer pipe capacities are dependent on many factors, including roughness of the pipe, the maximum allowable depth of flow, and slope of pipe. The City's applications of these factors and established requirements are discussed in Sections 6.2.1 and 6.2.2.

It is important to differentiate performance and design criteria when judging the performance of collection system infrastructure. Design criteria establish the standards for designing and constructing new sewers. Performance criteria establish the standards that are used to analyze adequacy of existing facilities and to trigger future infrastructure needs. Performance criteria are commonly less stringent than design criteria because existing sewer systems typically have aged significantly and would require extensive reconstruction to meet standards for new design. It is generally inappropriate to use standard design criteria as performance criteria, especially when significant wet weather flows impact an existing collection system (as is the case with an aged sewer system). For instance, new sewers are designed to convey flow under non-surcharged conditions (assuming limited I/I), while surcharging may be permissible during the analysis of existing sewers, especially during PWWFs. The following sections describe the City's established design criteria and performance criteria used herein.

6.2.1 Design Criteria

The design criteria are used to size new infrastructure recommended to alleviate system deficiencies.

6.2.1.1 Conveyance System

It is common practice to use diameter-based flow depth criteria for pipes when designing new gravity sewers. The d/D ratio is defined as the depth of flow in a pipe during peak flow conditions divided by the pipe's diameter. The City defines the acceptable d/D value of 0.92 for design of new sewers under design storm conditions and build out scenario. The City's Sewer Standards also define the minimum pipe diameter, which is 8-inch.

6.2.1.2 Lift Stations and Force Mains

Any new lift stations recommended will need to follow the City's Sewer Standards for lift stations and force main construction to meet Ecology requirements. These are detailed in Section 2.2.2 of Chapter 2 - Policies and Criteria.

6.2.2 Performance Criteria

6.2.2.1 Design Storm

The sewer system hydraulic capacity analysis was performed using a historical 10-year, 24-hour rainfall event (Station Portland Airport, HYDRA Rain Gauge Network) on December 6, 2015. This design storm is discussed in Section 3.4.6 of Chapter 3 - Basis of Planning.

For this GSP, the HYDRA historical event referenced above was selected as the design storm for modeling system response and system performance evaluation to realistically represent peak wet weather conditions. The historical HYDRA event was chosen for three reasons:

- NOAA Precipitation Atlas isopluvial mapping indicates that a 10-year, 24-hour storm at Camas produces approximately 3.5 inches of rainfall.
- The selected historical storm produced 3.37 inches of rainfall in 24 hours and provides a measured storm hydrograph for modeling.

6.2.2.2 Conveyance System

When evaluating existing sewers, using a conservative d/D ratio may lead to unnecessary replacement of existing pipelines. Therefore, the following performance criteria for the conveyance system was developed and used to evaluate the system under design storm PWWF conditions. The PWWF was defined using the standards summarized in Section 6.2.1.1.

- Sewer pipes can be surcharged. If surcharging is within 3-feet from manhole rim, then the sewer was deemed deficient.
- No surcharging (d/D>1) is allowed at shallow manholes. Shallow manholes are defined as MHs where the distance between crown of pipe and manhole rim is less than 3 feet. Shallow manhole locations are shown on Figure 6.1.

6.2.2.3 Lift Stations and Force Mains/Pressurized Mains

The City's performance criteria for existing lift stations include firm capacity, which is capacity with the largest pump out of service and force main and STEP main velocities. According to City Sewer Standards:

- Firm pump capacity shall be provided to handle the PWWF from the lift station's tributary area.
- Existing force mains shall not exceed a maximum pipe velocity of 8 feet per second (fps) for the design storm.
- The existing STEP mains and force mains shall not exceed a maximum velocity of 8 fps.

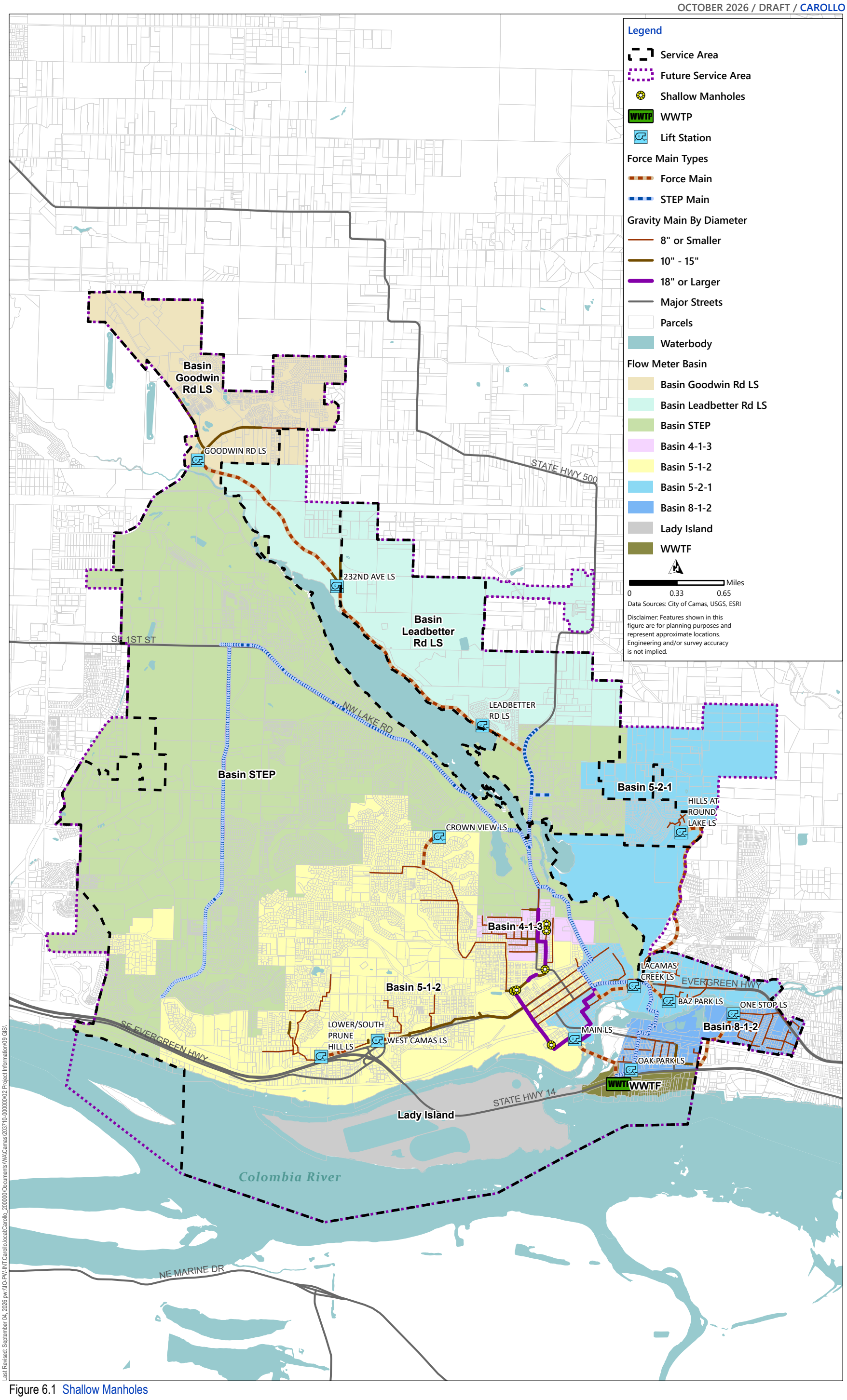


Figure 6.1 Shallow Manholes

6.3 Gravity Collection System Evaluation

A capacity analysis of the modeled collection system was performed using the City's calibrated hydraulic model and using the evaluation criteria identified above in Section 6.2. The capacity analysis identified areas in the sewer system where the performance criteria for surcharging were exceeded, or where the capacity of lift stations were exceeded. The collection system was evaluated for three development scenarios:

- Existing: Matching existing conditions.
- 20-Year: Incorporating growth through 2045 as identified in the 2045 Comprehensive Plan.
- Buildout: Development of the full-service area including UGA.

For the remainder of the chapter, the system evaluation focuses on existing and 20-year system conditions to identify capacity deficiencies and improvement projects for the 20-year planning horizon. The buildout scenario was used to size projects needed in the 20-year planning horizon to accommodate buildout conditions.

6.3.1 Key Causes of Deficiencies

The calibrated hydraulic model was exercised under design storm conditions, and the predicted results were analyzed using the performance criteria to identify segments of the system not meeting those criteria. The key causes triggering deficiencies in the City's collection system include:

- Adverse slopes and misaligned inverts.
- Shallow MHs.
- Pipe restrictions caused by a single, or a few, smaller diameter pipes between larger diameter pipes.
- Pipe diameter not sufficient to convey the PWWF.
- Lift station firm capacity not sufficient to pump the PWWF.
- Backwater condition.

6.3.2 Existing System Problem Areas

For the existing sewer collection system, the PWWF was routed through the hydraulic model to assess performance. In accordance with the established criteria for existing sewers, where the model predicted potential deficiencies, these were identified. Existing deficiencies are primarily located in Flow Monitoring Basin 5-1-2, with primary capacity issues in the downstream larger trunk lines receiving flow from smaller tributary areas and delivering sewage to NE Adams to SE 3rd Avenue Basin 5-1-2 experiences elevated I/I that contributes to the observed deficiencies along 6th Avenue, Division Street, and NW Fargo Street. Basin 4-1-3 is a smaller basin that also shows elevated I/I which causes observed deficiencies along NE Franklin Street and along the Mill Ditch. The locations of these predicted deficiencies under existing PWWF conditions are shown in Figure 6.2.

6.3.3 20-Year System Problem Areas

The 20-year (2045) system analysis was performed in a similar manner to the existing system analysis. The 20-year condition evaluated whether or not the sewers would be adequately sized to convey the future PWWFs, including projected growth in the North Shore area. This analysis incorporates the preliminary assumptions made for how and where to connect the growth areas to the existing system. The City's preference is for new development to connect to the gravity system and not the STEP system, where practical.

Three additional deficiency problem areas occur during 20-year PWWF conditions. The additional projected flows from the North Shore area add significant amounts of flow and are predicted to exceed the evaluation criteria and cause additional surcharging in the system. Additional growth upstream of 6th Avenue NW causes existing deficiencies to worsen under 20-year. The 20-year deficiency problem areas are shown in Figure 6.3.

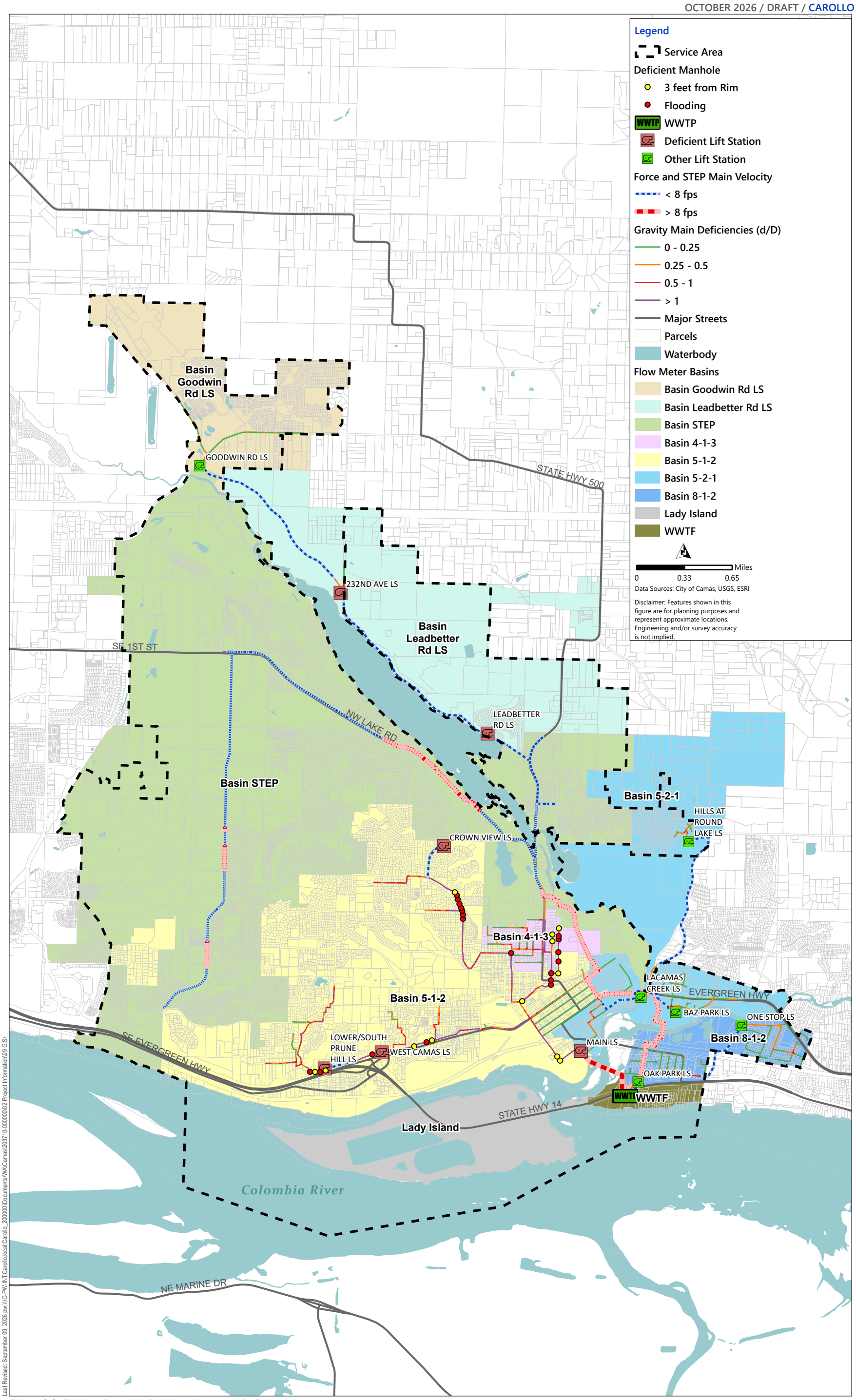


Figure 6.2 Existing Potential Problem Areas and Deficiencies

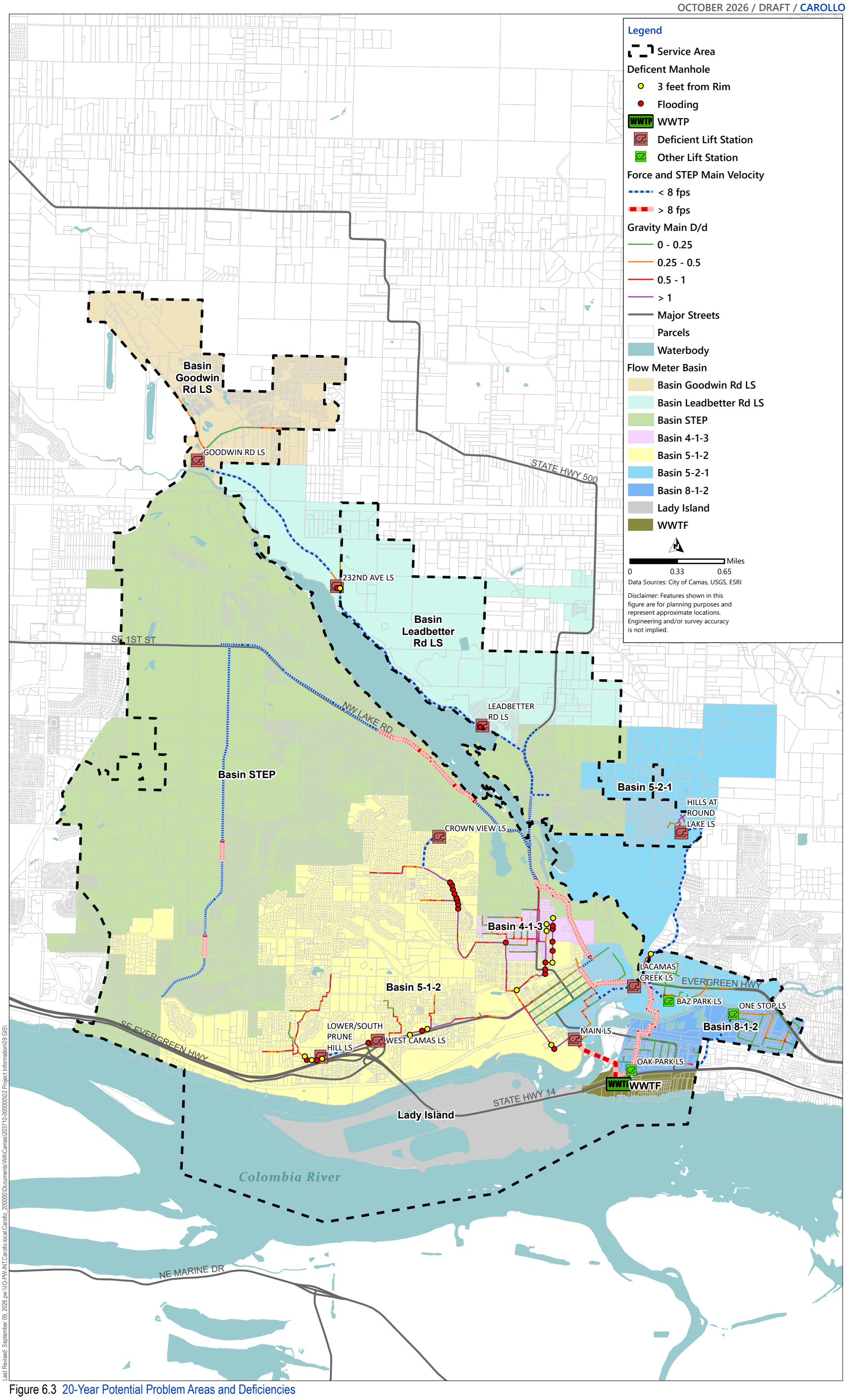


Figure 6.3 20-Year Potential Problem Areas and Deficiencies

6.4 STEP System Evaluation

The STEP system area was incorporated into the model with the main pipeline modeled as seen in Figure 6.3. The hydraulic analysis results show that the STEP system transmission main exceeds the performance criteria velocity of 8 fps under the existing PWWF and projected 2045 PWWF flows. These exceedances are located mainly where there are steep downhill slopes. Because the velocity is exceeded due to steep slopes under low pressure, there is no practical improvement project to address the high velocity. These velocity exceedance areas are mainly located along NW Parker Street from NW PacificRimBoulevard to NW 38th Avenue and along NW Lake Road from NW Leadbetter Drive to NW Lacamas Lane.

6.5 Lift Station Evaluation

Ensuring that lift stations have adequate capacity to convey peak flows is important to prevent sewage overflows at or near lift stations. In accordance with the established performance criteria, the City's existing lift stations were evaluated using results from the calibrated hydraulic model to determine if the lift stations have available capacity to convey existing and future PWWFs. If a lift station has inadequate capacity to pump the PWWFs, the water level in the wet well may rise to the overflow point, spilling sewage. Lift stations predicted to experience an influent PWWF greater than the existing firm capacity of the station were flagged as deficient.

The City's hydraulic model includes 12 of the City's 28 lift stations. The modeled lift stations are located in the City's gravity collection system. All flow from the gravity collection system goes through Main LS except for a small portion of gravity flow that enters the WWTP via One Stop LS and Oak Park LS. All 12 modeled stations are shown in Figure 6.1 in light blue. The estimated current and future peak flows were compared to the lift station firm capacities. The firm capacity of a lift station is defined as the capacity with the largest pump out of service. Table 6.1 summarizes the results of the lift station evaluation. Table 6.1 includes the total capacity at each station, as an additional point of reference for the modeled PWWF's. Firm and total capacities were provided by the City through as-built drawings and spreadsheet. Figures 6.2 and 6.3 show deficient lift stations in red and lift stations meeting the firm capacity in green.

Table 6.1 Lift Station Evaluation

Lift Station Name	No. of Pumps	Total Capacity (mgd)	Firm Capacity (mgd)	Existing Modeled PWWF (mgd)(4)	20-Year Modeled PWWF (mgd)(4)	Firm Excess Deficiency	20-Year Excess Deficiency
232nd Ave(1)(3)	2	1.05	0.53	0.70	1.42	Yes	Yes
Baz Park(1)	2	1.29	0.65	0.19	0.19	No	No
Crown View	2	0.64	0.32	0.85	0.85	Yes	Yes
Goodwin Rd(1)(3)	2	0.98	0.49	0.37	0.71	No	Yes
Hills at Round Lake(2)	2	0.74	0.37	0.20	0.96	No	Yes
Lacamas Creek(1)	2	2.74	1.37	0.96	1.54	No	Yes
Leadbetter Rd(1)(3)	2	1.74	0.87	0.88	2.6	Yes	Yes
Main(2)	3	16.6	11.1	15.9	18.5	Yes	Yes
Oak Park(2)	2	1.0	0.5	0.32	0.32	No	No
One Stop(2)	2	0.66	0.33	0.17	0.17	No	No
South Prune Hill(2)	2	1.73	0.86	2.40	2.60	Yes	Yes
West Camas(2)	2	2.88	1.44	3.10	3.13	Yes	Yes

Notes:
(1) Total and firm capacity from as-built drawings.
(2) Total and firm capacity provided by the City "Lift Station info List (updated 11-2-21).xlsx" spreadsheet.
(3) Has space for a third pump.
(4) PWWF Results shown are without any constrictions.

Based on the analysis and the results presented in Table 6.1, six of the modeled lift stations are considered deficient in the existing system scenario per the City's firm capacity performance criteria. These deficiencies are exacerbated and an additional three lift stations are identified as deficient under the 20-year conditions.

6.6 Recommended Collection System Improvements

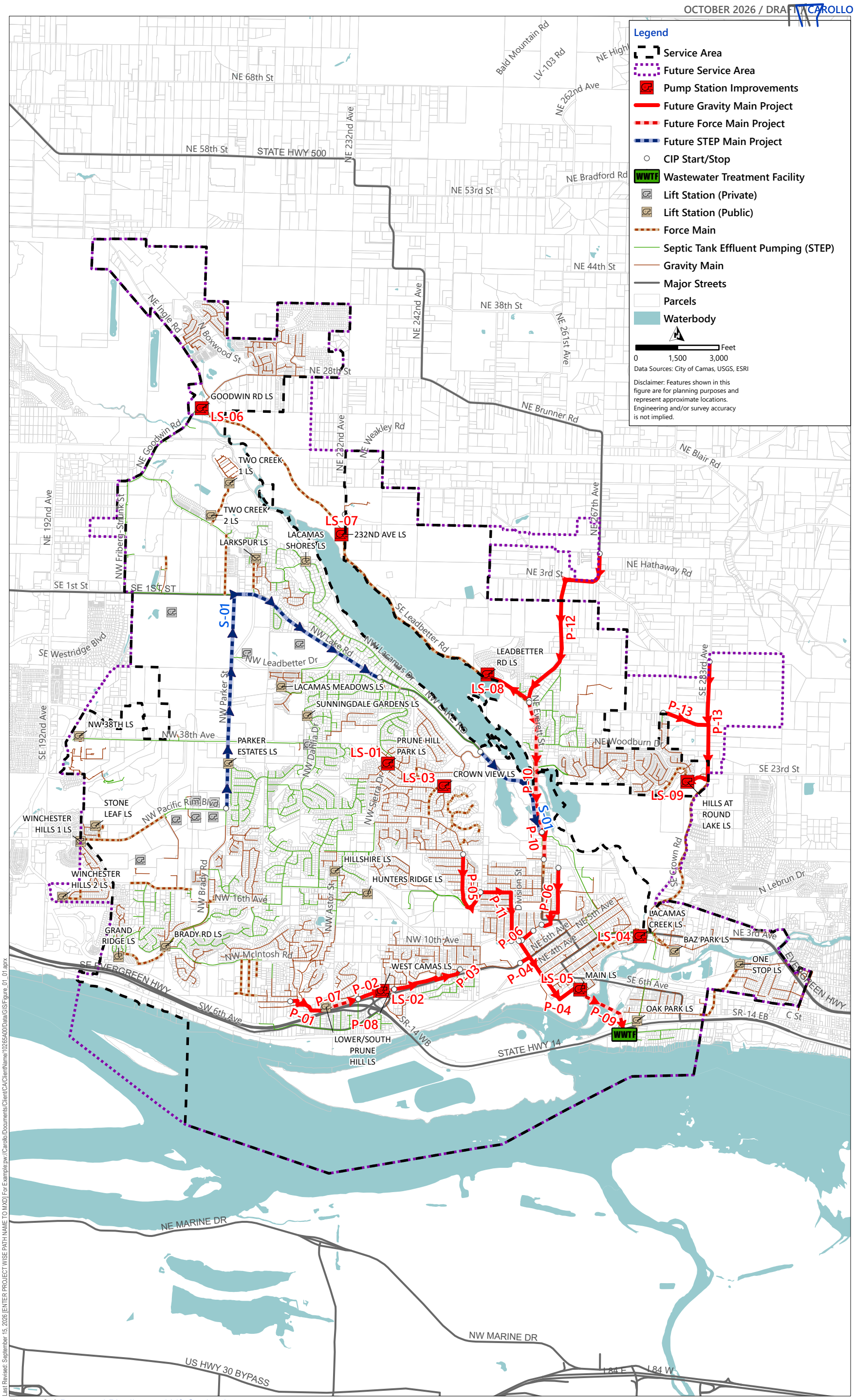
Following completion of the existing and 20-year system analyses, improvement projects and alternatives were developed to address the identified capacity deficiencies. These improvements are sized to meet buildout PWWF. The analysis identified 10 localized areas with pipeline capacity deficiencies and nine lift stations requiring upgrades to meet the established firm capacity criteria. In addition to these deficiency-driven projects, three system expansion improvements were developed to provide new conveyance capacity for planned future growth in the North Shore area and to connect future development to the existing sewer system.

The proposed improvements were not necessarily extended to achieve a d/D ratio of 0.92 or less in every pipe segment. Instead, the improvement extents were established to address identified capacity deficiencies while allowing some surcharging of the system. In locations where localized d/D ratios remain above 0.92, the hydraulic grade line (HGL) was evaluated to confirm that it remains at least 3 feet below the MH rim during PWWF. This approach provides a practical and cost-effective balance between improving system performance and limiting the extent of improvements while avoiding conditions that could result in manhole flooding. Localized d/D ratios greater than 0.92 may occur due to the existing

pipe geometry and hydraulic profile and do not necessarily indicate an unresolved capacity deficiency when the HGL remains at least 3 feet below the MH rim.

Figures 6.4, Table 6.2, and Table 6.3 identify the location and extents of the recommended system improvement projects. Tables 6.2 and 6.3 provide details of the recommended improvement (length, diameter, street location, etc.). The improvements summarized in Tables 6.2 and 6.3 utilize a numbering system cross-referenced with Figure 6.4. The deficiencies addressed by each project are explained in Section 6.5. Individual project summaries with additional project details are included in Appendix L - CIP Project Sheets. The columns used in Tables 6.2 and 6.3 refer to the following:

- Project ID: Assigned unique identifier associated with each improvement project. This is an alphanumeric number that starts with one or two letters indicating the type of improvement and continues with a number and a letter:
  - P= Pipe,
  - S= STEP,
  - LS = Lift Station.
- Improvement Type: Gravity pipelines, STEP pipes, or lift stations.
- Location: Street in which the improvement is proposed.
- Existing Size: This represents the diameter of the existing pipelines (inches), or the total capacity of existing lift stations (mgd).
- Proposed Size: This represents the diameter of the proposed pipelines, or the total capacity of lift stations after proposed improvement, or upon construction if a new facility to serve future growth.
- Length: Estimated length of the proposed improvement in feet. It should be noted that the length estimates do not account for re-routing the alignment to avoid unknown conditions, if more detailed planning and design identifies such constraints.



Last Revised: September 15, 2026 [ENTER PROJECT WISE PATH NAME TO MXD] For Example:pw://Carollo/Documents/Client/CA/ClientName/10265A00/Data/GIS/Figure_01_01.aprx

Figure 6.4 Proposed Pipeline and Lift Station Improvements

6.6.1 Recommended Pipeline Improvements

These are the recommended collection system improvements projects:

P-01: NW 6th Place West Improvements

P-01 experiences surcharging upstream of the South Prune Hill LS under existing conditions, as illustrated in Figure 6.4. The model also identified potential manhole flooding during the design storm at modeled MHs 10-1-8, 10-1-7, and 10-1-6. These deficiencies are caused by capacity limitations associated with the existing pipe diameters and slope constraints within the reach.

The proposed NW 6th Place West Upsize Improvements consist of upsizing approximately:

- 422 LF of pipe between MHs 10-6-1 and 10-1-11 should be upsized from 8- to 12-inch;
- 809 LF of pipe between MHs 10-1-11 to 10-1-7 from 8-inch to 15-inch, and;
- 472 LF of pipes between MH 10-1-7 and the South Prune Hills LS wet well from 8- to 18-inch.

The proposed improvements provide additional gravity conveyance capacity, alleviate the modeled surcharging and potential manhole flooding, and allow the system to meet the City's design criteria.

P-02: NW 6th Place East Improvements

P-02 experiences surcharging along NW 6th Place under existing conditions. The model also identified potential manhole flooding during the design storm at modeled MHs 10-1-3 and 10-1-1. This deficiency is caused by capacity limitations within the flatter gravity sewer pipelines in the reach.

The proposed NW 6th Place East Improvements consist of upsizing approximately:

- 682 LF of pipe between MH 10-1-3 to West Camas LS wet well from 8- to 21-inch.

The proposed gravity sewer improvements are located along NW 6th Place between South Prune Hill LS and West Camas LS, at an approximate depth of 5 to 10 feet. These improvements provide additional conveyance capacity, alleviate the modeled surcharging and potential manhole flooding, and allow the system to meet the City's design criteria.

P-03: NW 6th Place Avenue West Improvements

A capacity deficiency exists immediately downstream of the West Camas LS along NW 6th Avenue. The model identified surcharging and potential MH flooding at MHs 1-1-10, 1-1-6, and 1-1-4 under existing conditions. This deficiency is caused by capacity limitations in the existing gravity sewer and backwater conditions from downstream deficiencies.

The proposed NW 6th Avenue West Improvements consist of upsizing approximately:

- 1,943 LF of pipe between MHs 1-1-10 and 2-1-11 from 12- to 24-inch, and;
- 592 LF of pipe between MHs 2-1-11 and 2-1-9 from 12- to 21-inch.

The proposed gravity sewer improvements are located along NW 6th Avenue, immediately downstream of the West Camas LS and extending through Forest Home Park, at an approximate depth of 5 feet. These improvements will provide additional conveyance capacity to alleviate the modeled surcharging and potential manhole flooding and accommodate projected future growth.

Under the buildout scenario, additional segments were identified that exceed the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions:

- 446 LF of pipe between MHs 3-1-1 and 5-8-1 should be upsized from 18- to 27-inch;
- 260 LF of pipe between MHs 5-8-1 and 5-1-12 should be upsized from 21- to 30-inch,
- 402 LF of pipe between MHs 2-1-1 and 5-1-12 should be upsized from 12- to 30-inch;
- 545 LF of pipe between MHs 5-1-12 and 5-1-11 should be upsized from 21- to 36-inch;
- 947 LF of pipe between MHs 5-1-10 and 5-1-7 should be upsized from 24- to 36-inch;
- 1,126 LF of pipe between MHs 5-1-7 and 5-1-2 should be upsized from 21- to 36-inch, and;
- 34 LF of pipe between MHs 5-1-2 and 5-1-1 should be upsized from 24- to 36-inch.

These additional improvements are not needed under the 20-year scenario because the modeled surcharging remains more than 3 feet below the MH rim, but are recommended to meet the City's d/D criterion under full buildout conditions.

P-04: NW 6th Place Avenue East Improvements

Following implementation of the upstream P-03 (NW 6th Place Avenue West Improvements), the model identified surcharging along NW 6th Avenue between MHs 2-1-2B and 2-1-2. The additional upstream conveyance capacity results in increased downstream flows and reveals a capacity deficiency within the gravity sewer extending toward Main LS.

The proposed NW 6th Avenue East Improvements consist of upsizing gravity along NW 6th Avenue and SE 3rd Avenue to the Main LS. To alleviate surcharging, the proposed pipeline profile between MHs 5-1-5 and 5-1-1 was modified to provide a steeper downward slope through the relatively flat portion of the alignment, improving hydraulic conveyance through this segment. The shallow MH at 5-1-6 should also be evaluated during future project planning and design to determine whether an adjustment to the pipeline profile or MH invert could provide additional hydraulic benefit while maintaining adequate cover.

The proposed improvements consist of upsizing approximately:

- 446 LF of pipe between MHs 3-1-1 and 5-8-1 from 18- to 27-inch;
- 260 LF of pipe between MHs 5-8-1 and 5-1-12 from 21- to 30-inch;
- 402 LF of pipe between MHs 2-1-1 and 5-1-12 from 12- to 30-inch;
- 545 LF between MHs 5-1-12 and MHs 5-1-11 from 21- to 36-inch;
- 947 LF between MHs 5-1-10 and 5-1-7 from 24- to 36-inch;
- 1,126 LF of pipe between MHs 5-1-7 and 5-1-2 from 24- to 36-inch, and;
- 34 LF between MHs 5-1-2 and 5-1-1 from 21- to 36-inch.

The proposed improvements consist of gravity sewer pipelines generally located at an approximate depth of 5 feet.

Portions of the proposed improvements are located beneath an existing building, and a portion of the proposed alignment crosses an existing railroad. The proposed improvements may also be affected by an existing bridge along the alignment. An alternative alignment analysis was not performed as part of this GSP because future redevelopment and land use changes may affect the continued presence of the existing building and the feasibility of potential alternative alignments. Alternative alignments should be

evaluated during future project planning and design, when additional information regarding redevelopment and future land use is available. Depending on the condition and structural constraints of the existing bridge, replacement or modification of the bridge may be required to accommodate the proposed improvements.

P-05: NW Fargo, NW 18th Loop, NW 18th Avenue Improvements

The model identified surcharging and potential manhole flooding downstream of Crown View LS area along NW Fargo Street, NW 18th Loop, and NW 18th Avenue, indicating the need for additional gravity sewer capacity. Model surcharging and manhole flooding were identified between MHs 3-1-33 to 3-1-25. The deficiency is caused by a combination of pipe capacity limitations and changes in pipe slope. While portions of the upstream system have relatively steep slopes, several downstream pipe segments flatten, reducing hydraulic capacity and causing the HGL to increase.

The proposed NW Fargo Street, NW 18th Loop, and NW 18th Avenue Improvements consist of upsizing approximately:

- 2,744 LF of pipe between MHs 3-1-26 to 3-1-14 should be upsized from 8- to 15-inch.

The proposed gravity sewer improvements are located at an approximate depth of 10 feet. These improvements will provide additional conveyance capacity and alleviate the modeled surcharging and manhole flooding.

Under the buildout scenario, additional segments were identified that exceed the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions:

- 763 LF of pipe between MHs 3-1-36 and 3-1-33 should be upsized from 8- to 12-inch, and;
- 1,218 LF of pipe between MHs 3-1-33 and 3-1-26 should be upsized from 8- to 15-inch.

These additional improvements are not required under the 20-year scenario because the modeled surcharging remains more than 3 feet below MH rim but are recommended to accommodate full buildout conditions.

P-06: NE Garfield Street to NE 15th Avenue to NE Franklin Street along the Mill Ditch Improvements

P-06 experiences surcharging and potential manhole flooding along Division Street between NE Garfield Street and NE 15th Avenue, continuing toward NE Franklin Street and along the Creek Improvements area during the design storm. The model identified deficiencies at MHs 4-2A-1, 4-2-1, 4-1-2, 4-1-1, and 3-2-2 due to insufficient capacity in the existing gravity mains.

The proposed improvements include upsizing:

- 282 LF of pipe between MHs 4-2A-2 to 4-2A-Q should be upsized from 8- to 12-inch;
- 115 LF of pipe between MHs 4-2A-Q and 4-2A-1 from 8- to 15-inch;
- 795 LF of pipe between MHs 4-2A-1 and 4-2-2 from 8- to 18-inch;
- 427 LF of pipe between MHs 4-2-2 and 4-2-1 from 8- to 24-inch;
- 256 LF of pipe between MHs 4-2-1 and 4-1-2 from 8- to 27-inch;
- 254 LF of pipe between MHs 4-1-2 and 4-1-1 from 21- to 30-inch;
- 158 LF of pipe between MHs 4-1-1 and 3-2-6 from 21- to 30-inch, and;
- 347 LF of pipe between MHs 4-1-1 and 3-2-4 from 15- to 36-inch.

The portion of pipe between MHs 3-2-4 and 3-2-2 along the Mill Ditch is excluded from the project because these pipes were recently upsized, are in good condition, and meet performance criteria (i.e., they do not surcharge within 3 feet from MH rim). The proposed gravity sewer improvements would be constructed at an approximate depth of 10 feet and provide additional conveyance capacity to address the modeled surcharging and potential manhole flooding under the existing and 20-year conditions.

Under the buildout scenario, additional segments were identified that would exceed the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions, approximately:

- 290 LF of pipe between MHs 4-1-6 and 4-1-4 should be upsized from 18- to 24-inch;
- 269 LF of pipe between MHs 4-1-4 and 4-1-3 should be upsized from 21- to 24-inch;
- 422 LF of pipe between MHs 4-1-3 and 4-1-2 should be upsized from 18- to 30-inch, and;
- 376 LF of pipe between MHs 3-2-4 and 3-2-2 should be upsized from 21- to 30-inch.

These additional improvements are not required under the 20-year scenario because the modeled surcharging remains more than 3 feet below MH rim but are recommended to accommodate full buildout conditions.

P-07: South Prune Hill LS Force Main Improvements

P-07 experiences velocities above the City's maximum design criterion in the existing 10-inch force main serving the South Prune Hill LS. The South Prune Hill LS captures flows from the eastern portion of the City's gravity collection system. Based on the modeled flows and hydraulic conditions, the existing force main has the potential to exceed the City's maximum design criterion of 8 fps under existing and 20-year conditions.

The proposed improvement consists of upsizing approximately:

- 925 LF of force main between the South Prune Hill LS wet well and MH 10-1-3 from 10- to 18-inch.

The proposed improvement provides additional conveyance capacity and reduces force main velocities to improve system performance under future conditions.

It should be noted that the existing-condition velocity may appear to be below the City's 8 fps criterion because upstream hydraulic restriction limit the flow entering the force main. When P-01 improvements are implemented, the increased conveyance capacity upstream allows additional flow to reach the South Prune Hill LS, resulting in increased force main velocities and periods of unstable hydraulic performance. The proposed P-07 improvement addresses the interaction between the upstream gravity system and the force main provides more stable performance as additional system capacity is made available.

P-08: West Camas LS Force Main Improvements

The West Camas force main, located downstream of the P-01 and P-07 improvements along NW 6th Place, experiences a capacity deficiency under existing conditions. Implementation of the upstream improvements will increase conveyance capacity and allow additional flows to reach the West Camas LS, reaching in increased flows within the existing force main between the West Camas wet well and MH 1-1-10. The existing 6-inch force main does not have sufficient capacity to convey these increased flows.

The proposed improvement consists of upsizing approximately:

- 574 LF of force main between the West Camas wet well and MH 1-1-10 from 6- to 15-inch.

This improvement provides the additional conveyance capacity needed to accommodate the increased flow resulting from the upstream improvements.

P-09: Main LS Dual Force Main Improvements

P-09 includes the Main LS force main, which conveys flows from the majority of the City's sewer collection system, excluding the STEP Basin and Flow Meter 8-1-2, to the WWTF. As the downstream force main for the preceding system improvements, the Main LS force main conveys the increased flows resulting from the proposed upstream improvements. Under both existing and 20-year conditions, the modeled PWWF velocity in the existing 18-inch force main is approximately 14 fps, exceeding the City's design criteria of greater than 8 fps.

The proposed improvement consists of installing approximately:

- 2,347 LF of 21-inch force main from the Main LS wet well to the WWTF, creating a dual force main system.

The additional force main provides increased conveyance capacity for existing and future flows and reduces the hydraulic loading on the existing 18-inch force main. The existing force main would remain in service as part of the dual force main system.

The proposed dual 18-inch and 21-inch force main configuration should be evaluated as part of the system modeling to confirm PWWF velocities, available conveyance capacity, and operating conditions under 20-year and buildout conditions. Although the 20-year PWWF velocity remains slightly above the City's 8 fps criterion, further upsizing would reduce velocities during lower-flow conditions below the minimum velocity required to flush pipes (2.5 fps). Therefore, the proposed 24-inch force main provides a balance between reducing PWWF velocities and maintaining adequate velocities during lower-flow conditions.

P-10: Leadbetter Road Dual Force Main Improvements

The Leadbetter Road LS captures all flows from the North Shore area. Based on the modeled flows to the LS wet well, the existing single 8-inch force main does not have sufficient capacity to convey projected flows under 20-year system conditions, resulting in velocities that exceed the City's 8 fps design criterion and potential manhole flooding upstream of the Leadbetter Rd LS.

The proposed improvement consists of activating the existing parallel 8-inch force main and installing approximately:

- 6,500 LF of parallel 10-inch force main from Node_161, near the intersection of SE Leadbetter Road and NE Everett Street, to Node_27, near the intersection of NE 23rd Avenue and NE Everett Street.

These improvements increase force main capacity and alleviate the potential for upstream MH flooding under 20-year conditions. While the modeled PWWF velocity slightly exceeds the City's maximum design criterion of 8 fps, further upsizing would reduce velocities during lower-flow conditions below the minimum velocity required to flush pipes (2.5 fps). Therefore, the proposed 10-inch force main provides a balance between reducing PWWF velocities and maintaining adequate velocities during lower-flow conditions.

P-11: Division Street Improvements

Along Division Street, downstream of P-05, the model identified surcharging and manhole flooding between MHs 3-1-11 to 3-1-10, and 3-1-6 under the existing system, indicating the need for additional pipe capacity. To alleviate surcharging:

- 827 LF of pipe between MHs 3-1-14 and 3-1-11 from 8- to 15-inch;
- 505 LF of pipe between MHs 3-1-11 and 3-1-9 from 8- to 21-inch, and;
- 1,526 LF of pipe between MHs 3-1-9 and 3-1-2 from 8- to 18-inch.

These improvements provide additional conveyance capacity, alleviate the modeled surcharging and potential manhole flooding, and allow the system to meet the City's design criteria.

Under the buildout scenario, the gravity sewer segment between MHs 3-1-2 and 3-1-1 was identified as exceeding the City's design criterion of d/D less than 0.92. To meet the d/D criterion under buildout conditions:

- 276 LF of pipe between MHs 3-1-2 and 3-1-1 should be upsized from 15- to 18-inch.

This improvement is not required under the 20-year scenario because the surcharging is not within 3 feet from MH rim but are recommended to accommodate full buildout conditions. This project is at a depth of approximately 10 feet.

P-12: SE Everett Road to Leadbetter Road Extension

The proposed project will extend the existing sanitary sewer system to serve planned development. The improvements consist of installing approximately:

- 2,031 LF of 8-inch,
- 692 LF of 12-inch, and;
- 6,036 LF of 18-inch gravity sewer along the proposed alignment from NE Everett Road to NE Leadbetter Road.

New sewer infrastructure will provide the capacity necessary to accommodate projected development and connect the new development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer. For more information, see Chapter 9 - Capital Improvement Plan.

P-13: SE 238rd Avenue to NE Woodburn Drive Extension

The proposed project will extend the existing sanitary sewer system to serve planned development. The improvements consist of installing approximately:

- 6,782 LF of 12-inch, 692 LF of 12-inch gravity sewer along the proposed alignment from SE 283rd Avenue to NE Woodburn Drive.

New sewer infrastructure will provide the capacity necessary to accommodate projected development and connect the new development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer. For more information, see Chapter 9 - Capital Improvement Plan.

S-01: NW Parker Street to NW Lake Road STEP Main

The NW Parker Street to NW Lake Road STEP Main conveys flows from the STEP Basin areas associated with NW Parker Street and NW Lake Road. Based on the modeled flows and velocity results, the existing 21- and 24-inch STEP mains do not have sufficient capacity to convey projected flows under 20-year system conditions, resulting in elevated hydraulic grade lines. To address this deficiency and provide additional capacity for future conditions, a parallel STEP main is proposed. The existing STEP main will remain in place for emergency bypass.

The proposed improvement consists of approximately:

- 14,032 LF of 30-inch STEP main.

Following construction, the existing STEP main in this area will be taken out of active service and retained for emergency bypass conditions or use during PWWF events. The proposed 30-inch STEP main will provide the primary conveyance capacity for flows from the STEP Basin and accommodate projected future flows. For more information, see Chapter 9 - Capital Improvement Plan.

There are 11 projects recommended to address existing system deficiencies and three projects recommended to address future growth-driven deficiencies. Some projects address deficiencies that are existing and are exacerbated by future growth.

Table 6.5 shows a summary of the City's recommended pipe capacity improvements and expansion.

Table 6.2 Recommended Pipe Capacity Projects

Project ID	Improvement Type	Location	Existing Size (inch)	Proposed Size (inch)	Length (feet)
P-01	Gravity	NW 6th Place West Upsize Improvements	8 8 8	12 15 18	422 809 472
P-02	Gravity	NW 6th Place East Upsize Improvements	8	21	682
P-03	Gravity	NW 6th Place Avenue West Upsize Improvements	12 12	24 21	1,943 592
P-04	Gravity	NW 6th Place Avenue East Upsize Improvements	18 21 12 21 24 21 21	27 30 30 36 36 36 36	446 260 402 545 947 1,126 34
P-05	Gravity	NW Fargo Street, NW 18th Loop, and NW 18th Avenue Upsize	8	15	2,744
P-06	Gravity	NE Garfield Street to NE 15th Avenue to NE Franklin Street to along the Creek Improvements	8 8 8 8 8 21 21 15	12 15 18 24 27 30 36 36	282 115 795 427 256 254 158 347

Project ID	Improvement Type	Location	Existing Size (inch)	Proposed Size (inch)	Length (feet)
P-07	Force Main	South Prune Hill Force Main Improvements	10	18	925
P-08	Force Main	West Camas LS Force Main Improvements	6	15	574
P-09	Force Main	Main LS Dual Force Main Improvements	-	21	2,348
P-10	Force Main	Leadbetter Road LS Dual Force Main Improvements	-	10	6,500
P-11	Gravity	Division Street Upsize	8 8 8	15 21 18	827 505 1,526
P-12	Gravity	SE Everett Road to Leadbetter Road Extension	- - -	8 12 18	2,031 692 6,036
P-13	Gravity	SE 283rd Avenue to NE Woodburn Drive Extension	-	12	6,782
S-01	STEP	NW Parker Street to NW Lake Road STEP Main Improvements	-	30	18,063

6.6.2 Recommended Lift Station Improvements

It is recommended that nine lift stations all be upgraded to improve pump capacity and redundancy and to accommodate existing and 20-year system demands. South Prune Hill, West Camas, Crown View, and Main LSs do not currently meet the City's required firm capacity under existing conditions. Improvements at these stations consist of adding redundant pumping capacity to allow the stations to maintain service during a pump outage or maintenance event. Table 6.2 shows the recommended lift station improvements.

Table 6.3 Recommended Lift Station Improvement Projects

Project ID	Improvement Type	Location	Description
LS-01	Lift Station	Lower/South Prune Hill	Construct a new Lower/South Prune Hill LS with a pump capable of pumping 3.0 mgd of firm capacity to provide additional capacity and support future system needs.
LS-02	Lift Station	West Camas	Construct a new West Camas LS with a pump capable of pumping 3.3 mgd of firm capacity to provide additional capacity and support future system needs. This LS is downstream of Lower/South Prune Hill LS, so this project should be implemented after the Lower/South Prune Hill LS improvements.
LS-03	Lift Station	Crown View	Construct a new Crown View LS with a pump capable of pumping 1.0 mgd of firm capacity to provide additional capacity and support future system needs.
LS-04	Lift Station	Lacamas Creek	Replace the two existing pumps capable of pumping 2.13 mgd each to meet the required firm capacity.
LS-05	Lift Station	Main LS	Construct a new Main LS with pumps capable of pumping 21.0 mgd of firm capacity to provide additional capacity and support future system needs.
LS-06	Lift Station	Goodwin Road	Add a pump capable of pumping 0.49 mgd.
LS-07	Lift Station	232nd Avenue	Add a pump capable of pumping 0.53 mgd

Project ID	Improvement Type	Location	Description
LS-08	Lift Station	Leadbetter Road	Add a pump capable of pumping 0.87 mgd
			Replace the three existing pumps with pumps capable of pumping 1.82 mgd each.
LS-09	Lift Station	Hills at Round Lake	Replace the two existing pumps with three new pumps, each capable of pumping 0.65 mgd to meet the required firm capacity.

6.6.3 Recommended General Projects

The recommended sewer improvements identified in this GSP are critical to maintaining reliable and adequate wastewater collection and conveyance as the City continues to grow. The improvements address existing capacity deficiencies, accommodate projected future flows, and provide additional capacity to support planned development and 20-year conditions. Improvements include gravity sewer upsizing, force main, and STEP main improvements, lift station upgrades, and extensions of the existing sewer collection system to serve future growth areas. In addition to these capital improvements, several general system improvements are recommended to support ongoing sewer system management, improve understanding of system conditions, and inform future capital improvement planning. Table 6.3 shows a summary of the recommended general improvement projects.

Table 6.4 Recommended General Projects

Project ID	Improvement Type	Project Name	Description
G-01	Study	Basin 4-1-3 Pilot I/I Study	This program will investigate the source and magnitude of I/I of storm and groundwater into the wastewater system at locations where suspected high I&I is currently or is forecast to exceed conveyance and/or lift station capacity. Identifying and removing non-sewage flow where that would reduce surcharging such that costly capacity improvements might be avoided.
G-02	Study	Basin 5-1-2 Flow Monitoring	This project is to install temporary flow meters in Basin 5-1-2 to capture flows from the Camas LS and Upper Prune Hill contributing areas separately. Both areas have pipe and LS capacity deficiencies and additional flow monitoring within this basin would help to understand if part of the basin is contributing a greater portion of I/I. This study should evaluate if projects within the basin have the potential to reduce I/I such that projects to increase hydraulic capacity within the system can be avoided. Reducing I/I has downstream benefits at the treatment plant as well.
G-03	General	Basin 5-1-2 Flow Monitoring	This project includes general GIS improvements to maintain and update wastewater asset information, improve data accuracy, and support ongoing system planning and management.
G-04	Study	Systemwide	Update and expand the City's hydraulic model to include additional collection system pipes and provide a more complete evaluation of system capacity and deficiencies.
G-08	General	Systemwide	2035 General Sewer Plan Update
	General	Systemwide	2045 General Sewer Plan Update

6.6.4 Recommended Annual Repair and Replacement Program

The City has established an annual maintenance program as part of its CIP to maintain and improve the existing wastewater system. These improvements will help the City address aging infrastructure, maintain reliable operation of the collection system, and extend the useful life of existing assets. Continued investment in these projects will also help the City address maintenance needs as they arise and support the long-term goals of the GSP. Table 6.4 shows a summary of the City's annual repair and replacement program.

Table 6.5 Recommended Annual Repair and Replace Program Projects

Project ID	Improvement Type	Project Name	Description
R-01	R&R	Sewer Main R&R Program	This program will investigate the condition of wastewater collection system pipelines identified as having been installed prior to 1940s. The program will evaluate the condition and performance of these older pipelines to identify potential structural, operational, or capacity concerns and determine whether rehabilitation or replacement is needed.
R-02	R&R	Miscellaneous LS Projects	This project includes miscellaneous improvements at existing lift stations to address operational and maintenance needs. Improvements may include pump and piping replacement, electrical and controls upgrades, instrumentation, wet well improvements, odor control, and other equipment or site improvements as needed. These improvements will help maintain reliable operation and address deficiencies that may be identified through regular operation and maintenance of the lift stations.

6.7 Additional Recommendations

Our collection system evaluation was limited to the collection system that was modeled. The collection system includes gravity and STEP elements, but only portions of the gravity system and the STEP transmission main are set up for capacity evaluation with the hydraulic model. Other factors such as lack of extensive city-wide GIS limited the scope of the collection system evaluation. The following bullet points explain future projects the City should undergo to allow more effective evaluation of the gravity and STEP system, respectively:

- **Gravity Collection System Model:** The gravity collection system model is skeletonized, with only 28 percent of the gravity system pipes, STEP trunk mains, force mains are connected to the 12 modeled lift stations. While most of the critical trunks are included, a full pipe or less skeletonized model is needed for a more robust evaluation of the system. To expand the model, accurate and updated GIS for the collection system should be developed.
- **STEP Main Model Calibration:** The STEP system model should be further calibrated to verify and refine the modeled results. Additional metering at lift stations farther upstream would provide data necessary to properly calibrate the STEP portion of the model. While these individual lift stations do not necessarily need to be explicitly represented in the hydraulic model, accurate data on their flows and contributions to the STEP system should be collected and incorporated into the model. The current STEP system model primarily includes the major trunk lines; therefore, incorporating additional STEP mains and piping would provide a more detailed representation of the system and improve the accuracy of future hydraulic evaluations and model refinement. The addition of a manhole with a flow meter near the intersection of NW Lake Road and NW Lacamas Drive or near NW

Parker Street and NW Knapp Lane should also be considered to provide additional flow data and aid in model calibration.

- **STEP Main Condition Assessment:** The addition of manholes to the STEP system would help facilitate investigation of the STEP mains condition and allow any partially obstructed portion of the STEP Main to be identified. A future investigation of debris, solids, and other obstruction is recommended in the sags in the system.
- **STEP System Lift Stations:** The STEP system lift stations could not be fully evaluated under PWWF conditions using the system model due to limited operational data. Implementing SCADA systems with historian capabilities would allow the City to monitor and record pump operation, flow conditions, and pump run times, providing the data necessary to evaluate lift station performance and improve future system modeling. SCADA implementation should be prioritized at lift stations where the City anticipates receiving the highest flows, as well as at all future City-owned lift stations as they are expanded or constructed.

CHAPTER 7 WASTEWATER TREATMENT FACILITY

7.1 Introduction

The City serves the water quality needs of approximately 8,500 residential, industrial, and commercial accounts by maintaining and operating their WWTF which has a maximum month design flow of 6.1 mgd.

To support development of the City's GSP, a unit process analysis was completed to identify shortfalls in plant capacity that will prevent the City from reliably treating and disposing of projected flow and loads at the end of the planning period (i.e., year 2045). To address the identified deficiencies, an alternatives analysis of the most viable improvement options was conducted, which resulted in the development of 25 projects to be incorporated into the GSP's CIP.

This chapter summarizes the methods and results of these tasks, thus defining the condition and capacities of the WWTF's unit processes and presenting sequenced recommendations that will allow the City to reliably and cost-effectively serve their customers now and into the future.

7.1.1 Current National Pollution Discharge Elimination System Permit

The City's WWTF effluent must comply with limits on BOD_5, TSS, ammonia, pH, summer heat load, and fecal coliform bacteria as conditions of their NPDES permit. The current permit, Permit No. WA0020249, is effective as of August 1, 2025. The current discharge limits are summarized in Table 7.1. See Appendix H for the City's Permit.

A Reasonable Potential Analysis (RPA) was prepared to identify any new reasonable potential for the projected 2035 discharges to cause or contribute to any excursions above state water quality standards with the current design effluent water quality. The *Reasonable Potential Analysis Project Memorandum*, included in Appendix J, did not identify any new reasonable potentials.

Table 7.1 NPDES Permit Effluent Limits for Permit No. WA0020249

NPDES Permit Effluent Limits		
Parameter	**Average Monthly**	**Average Weekly**
BOD_5	▪ 20 mg/L ▪ 842 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,264 ppd
TSS	▪ 20 mg/L ▪ 1,017 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,525 ppd
Ammonia (NH_3 as N) during summer (1)	▪ 20 mg/L	▪ 30 mg/L
Ammonia (NH_3 as N) during winter (2)	▪ 7 mg/L	▪ 11 mg/L
Parameter	**Minimum**	**Maximum**
pH	▪ 6 SU	▪ 9 SU

NPDES Permit Effluent Limits		
Parameter	**Monthly Geometric Mean**	**7-day Geometric Mean**
Heat Load during summer (1)	▪ 5.87 x 10^8 kcal/day	▪ N/A
Fecal Coliform Bacteria	▪ 200 organisms/100 mL	• 400 organisms/100 mL

Notes:
(1) Applicable only from June 1 to September 30.
(2) Applicable only from October 1 to May 31.
SU - standard units.

7.1.2 Past Evaluation of Reuse

In the *2010 General Sewer/Wastewater Facility Plan* (Gray & Osbourne, Inc. 2010) (2010 GSP), the City explored their potential to practice wastewater reclamation, or the production and beneficial use of reclaimed water. As such, an evaluation was completed to understand the feasibility of reusing effluent from the WWTF or constructing a new water reclamation facility (WRF) to treat wastewater for reuse.

The evaluation determined that, though environmental and social benefits are difficult to quantify and assess, the City and their surrounding communities can benefit indirectly from the use of reclaimed water in the following ways:

- Development of additional outdoor recreational sites for the community.
- Irrigation of parks and playfields, which can potentially increase property values.
- Conservation of the quality and quantity of the City's water resources.
- A flexible and reliable alternative water source for industrial water customers.

However, the evaluation also confirmed that the production of reclaimed water is only economically feasible if the cost of producing reclaimed water is less than or equal to the cost of purchasing water or developing additional water rights.

Capital, operation, and maintenance costs for the two alternatives were taken from the 2010 general sewer plan and converted from 2006 dollars to 2025 dollars. A new 20-year present worth analysis was conducted with the updated values. Both the 2010 GSP and the current 20-year present worth analysis found that neither the costs to modify the existing WWTF nor construct a satellite WRF were less than or equal to the cost of developing additional water rights, which are available at notably lower costs. The cost to develop and acquire additional water rights was expected to not exceed $5 million in 2006, which would be $15 million in 2025.

Comparisons of the two alternatives are shown in Table 7.2. Alternative 1 has a 20-year present worth of $30.5 million and alternative 2 has a 20-year present worth $81.6 million. Both alternatives are considerably larger than the 15 million dollars to develop and acquire additional water rights. Therefore, water reclamation and reuse were determined to be economically infeasible and not pursued at the City's WWTF. As the potential for reclaimed water demands have not significantly changed since 2010, the previous analysis remains applicable to current conditions.

Chapter 10 of the 2010 GSP documents the feasibility evaluation of reuse in further detail.

Table 7.2 Reuse Alternative Cost Comparison

	Alternative 1 Modify Existing WWTF	Alternative 2 Construct Satellite WRF
Capital Cost(1)	$24,414,000	$68,235,000
Annual O&M Cost(2)	$317,000	$705,000
20-year Present Worth(3)	$30,457,000	$81,662,000

Notes:
(1) 2010 GSP used 2006 costs. The Handy-Whitman Index for the Pacific Region in July 2006 and July 2025 were used.
(2) 2010 GSP reported 2004 costs. Costs were updated using the Handy-Whitman Index for the Pacific Region in January 2004.
(3) Discount rate assumed 5% bond repayment rate and 4% inflation for a total rate of 1%.

7.2 Unit Process Analysis

A unit process analysis comparing the design or rated capacity of each WWTF unit process against its requisite treatment demands under current and projected flows and loads. This is detailed in Appendix I - *Evaluation of the Wastewater Treatment Facility Report*. This comparison identified deficiencies or limitations in the plant's current installed capacity to meet its various regulatory and operational requirements by 2045.

To this end, the unit process analysis was completed in the following six sequential tasks:

- Compile and analyze three years (January 2022 to December 2024) of WWTF data.
- Develop a hydraulic model of the collection system (collection system model) to estimate future average day flow (ADF), MMF, MDF, and peak hour flow (PHF) at the WWTF under the design storm.
- Estimate future flows and mass loadings through the planning year 2045.
- Prepare spreadsheet-based capacity estimates of existing liquid and solids processes to meet anticipated permit conditions under current and future influent characteristics.
- Update and recalibrate hydraulic and BioWin models with recent plant data (May to June 2025) to assess future flows and loadings impacts on existing plant facility performance. Both models were originally developed for the previous GSP (2024).
- Conduct plant tours in June 2025 to review and update prior condition assessments completed as part of the 2024 GSP and identify any limitations.
- Using both the spreadsheet-based capacity assessment and the results of the calibrated hydraulic and BioWin modes, determine future treatment capacities required for each unit processes and estimate the ideal timing of future plant improvements.

The following sections highlight key points and findings from the above tasks.

7.2.1 Flows and Loads

Flows and loads and presented are in Chapter 3 - Basis of Planning. Tables 3.10 and 3.11 present the current and projected flows and loads, which must be treated and discharged to the Columbia River. These projections were developed according to historical influent flows and raw wastewater pollutant concentrations, typical septage and STEP system characteristics, population growth projections, and industrial flow contributions. Projected future flows are based on Comprehensive Plan 2045 land uses and

wastewater flow factors developed for the various land uses. Chapter 3 Basis of Planning details the method by which these flows and loads were analyzed.

7.2.2 Hydraulic Modeling

Carollo Engineers' Hydraulix® modeling software was used to establish the hydraulic capacities of individual unit processes and water surface elevations (WSE) under 2045 peak flows. More specifically, this software modeled the flow through the WWTF by calculating both energy grade lines and hydraulic grade lines according to head loss and velocity at each hydraulic element under various influent flow conditions identified in Table 7.3.

Each individual unit process was considered "at risk" when the model indicated less than 18 inches of freeboard in a structure or less than six inches of fall from flow over a weir to the downstream water surface. A unit process was considered "overloaded," or as having a true hydraulic limitation, when the model indicated less than 12 inches of freeboard or a weir was submerged. Less than 12 inches of freeboard in an open channel puts the WWTF at risk of flow overtopping a structure and must be avoided at all costs. Additional details about the hydraulic model assumptions and results can be found in Section 5.5 of the Evaluation of the Wastewater Treatment Facility Report in Appendix I.

7.2.3 State Point Analysis

The relationship between mixed liquor suspended solids (MLSS) concentrations, plant flows, and clarifier capacity can also be illustrated by another graphical method commonly called state point analysis as described below.

A clarifier state point analysis determines the effect of operating conditions on secondary clarifier capacity by comparing the actual solids loading to the theoretical maximum solids loading rate in pounds per day per square foot (ppd/sf) of the clarifier surface area as a function of the MLSS concentration. Key factors in a state point analysis are the MLSS concentration, the flow fed to the clarifiers, and the settling velocity of the MLSS as predicted by the selected correlation between SVI and settling velocity. State point analyses are very useful for predicting the ability of secondary clarifiers to operate successfully under peak flow conditions. Additional information on the state point analysis is provided in the Evaluation of the Wastewater Treatment Facility Report in Appendix I.

The desktop analysis indicates that the City should reconstruct Secondary Clarifier No. 1 with a new sloped bottom and spiral scraper mechanism identical to the existing Secondary Clarifier No. 3, as well as constructing a fourth Secondary Clarifier (No. 4) in the future (by 2040) to provide adequate capacity to treat flows and loads through 2045 and beyond.

The statistical evaluation of historical plant data revealed periodic occurrences of sludge bulking in the biological nutrient removal (BNR) process. For the three years of data examined there were three periods where the sludge volume index (SVI) exceeded the proposed design SVI of 160. Although these periods present less than 10 percent of the days in that two-year period, they are a concern as they indicate that the current method of bulking control (chlorination) takes weeks to be effective. All three episodes occurred in winter or early spring when peak wet weather flows typically occur. The secondary clarifiers could fail in the future (when both plant flow and peak flows are projected to be higher than existing flows) if the peak flows occur during a bulking episode.

There have been significant advances in the last decade in the use of selectors and other methods of obtaining a densified activated sludge that provides lower and more stable operating SVIs. It is recommended that the WWTF evaluate the causes of the bulking including identification of the causative organisms and evaluate the feasibility of implementing at least one of the methods before or during the next design and construction project at the WWTF.

7.2.4 BioWin Modeling

BioWin version 6.3 was used to simulate the real-world physical, chemical, and biological treatment processes of the WWTF. This model was updated and recalibrated using existing treatment facility operational data from January 2022 through December 2024 supplemented by data obtained from the special sampling events, and by running a dynamic simulation using the daily plant influent and effluent values (BOD_5, TSS, ammonia) and MLSS concentrations from May 2025.

Once the calibration effort was deemed acceptable, parameters were established for future conditions under which the WWTF must operate. Specifically, this effort adopted the flows and load projections presented in Tables 7.3 and 7.4 while assuming that effluent limits on ammonia would be as low as 7 mg/L for all scenarios.

Finally, the BioWin model was used to model performance of the entire WWTF under the following anticipated future conditions:

- TSS removal rates of 54, 47, 44 and 34 percent were assumed for the primary clarifiers under 2045 average annual, maximum monthly, maximum week, and maximum day conditions (Table 7.4)
- A minimum aerobic solids retention times (aSRT) of 8.0 days under maximum month conditions and 6.05 days under maximum week conditions. These aSRTs result in nitrification safety factors of 2.9 and 2.2 under maximum month and maximum week flow conditions, respectively.
- An SVI, which is a quantification of MLSS settling velocity, of 160 milliliters per gram (mL/g).

Additional details about the process simulation (BioWin modeling) including the model configuration and results can be found in Section 5.4 of the Evaluation of the Wastewater Treatment Facility Report in Appendix I.

7.2.5 Condition Assessment

A condition assessment was conducted as part of the 2024 GSP to identify major facility deficiencies and provide a general priority rating for mechanical equipment, treatment units, structures, and electrical, instrumentation, and control (E&IC) systems. The compiled information was updated during the plant tours conducted in June 2025 as part of this GSP Update to determine which portions of the facility can be retained, which require major upgrades, and which should be abandoned or replaced.

To begin, the assessment team reviewed drawings and design criteria for each unit process, including the recommended WWTF redundancy criteria for flows and loads as published in the *Criteria for Sewage Works Design* (August 2008, Department of Ecology) and summarized in Table 2.4 of Chapter 2.

Next, the team discussed maintenance history, plant shortcomings, and general operational issues with City staff, who also accompanied the team on walk-through inspections of the WWTF following the general occurrence of the processes and associated major equipment in the direction of flow.

Table 7.5 summarizes each key WWTF component's condition and rated capacity. For more information, see Appendix K, *Condition Assessment of Camas Wastewater Treatment Facility Project Memorandum*.

Table 7.3 2025 Condition Assessment Summary

WWTF Component	Rated Capacity	2019 Condition Assessment Associated with 2024 GSP(1)	2025 Condition Assessment
Plant Headworks			
Influent Pipe	▪ N/A	▪ Headworks influent pipe configuration occasionally causes upstream overflow at the Parshall Flume during high flows.	▪ Same observation as in 2019 Condition Assessment. Influent piping should be modified by installing a rigid plate or concrete cover.
Influent Screens and associated washer/compactors	▪ Two mechanical screens. 7 mgd per screen, total 14 mgd. ▪ Washer/compactors are rated for 10 cf/hr.	▪ No significant condition issues identified.	▪ One of the influent screens needs a bearing replacement, and the plant is planning to perform this repair in-house.
Manual Bar Rack	▪ One manual bar rack.	▪ No significant condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Slide Gates	▪ Seven slide gates.	▪ No significant condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Primary Clarifiers (PC)	▪ 60-foot diameter, 10-foot SWD. ▪ SOR - 3,608 gpd/sf at PHF with both units operational.	▪ No significant condition issues identified.	▪ Severe corrosion of clarifier mechanisms; city replacing internals of both clarifiers as part of ongoing project.
Aeration Basin Influent flow splitter box	▪ N/A.	▪ N/A	▪ One shaft mixer was non-operational; staff noted the structure's freeboard is limited during high-flow events.
Aeration Basins (AB)	▪ Three ABs - 120 feet long, 40 feet wide and 21 feet SWD. ▪ ~3.9 to 5.7 mgd on max. week loading (3 AB, 3 SC at SVI of 90 - 160 mL/g).	▪ Flow split between the 3 basins is uneven. ▪ Weir walls between the zones are uneven. Wooden walls in anaerobic zones.	▪ Same observation as in 2019 Condition Assessment. Also, the internal recycle from the end of the aerobic zone is sent to the end of the anaerobic zone.
Secondary Clarifiers (SC)	▪ Three 75-foot diameter SC, 15 feet SWD.	▪ SC. No. 1 is non-operational due to its flat bottom	▪ Same observation as in 2019 Condition Assessment.
Aeration System	▪ Four 150 hp centrifugal blowers. ▪ Firm capacity of 4,890 scfm at 10 psig.	▪ Unable to control blowers when operating multiple in parallel	▪ Same observation as in 2019 Condition Assessment. City is replacing two 150 hp blowers with 100 hp high speed turbos; however, the new and old blowers will not be able to operate together.
Effluent Filters	▪ Two Cloth disk filters (10 micron). 3 mgd per filter, total 6 mgd.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. Plant staff indicated the filters are backwashing 30% of the time, which is higher than the anticipated 20% or less.
UV Channel	▪ Four UV banks. ▪ 13.7 mgd at 65% UVT.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. City is replacing the existing UV system with new UV system as part of an ongoing project.
Effluent Transfer Pumps	▪ Three 4,550 gpm at 16-feet TDH, 30 hp pumps. Firm Capacity is 13.09 mgd.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Non-potable Water Transfer Pumps	▪ Three 200 gpm at 185-feet TDH, 15 hp pumps.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. City is replacing the motors for these pumps with new motors and variable frequency drives as part of an ongoing project.
RAS Pumps	▪ Each SC has two RAS pumps. ▪ SC No. 1 has two pumps 1,000 gpm each. ▪ SC No. 2 has two pumps 1,050 gpm each. ▪ SC No. 3 has two pumps 1,400 gpm each	▪ No condition issues identified. SC No. 1 is not operation.	▪ Same observation as in 2019 Condition Assessment. ▪ City is replacing the VFD for a couple of RAS pumps as part of an ongoing project.
WAS Pumps	▪ Each SC has one WAS pump. ▪ SC No. 1 has one pump 85 gpm. ▪ SC No. 2 has one pump 85 gpm. ▪ SC No. 3 has one pump 240 gpm.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Primary Sludge Pumps	▪ Two pumps. Each 220 gpm.	▪ No condition issues identified.	▪ One of the primary sludge pumps was making a very loud noise.
Internal Recycle Pumps	▪ Each AB has one submersible pump. 3,125 gpm.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Degritting Cyclone ang grit classifier	▪ Two units. Each 220 gpm.	▪ End of useful life.	▪ Same observation as in 2019 Condition Assessment. City is replacing both units with new as part of an ongoing project.
Gravity Thickener	▪ One unit. 30-foot diameter, 10-foot SWD.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment. ▪
Thickened Primary Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Rotary Drum Thickener	▪ One unit. 100-300 gpm.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Thickened WAS Pumps	▪ Two units. Progressive Cavity pumps, 50 gpm each .	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Anaerobic Digesters (AD) and Digested Sludge Holding Tank (DSHT)	▪ Two AD tanks. 32-foot diameter, 29-feet SWD. ▪ One DSHT tank. 32-foot diameter, 29-feet SWD.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
AD mixing and heating equipment	▪ Each digester has one draft tuber mixer and spiral heat exchanger. ▪ One hot water boiler with hot water pumps.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.

WWTF Component	Rated Capacity	2019 Condition Assessment Associated with 2024 GSP(1)	2025 Condition Assessment
Digested Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each	▪ N/A	▪ N/A
Dewatering Centrifuge	▪ One unit. 130 gpm at 2-2.5% solids	▪ Near end of useful life.	▪ No issues observed with the existing unit. ▪ City is adding one new centrifuge (unit) as part of an ongoing project.
Sludge Thermal Dryer	▪ One complete belt-drying system.	▪ No condition issues identified.	▪ Same observation as in 2019 Condition Assessment.
Plant Drain Pump Station No. 1	▪ Two submersible pumps. 250 gpm each.	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2019 Condition Assessment.
Plant Drain Pump Station No. 2	▪ Two submersible pumps. 450 gpm each	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2019 Condition Assessment.
Electrical Components			
Utility Transformer No. 1 (UT1)	▪ 500 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ UT1 shows some signs of rusting but no major concerns.
▪ UV Electrical Room ▪ MDS-UV ▪ MCC-D1 ▪ MCC-D2 ▪ MCC-D3	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing the UV system and associated power distribution panels and a new ATS.
▪ Old Controls Building ▪ MCC-A ▪ PLC-A ▪ Network Rack ▪ Transformer TL and Panel L	▪ N/A	▪ N/A	▪ The main concern in this building is the working clearance around electrical equipment seems low, increasing likelihood of tripping hazard.
Utility Transformer No. 2 (UT2)	▪ 1000 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ UT2 shows some signs of rusting but no major concerns.
▪ Equipment Blower Building ▪ MDS-EB ▪ MCC-C1/C1A ▪ MCC-C2/C2A ▪ Blower VFDs	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing as part of an ongoing project the following: ▪ Two blowers and associated VFDs. ▪ New centrifuge control panels and VFDs
Emergency Generator	▪ 250 kW	▪ N/A	▪ City is replacing with new 450 kW generator as part of an ongoing project.
▪ Digester Electrical Building ▪ SWBD-F ▪ MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820. ▪ City is adding a new MCC-F as part of the ongoing project.
▪ Biosolids Electrical Building ▪ SWBD-F ▪ MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820.
Instrumentation and Controls			
SCADA system	▪ N/A	▪ N/A	▪ The current control system operates on standalone desktop PCs. When the remote display interface is engaged, control functionality on the primary desktop becomes inaccessible. This configuration presents a single point of failure and limits operational flexibility. To address this, a transition to multi-user control architecture is recommended. Additionally, the system must support routine Windows updates without requiring downtime of the primary control workstation, which currently manages all plant operations.
PLC Infrastructure and Upgrade Status	▪ N/A	▪ N/A	▪ Progress on PLC upgrades have progressed. Several PLC components in use have reached end-of-life status, posing reliability and supportability risks. It is strongly advised to prioritize the replacement of these legacy PLCs to ensure continued system integrity and maintainability.

Notes:
(1) Condition Assessment performed as part of the 2024 GSP.
ATS - automatic transfer switch; cf/hr - cubic feet per hour; hp - horsepower; kVA - kilovolt-amperes; kW - kilowatts; MCC - motor control center; MDS-EB - main distribution switchboard - elevator board; N/A - not applicable; NFPA - National Fire Protection Association; PLC - programmable logic controller; psig - pounds per square inch gauge; scfm - standard cubic feet per minute; SOR - surface overflow rate; SWBD - switch board; SWD - side water depth; TDH - total dynamic head; UVT - ultraviolet transmittance; VFD - variable frequency drive.

7.3 Summary of Key Improvements and Preferred Alternatives

Comprehensive analysis of the WWTF's unit processes identified several current and anticipated condition or capacity issues in WWTF's hydraulic, liquid treatment, solids treatment, and plant support systems. The following sections highlight key issues with unit processes at the WWTF and also recommend improvements to mitigate them.

Each unit process's complete description; condition findings, hydraulic capacity, and process capacity analyses; 2045 design criteria, and recommendations for improvements and alternatives are available in Appendix I - Evaluation of Wastewater Treatment Facility Report.

7.3.1 Preliminary Treatment

1. To prevent spraying of the influent wastewater during peak flow events, add a concrete cap over the portion of the channel where the influent pipe enters vertically into the structure upstream of the Parshall Flume.
2. Conduct a structural investigation, perform required structural repairs, add appropriate coatings to the channels.
3. Remove Influent Channel and Parshall Flume and replace with next larger size.
4. Replace the two screens and associated washer/compactors by 2030. The existing screens size have sufficient capacity to handle the 2045 PIDF of 22.2 mgd with both mechanical screens operating (11.1 mgd per screen) at the design blinding of 30 percent.
5. Replace all seven slide gates at the same time as replacing the influent screens.
6. Collect appropriate samples to measure incoming TKN and NH_3 as well as influent alkalinity daily.

7.3.2 Septage Receiving Station

The City is replacing the septage screening equipment as part of an ongoing project. Therefore, no recommendations for further improvements are made at this time.

7.3.3 Primary Treatment

1. Add a weir, dropbox, and piping as needed to construct a bypass around the primary clarifiers. This bypass will direct all flows greater than the MDFs around the primary clarifiers.
2. Add a third clarifier to:
    a. Maintain high removals of BOD_5 and TSS during normal flow.
    b. Operate the aeration tanks at lower MLSS concentrations during maximum month organic loadings.
    c. Reduce oxygen demands in the BNR process and increase gas production in the digesters.

7.3.4 Secondary Treatment

1. Relocate the internal recycle piping such that the recycle is introduced just upstream of the first of the two anoxic zones and not in the last anerobic zone for the three existing aeration basins.
2. The baffle walls that divide the zones within the existing aeration basins should be repoured to a smooth level. Plywood baffle walls in the anaerobic selector zone should be removed and replaced with 316 stainless steel baffle plates for rigidity.
3. Evaluate (and implement modifications if advantageous) the ability of reconfiguring the selector zones to improve the settling characteristics of the mixed liquor.
4. Demolish and rebuild Secondary Clarifier No. 1 to match the size, slope, and other criteria of Secondary Clarifier No. 3. Install new RAS, WAS, and scum pumps matching the size of those serving Secondary Clarifier No. 3.
5. Replace the RAS pumps for Secondary Clarifier No. 2 to match the size as that of Secondary Clarifier No. 3.
6. Implement hydraulic solids retention time (SRT) control by programming a hydraulic SRT control system in the plant PLC.
7. Replace the diffusers in the existing three aeration basins. Add diffusers to the second of the two anoxic zones in each aeration basin to convert it to a swing zone. Supports for diffusers in the swing zone should be adequately designed to withstand the forces exerted by the existing submersible mixers.
8. Construct a new Secondary Clarifier No. 4 with new RAS, WAS and scum pumps matching the size of that of Secondary Clarifier No. 3.
9. Construct a new Aeration Basin No. 4 with fine bubble diffusers and aeration piping and internal recirculation pump matching the size of the existing aeration basin. With four aeration basins, the plant can take one of the aeration basins out of service for cleaning and preventative maintenance and still maintain an eight-day SRT necessary for stable complete nitrification using three aeration basins by adding air to the swing zone and operating all four secondary clarifiers.

7.3.5 Aeration Blowers

Remove and replace the two existing 150 hp multistage centrifugal blowers with two 150 hp high-speed turbo (HST) blowers. It is assumed that all four blowers will need to be on-line to satisfy the 2045 peak oxygen demand.

7.3.6 Tertiary Filtration

As the existing tertiary filters approach the end of their useful life, they should be replaced with similar units.

7.3.7 UV Disinfection

The City is planning to build a new UV Channel replace the existing UV Trojan 3000+ system with a new Trojan 3000+ system as part of an ongoing project.

1. Rehabilitate the old UV Construct a new second UV channel outside the existing building on the west to allow disinfection of the entire plant effluent at PHF (22.2 mgd).

7.3.8 Effluent Pump Station and Pumps

Under high river water level conditions, when the headloss is too great for gravity flow to the Columbia River, the effluent is pumped using three vertical propeller effluent pumps, located in the second compartment of the effluent wet well. Each pump has a capacity of 4,550 gpm (6.54 mgd). The total capacity of the effluent transfer pump station is 19.6 mgd with a firm capacity of 13.09 mgd.

1. The process implications of exceeding the effluent pumps' capacity are catastrophic, under the high river level conditions. Such conditions could quickly submerge upstream plant processes. Therefore, it is recommended to replace the existing pumps with larger impellers, motor, and associated VFDs to allow pumping of the entire plant effluent (PIDF of 22.2 mgd).

7.3.9 Primary Sludge Pumping, Degritting and Thickening

The City is already planning to replace the two primary sludge degritting equipment (hydrocyclones and classifiers). Sludge pumping equipment should last for 10 to 15 years depending on the amount of grit and wear and tear they experience, so they should be replaced and repaired as needed. No additional recommendations are made for the primary sludge and degritting equipment at this time.

1. The thickened primary sludge pumps are too large for the system. For this reason, the existing units are recommended for replacement with new, appropriately sized, 70 gpm progressive cavity pumps.

7.3.10 WAS Pumping and Thickening System

No recommendations are made for the WAS pumping equipment at this time:

1. There is only one rotary drum thickener (RDT) for WAS thickening, which has been in service for more than 10 years so a second RDT is recommended for redundancy.
2. To meet hazardous area classification per NFPA 820, a new electrical building constructed to the west of the Digester complex serving all the digester equipment is purposed.

7.3.11 Anaerobic Digestion and Waste Gas Flare

The digester equipment should last for 20 to 25 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. No recommendations for the Anaerobic Digestion system are made currently.

7.3.12 Dewatering Centrifuge

The City is already planning to add a second dewatering centrifuge as part of an ongoing project. With two dewatering centrifuges, the plant should be able to process the anaerobically digested sludge for the foreseeable future and therefore no recommendations are made at this time.

7.3.13 Biosolids Belt Dryer

The sludge dryer will need to be operated 7 days a week, 24 hours a day to process the maximum day sludge produced. Alternatively, if the capacity of the dryer is exceeded, the cake can be diverted for off-site disposal. The sludge dryer was installed in 2014 and is about 10+ years old. Typical sludge drying equipment will need major overhaul in the next 10 years (20-year life). City should plan to replace the

dryer in the next 10 to 15 years. However, for the 2025 GSP, a firm recommendation is not made as some of the regulations, in particular with respect to per- and polyfluoroalkyl substances (PFAS) in biosolids are still evolving.

7.3.14 Plant Drain Pump Stations

The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Pump Station No. 1 and 2 be rehabilitated by:

- Replacing the pumps (500 gpm each).
- Installing a liner in the wet well to extend the line of the existing structure.
- Replacing control panel, pump guide rails, and discharge piping within the wet well.
- Adding a totalizing flow meter and composite sampler.

7.3.15 Non-Potable Water Pumps

The City is planning to install new VFDs for each of the three non-potable water pumps and a new motorized strainer as part of an ongoing project. No recommendations are made at this time.

7.3.16 WWTF Electrical Upgrades

Reference section 7.9.8 of the WWTF Evaluation Report in Appendix I for more information on the current electrical system and background on previous upgrades.

1. MCC-A currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. Carollo recommends removing MCC-A from the plant's distribution system and refeeding its remaining loads from nearby sources.
2. Carollo recommends removing PLC-A from the Old Controls Building, and controlling the current PLC-A loads from another nearby PLC. This would allow the Old Controls Building to be fully repurposed as a maintenance and workshop area, which reflects its current use.
3. The electrical equipment installed in 2002 remains in generally good condition and does not require immediate replacement; upgrades should instead coincide with future plant process improvement projects to minimize repeated modifications. However, when replacing gear in the UV or Equipment Building electrical rooms, updated layouts will likely be required to meet current National Electrical Code working clearance standards.
4. Electrical gear from 2012 remains in excellent condition and does not need replacement in the near term.
5. During the site visit, it was also noted that the water utility has no in-house electrician or instrumentation technician and no on-call agreements with outside specialists. Carollo recommends establishing either internal staffing or on-call contracts with qualified electricians and system integrators to ensure prompt response to electrical and controls issues.
6. No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety.

7. The owner also reported that the last major flood affecting the plant occurred in 1997. Carollo recommends a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience.
8. Electrical rooms from the 2002 upgrade were found to be dusty, poorly ventilated, and not fully sealed from adjacent areas. These conditions can accelerate equipment degradation and lead to premature failures of PLCs, VFDs, and network components. Carollo recommends installing dedicated ventilation systems, sealing the rooms from process and generator areas, and performing heating, ventilation, and air conditioning load calculations to determine whether air-handling units or cooling systems are needed to manage internal temperatures.
9. Throughout the plant, exposed network hardware, wiring, and cables were also observed, leaving them at risk of accidental damage. Carollo recommends installing dedicated, wall-mounted network enclosures and routing all cables through conduits for better protection and organization.
10. To ensure regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code.
11. Extensive corrosion was noted on outdoor conduits and equipment enclosures at several locations, including the influent/screens structure and biological basins. Carollo recommends replacing these components with PVC-coated or corrosion-resistant materials to enhance reliability and reduce any potential disruptions to plant operations due to power or control failures.

7.3.17 Facility Control Systems, Including the PLC and Central SCADA

Multiple network switches are currently installed in operational areas where they are exposed to environmental conditions. To mitigate risks associated with dust, moisture, and physical damage, the following recommendations are made:

1. Relocate switches into protective enclosures, consistent with best practices already implemented elsewhere on site.
2. As a short-term fix to minimize the risks to the network switches, place dust filter foam over vents on the switches to reduce the intrusion of dust. Additionally, place tape over unused network ports on the face of the switch until an enclosure is provided for the switches.

It was observed that the centrifuge cannot initiate operations when the system is in Automatic mode. Manual intervention is required to start the centrifuge, after which the system can be returned to Automatic. This behavior indicated a controls problem and should be investigated and resolved.

Magnesium Oxide tank level sensors are ultrasonic instruments, which are highly susceptible to condensate in the tank and will provide false readings. This sensor should be replaced with a Guided Wave Radar level instrument to eliminate the noise caused by condensate.

7.4 Recommendations

This section summarizes recommendations for WWTF improvement projects. Cost estimates and timing of projects are included in the CIP presented in Chapter 9. Each project is assigned a unique identifier which is an alphanumeric number that starts with one or two letters indicating the type of improvements and is consistent with the collection system identifiers. “TP” stands for Treatment Plant, “R” stands for Renewal and “G” stands for General. Individual project sheets are included in Appendix L - CIP Summary Sheets.

7.4.1 Recommended WWTF Improvement Projects

The improvements recommended to address WWTF capacity limitations over the next 20 years and address current condition issues that prohibit reliability or performance are summarized in this section. The recommended alternatives presented in Section 7.3 were re-organized and, in some cases, grouped together to suggest construction sequencing and project timing the city should consider when implementing these improvements. The following 25 distinct projects were developed for incorporation into the City's general sewer system plan CIP. The cost estimates of these projects can be found in Chapter 9 - Capital Improvement Plan.

- **TP-01: Parshall Flume Replacement**

  This project includes replacement of the existing Parshall Flume with a new higher-capacity Parshall Flume to accommodate peak flow conditions and structural modifications to prevent influent wastewater from spraying during peak flow events. The improvements include demolition of the existing top slab, walls, foundation slab, and guardrails; extension of the influent channel wall footing; construction of new influent channel walls and foundation slab; excavation and backfill; installation of new guardrails; construction of shoring and an elevated slab to support the new Parshall Flume; and associated electrical, instrumentation, and controls improvements. This project addresses existing and future growth-driven capacity issues.

- **TP-02: Primary Clarifier Bypass**

  This project includes construction of a bypass around Primary Clarifiers No. 1 and 2 to route flows greater than the maximum day flow around the primary treatment process. The improvements include installation of a new 30-inch bypass pipeline, structural modifications at the Plant Headworks Effluent, and installation of weir gates to control and direct flow through the bypass. Additional site work will also be required to support construction of the bypass improvements. This project is driven by growth, predominantly development in the North Shore area. This project addresses existing capacity issues and process upgrades.

- **TP-03: Aeration Basin Influent Flow Splitter Box**

  This project includes construction of a new aeration basin influent flow splitter box to improve mixing and flow distribution to the aeration basins. The splitter box should also be designed to address the issue of very little head available between the primary clarifier and aeration basins. The improvements include an 18-inch foundation slab, 12-inch-thick walls, new guardrails and aluminum grating, and associated excavation and backfill. New 60-inch by 30-inch and 24-inch by 24-inch stainless steel slide gates will be provided to control flows through the splitter box. The project also includes demolition of the existing Aeration Basin Flow Splitter Box, temporary pumping and piping during construction, installation of piping to and from the new splitter box, and additional site work as needed to complete the improvements. This project addresses existing capacity issues and process upgrades.

- **TP-04: Plant Headworks**

  This project includes replacement of the existing screens and slide gates at the WWTF Headworks to improve the reliability and operation of the screening process. The improvements include replacement of the existing screens/washer compactors with new units and installation of new 66-inch by 48-inch, 66-inch by 36-inch, and 72-inch by 36-inch stainless steel slide gates. The project also includes associated installation, electrical, instrumentation, and controls improvements, as well as

additional site work required to complete the improvements. This project addresses growth-driven capacity issues.

- **TP-05: Anoxic Selector IR Re-Piping**

  This project includes relocation of the internal recycle piping at the three existing aeration basins to improve the treatment process. The IR piping will be relocated to introduce recycled flow at the beginning of the Anoxic Selector, just upstream of the first of the two anoxic zones, rather than discharging into the last anaerobic zone. The project also includes associated electrical, instrumentation, and controls improvements, as well as additional site work required to complete the improvements. The City currently has two options for where recycled flow is discharged to: one from the splitter box (currently used) and the other at the end of the selector zone. It is recommended that the City use switch to discharge at the end of the selector zone and to monitor and test before and after the switch to assess improvement in treatment performance from this change to see if it is sufficient. TP-05 could potentially be completed in-house. This project addresses existing capacity issues and process upgrades.

- **TP-06: Anaerobic Selectors Baffle Wall**

  This project includes modifications to the baffle walls separating the anaerobic selectors within the existing aeration basins to improve flow distribution and maintain proper separation between treatment zones. The existing baffle walls between the anoxic and anaerobic zones will be repoured to provide a smooth and level surface. Gradient should be evaluated for improved settleability. Existing plywood baffle walls within the anaerobic selector zones will be removed and replaced with 316 stainless steel baffle plates to provide increased rigidity and durability. The project also includes associated electrical, instrumentation, and controls improvements. This project addresses existing capacity issues and process upgrades.

- **TP-07: Replace Secondary Clarifier No. 1**

  This project includes demolition and replacement of Secondary Clarifier No. 1 to improve the reliability and performance of the secondary treatment process. The new clarifier will be constructed as a 75-foot-diameter clarifier with a 15-foot SWD, matching the size, slope, and other design criteria of Secondary Clarifier No. 3. The improvements include a new concrete foundation slab and walls, sludge collection box, launder and effluent structures, aluminum grating, stairs, platforms, and railings, as well as new internal clarifier mechanisms. New RAS and WAS pumps will also be installed to match the size of those serving Secondary Clarifier No. 3. The project also includes associated demolition, installation, electrical, instrumentation, and controls improvements, and additional site work required to complete the improvements. The City is currently evaluating this project. This project addresses existing capacity issues and process upgrades.

- **TP-08: SC No. 2 RAS Pump Replacement**

  This project includes replacement of the RAS pumps serving Secondary Clarifier No. 2 to improve pumping capacity and maintain consistency with the existing Secondary Clarifier No. 3 facilities. Two new non-clog submersible RAS pumps, each rated at 1,400 gpm, will be installed to match the pump capacity serving Secondary Clarifier No. 3. The project also includes associated installation, electrical, instrumentation, and controls improvements. This project addresses existing capacity issues, age-related issues, and process upgrades. This project is driven by growth, predominantly development in the North Shore area.

- **TP-09: Replace Plant Drain Pump Station 1**

  This project includes rehabilitation of Plant Drain Pump Station No. 1 to address concrete corrosion identified during the condition assessment and replace pumps that are nearing the end of their useful life. The improvements include replacement of the existing pumps with new pumps rated at 500 gpm each, installation of a liner in the wet well to extend the service life of the existing structure, and replacement of the control panel, pump guide rails, and discharge piping within the wet well. A totalizing flow meter and composite sampler will also be installed to improve flow monitoring and sampling capabilities. The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace No. 1 and 2. This project addresses existing capacity issues, age-related issues, and process upgrades.

- **TP-10: Replace Plant Drain Pump Station 2**

  This project includes rehabilitation of Plant Drain Pump Station No. 2 to address concrete corrosion identified during the condition assessment and replace pumps that are nearing the end of their useful life. The improvements include replacement of the existing pumps with new pumps rated at 500 gpm each, installation of a liner in the wet well to extend the service life of the existing structure, and replacement of the control panel, pump guide rails, and discharge piping within the wet well. A totalizing flow meter and composite sampler will also be installed to improve flow monitoring and sampling capabilities. The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace nos. 1 and 2. This project addresses existing capacity issues, age-related issues, and process upgrades.

- **TP-11: PLANTWIDE: Electrical Conduit and Stand Replacement**

  The project includes plantwide replacement of existing electrical conduit and support stands to improve the reliability and condition of the plant electrical infrastructure. Existing conduit and support stands will be demolished, with existing conductors protected for reuse where feasible. New electrical conduit and support stands will be installed throughout the plant as needed. This project addresses existing age-related issues.

- **TP-12: NETWORK: Equipment Enclosure and Cable Protection Upgrade**

  This project includes plantwide improvements to equipment enclosures and cable protection to improve the reliability and protection of the instrumentation and control system. Improvements include installation of new instrumentation and control cabinets, de-termination and re-termination of existing conductors, and installation of conduit to provide additional protection for cables and conductors. This project addresses existing age-related issues.

- **TP-13: MCC-A Replace and Electric Equip Relocation**

  This project includes replacement of MCC-A and relocation of associated electrical equipment to improve the reliability and maintainability of the plant electrical system. MCC-A currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. MCC-A will be removed from the plant distribution system, and its remaining loads will be re-fed from nearby electrical sources. PLC-A will also be removed from the Old Controls Building, with its current loads

transferred to another nearby PLC. This will allow the Old Controls Building to be fully utilized as a maintenance and workshop area, consistent with its current use. The project includes replacement of MCC-A and relocation of electrical equipment from the Old Controls Building, along with associated electrical, instrumentation, and controls work. The City is currently evaluating this project. This project addresses existing age-related issues.

- **TP-14: Replace Aeration Basin Diffusers**

  This project includes replacement of the existing diffusers in the three aeration basins and installation of additional diffusers in the second of the two anoxic zones within each basin. The additional diffusers will allow the anoxic zones to function as swing zones, providing greater operational flexibility and treatment capacity. New diffuser supports within the swing zones will be designed to withstand the forces exerted by the existing submersible mixers. This project addresses existing age-related issues.

- **TP-15: Disk Filtration Replacement**

  This project includes replacement of the two existing disk filtration units with new units to improve filtration performance and operational reliability. The new disk filtration units will be sized for a capacity of 6.0 mgd. Plant staff indicated that the existing filters are currently backwashing approximately 30 percent of the time, which is higher than the anticipated 20 percent or less. The project includes removal of the existing disk filtration units, installation of the new units, and associated electrical, instrumentation, and controls improvements. The City will assess the need for the disk filters, which are currently not run all the time, prior to completing this project. This project addresses existing age-related issues.

- **TP-16: Second UV Channel**

  This City recently constructed a second UV disinfection channel which will be used going forward while the existing channel will serve as bypass. This project is to rehabilitate the existing channel and put back into service for UV disinfection to provide sufficient disinfection capacity for the entire plant effluent at peak hour flow conditions of 22.2 mgd. The project includes installation of the new UV equipment and associated electrical, instrumentation, and controls improvements will also be included. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-17: Effluent Transfer Pump Replacement**

  This project includes replacement of the existing effluent transfer pumps with larger impellers, motors, and associated VFDs to provide sufficient capacity to pump the entire plant effluent flow of 22.2 mgd. Under high river water level conditions, when gravity flow to the Columbia River is not sufficient due to increased headloss, the effluent transfer pumps are required to convey plant effluent. The existing station consists of three vertical propeller pumps, each rated at 4,550 gpm (6.54 mgd), with a total station capacity of 19.6 mgd and a firm capacity of 13.09 mgd. The existing capacity is insufficient to convey the full peak flow, and failure to provide adequate pumping capacity during high river conditions could result in elevated water levels and potential impacts to upstream plant processes. The replacement pumps will be rated at approximately 4,700 gpm and will include associated structural and mechanical modifications, installation, and electrical, instrumentation, and controls improvements. This project addresses existing age-related issues.

- **TP-18: Outfall**

  This project includes construction of a second plant outfall to the Columbia River to provide additional discharge capacity and improve the reliability and flexibility of the plant effluent discharge system. The new outfall will consist of approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser. The project includes mobilization, cleanup, and demobilization; erosion control; additional pipe fittings; trench safety; excavation and backfill; and installation of the new outfall. Associated electrical, instrumentation, and controls improvements will also be included. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-19: Digester Electrical Building**

  This project includes construction of a new electrical building west of the Digester complex to house electrical equipment serving the digester facilities. The new CMU block electrical building will be designed to meet the hazardous area classification requirements of NFPA 820 and provide a suitable location for electrical equipment serving the digester process. The project includes construction of the new building, electrical equipment and installation, and associated electrical, instrumentation, and controls improvements. This project addresses code compliance issues.

- **TP-20: New Rotary Drum Thickener**

  This project includes construction of a second RDT for WAS thickening to provide redundancy and improve the reliability of the thickening process. The existing RDT has been in service for more than 10 years, and a second unit is recommended to provide additional operational flexibility and backup capacity. The project includes a new RDT, associated polymer blending unit, thickened sludge pump, access platform, stairs, and supporting structures. The project also includes installation, additional site work, and associated electrical, instrumentation, and controls improvements. This project provides reliability and redundancy for the thickening process.

- **TP-21: Primary Clarifier No. 3**

  This project includes construction of a new Primary Clarifier No. 3 to improve primary treatment performance and provide additional process capacity. The additional clarifier will help maintain high BOD_5 and TSS removals during normal flow conditions, allow the aeration basins to operate at lower MLSS concentrations during maximum month organic loadings, and reduce oxygen demands in the BNR process while increasing gas production in the digesters. The new clarifier will be approximately 60 feet in diameter with a 10-foot SWD and will include new internal mechanisms, sludge collection box, concrete foundation and walls, launder structure, aluminum stairs, catwalk framing, grating, and railing. The project also includes new LS pumps, excavation and backfill, installation, additional site work, and associated electrical, instrumentation, and controls improvements. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-22: Secondary Clarifier No. 4**

  This project includes construction of a new Secondary Clarifier No. 4 to provide additional secondary treatment capacity and accommodate future growth. The new clarifier will be approximately 75 feet in diameter with a 15-foot SWD and will include new internal mechanisms, sludge collection box, effluent box, launder structure, concrete foundation and walls, aluminum grating, stairs, platforms, and railings. The project also includes new RAS and WAS pumps and approximately 36-inch piping to connect the new clarifier to the existing system. Associated excavation and backfill, installation,

additional site work, and electrical, instrumentation, and controls improvements will also be included. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-23: Centrifugal Blower Replacement**

  This project includes replacement of the two existing 150 hp multistage centrifugal blowers with two new 150 hp HST blowers to provide sufficient aeration capacity for future peak oxygen demands. The existing centrifugal blowers will be removed and replaced with two HST blowers (Model HST 10-3600-1-U150-48). It is assumed that all four blowers will need to operate simultaneously to meet the projected 2045 peak oxygen demand. The project also includes associated installation and electrical, instrumentation, and controls improvements. The City is currently working on a project to increase capacity of blowers 3 and 4. This project addresses existing capacity issues and process upgrades.

- **TP-24: Biosolids Dryer Replacement**

  This project includes replacement of the existing sludge dryer with new sludge drying equipment to maintain reliable biosolids processing as the existing equipment approaches the end of its useful life. The existing sludge dryer was installed in 2014 and is more than 10 years old. Typical sludge drying equipment may require a major overhaul within approximately 10 years, and the City should plan for potential replacement within the next 10 to 15 years. However, a firm recommendation for replacement is not made as part of this 2025 GSP, because regulations related to biosolids, particularly per- and polyfluoroalkyl substances (PFAS), continue to evolve and may affect future biosolids management requirements. The project includes new sludge belt drying equipment (BDS-10) and associated components, partial demolition and expansion of the existing building, additional site work, installation, and associated electrical, instrumentation, and controls improvements. The City has contracted for an evaluation of the dryer and alternatives for solids handling. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

- **TP-25: Biofilter Replacement**

  This project includes replacement of the existing biofilters with new biofilters to maintain reliable odor control as the existing tertiary filters approach the end of their useful life. The new biofilter odor control system will be designed for approximately 10,000 cubic feet per minute and will include associated ductwork, sump pumps, water panels, and other necessary components. The project also includes construction of a structural pad, installation, and associated electrical, instrumentation, and controls improvements. Prior to completion of this project, the City may consider replacing the biofilters with trickling filters which have a smaller footprint. This project addresses growth-driven capacity and process constraints, primarily from development in the North Shore Area.

7.4.2 Recommended Annual WWTF Repair and Replacement Program

The City has established an annual maintenance program as part of its CIP to maintain and improve the WWTF. These improvements will help the City address aging infrastructure, maintain reliable operation of the WWTF, and extend the useful life of existing assets. Continued investment in these projects will also help the City address maintenance needs as they arise and support the long-term goals of the GSP. Table 7.4 shows a summary of the City's annual repair and replacement program for the WWTF.

Table 7.4 Recommended Annual Repair and Replacement Program for the WWTF

Project ID	Improvement Type	Project Name	Description
R-03	R&R	Miscellaneous WWTF Projects	This project includes miscellaneous improvements at the existing WWTF to address operational, maintenance, and reliability needs. Improvements may include replacement or rehabilitation of process equipment, electrical and controls upgrades, instrumentation, piping, structural improvements, and other equipment or site improvements as needed. These improvements will help maintain reliable plant operation and address deficiencies that may be identified through regular operation, maintenance, and future condition assessments.

7.4.3 Recommended General WWTF Projects

General project recommendations for the WWTF include the following studies and assessments:

- **G-05: Electrical System Arc Flash Study**

  No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety. This project should be completed in the near term to address the identified safety concern.

- **G-06: Hazardous Area Classification Study**

  For regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code. This project should be completed in the near term to address the identified safety concern.

- **G-07: Flood Risk Assessment**

  Carollo recommends a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience.

7.4.4 Additional Recommendations

The following sections present additional recommendations, some of which can be performed by City staff, such as sampling, and therefore are not included in the CIP.

7.4.4.1 Additional Monitoring of Plant Influent

Carollo recommends that the City expand monitoring of the plant influent wastewater to include TKN, NH4 and alkalinity.

7.4.4.2 Mixed Liquor Settling Characteristics

Historical SVI data (Appendix I - *Evaluation of the Wastewater Treatment Facility Report*) shows that poor settling of the mixed liquor occurs during the late winter and spring each year. During these bulking episodes, the SVI can increase to values between 250 and 350. These episodes of poor settling present a significant risk of operational upset since peak wet weather flows often occur during this same period.

Carollo recommends that the microorganisms and probable causes for the bulking episodes be found, and methods evaluated for reducing or stopping the bulking.

7.4.4.3 Supplemental Alkalinity

The treatment plant currently uses magnesium hydroxide to supplement the natural wastewater alkalinity so that sufficient alkalinity is present to allow nitrification in the activated sludge process. Essentially complete nitrification is needed to meet the plant's NPDES permit. While magnesium hydroxide is often a desirable chemical for adding alkalinity, it does contribute to the formation of struvite scale in sludge processes, piping, and appurtenances. Struvite is a sparingly soluble mineral that is composed of ammonium, magnesium, and phosphate (NH4MgPO4·6H2O). Often magnesium is the element that limits the formation of struvite.

The alkalinity (and oxygen) consumed by the nitrification process can be partially recovered by denitrification. Denitrification (aka nitrogen removal) converts the nitrate formed by the nitrification process into nitrogen gas which then escapes from the water. Although denitrification is not required by the City's NPDES permit and is not likely to be required in the future, it can be used to reduce the need for supplemental alkalinity. There are several factors to be considered, but the City may be able to enhance denitrification through operational controls of the treatment process.

Carollo recommends that the City investigate switching to an alternative chemical to provide the needed alkalinity for the nitrification process to reduce the formation of struvite scaling. In addition, the City should evaluate alternative strategies for enhancing denitrification with the dual goals of reducing the need for supplemental alkalinity and reducing oxygen demands.

7.4.4.4 Potentially Toxic Compounds

During calibration of the BioWin model matching predicted effluent 5-day carbonaceous biological oxygen demand ($cBOD_5$) and NH_4 concentrations with measured values required reducing kinetic coefficients for both types of reactions. This suggests the presence in the municipal wastewater of one or more compounds that are toxic to both ordinary heterotrophic organisms and nitrifying bacteria. Semiconductor manufacturing is known to use compounds that are toxic to the bacteria in activated processes, so it is possible that the biological process at the treatment plant experiences inhibition. The intermittent recycling of ammonia with the dewatering centrate is responsible for intermittently high effluent ammonia concentrations but it does not appear to be entirely responsible for the elevated effluent ammonia concentrations.

Carollo recommends both evaluation of the biological reaction rates and discussions with the industrial customers are called for to proactively identify these toxins and develop methods or procedures for minimizing their presence in the raw wastewater.

7.4.4.5 Selector Design and Densified Activated Sludge

Over the course of the last few decades the design of biological selectors and various methods of achieving densified activated sludge has advanced considerably. A densified activated sludge has been operationally defined as one with larger, denser floc particles that settle faster. Mixed liquor settling can be improved through the use of improved selector design, operational controls, the use of cyclones, and mobile-biofilm carriers.

In conjunction with an evaluation of bulking at the plant, Carollo recommends that the City also investigate the potential for implementing one or a combination of the methods for achieving a densified activated sludge. Ideally this should be completed before the next design and construction project at the wastewater treatment facility.

CHAPTER 8 OPERATION AND MAINTENANCE

8.1 Introduction

This chapter provides an overview of the City Wastewater Utility organization, staffing, and O&M program. This chapter documents existing practices and identifies changes that may improve system O&M.

8.2 Organization Structure

The City Public Works Department is organized as shown in Figure 8.1 and is managed by Scott Collins. The Utility group is managed by Rob Charles. There are various groups relevant to this Plan including the WWTF, and a combined group with responsibilities pertaining to sewer and water disciplines. The WWTF is supervised by Kyle Stephens.

Note, Stormwater and Sewer/Water groups assist each other during abnormal conditions, such as cleanup after a major storm or repairs requiring specialized staff and equipment.

The Capital Engineering group, managed by James Carothers, leads major wastewater capital projects, such as new lift stations. The Utility group leads lift station retrofits, repair and replacement projects, and operations and maintenance projects.

8.3 Staffing

8.3.1 Maintenance and Operations Staff

The City has recently separated the water and sewer groups into two divisions. Staff under the sewer division work on sewer mains including the STE systems. They are also in charge of making sewer system repairs. Operational staff work full shifts on weekdays and there is always at least one person on duty during the day on weekends. There is always at least one person on call in the evenings to address emergencies.

No additional positions are sought although as of October 2025, there is one vacant water/sewer staff position the City is seeking to fill. There is also a vacant water/sewer supervisor position in the budget that has remained unfilled for several years.

8.3.2 Wastewater Utility Engineering Staff

WWTF staff work primarily on the treatment plant and are also in charge of the sewer lift stations in the conveyance system. The City's WWTF NPDES permit requires a Washington Wastewater Treatment Facility Operator (WWTFO) Class IV certified operator to be responsible for the plant at all times. Table 8.1 lists WWTF staff certifications. The City has two Class IV operators in the event that one is unavailable. The NPDES permit does not require anyone other than the responsible operator(s) to hold a certification, but the City requires all operators to have a Class I certification or have the ability to acquire one within six months of employment.

Table 8.1 Wastewater Utility Operator Certifications

Name	Position	Certification
Kyle Stephens	WWTF Manager	WWTFO Class IV
Jacob Taylor	WWTF Operator Lead	WWTFO Class IV
Ken Murray	WWTF Operator	WWTFO Class I
Steve Carroll	WWTF Operator	WWTFO Class II
Joe Calderone	WWTF Operator	WWTFO Class I
Matt Golphenee	WWTF Operator	WWTFO Class II
Casey Chase	WWTF Operator	WWTFO Class I
Aaron Eyler	WWTF Operator	WWTFO Class I
Angelica Vazquez	WWTF Laboratory Analyst	WWTFO Class I

8.4 Records

For O&M record keeping, the WWTF uses a Computerized Maintenance Management System (CMMS) called Fiix, which is a Rockwell software, data-tracking Excel spreadsheets, handwritten logbooks, and an electronic repository of equipment documentation. The WWTF staff have a "WWTF" shared drive at the plant, which is a reference library of construction documents, O&M documentation for individual equipment, training materials, etc.

The STEP systems tanks are set using iAUDIT on an iPad. Once the tank set is complete and the City accepts the system, the data is entered into Tyler to track the asset and its 8-year preventative maintenance schedule. An as-built drawing is also created and saved to the shared drive for future reference. The City currently uses iAUDIT to document work and plans to move to the same software as the WWTF in the future to better track current activities. The implementation plan is to add new activities to the software as it comes up.

City staff and third-party customer service representatives receive utility-related calls made by system users, and information is dispatched to the appropriate utility staff.

8.5 Current Operation and Maintenance Program

8.5.1 Maintenance

8.5.1.1 Lift Station Inspection and Maintenance

Lift station inspection and maintenance is completed by City WWTF Operators listed in Table 8.1.

For all lift stations, pump run hours are closely tracked to identify potential issues. Additionally, periodic maintenance is completed. Table 8.2 presents each activity and frequency staff completes for the sewer lift stations.

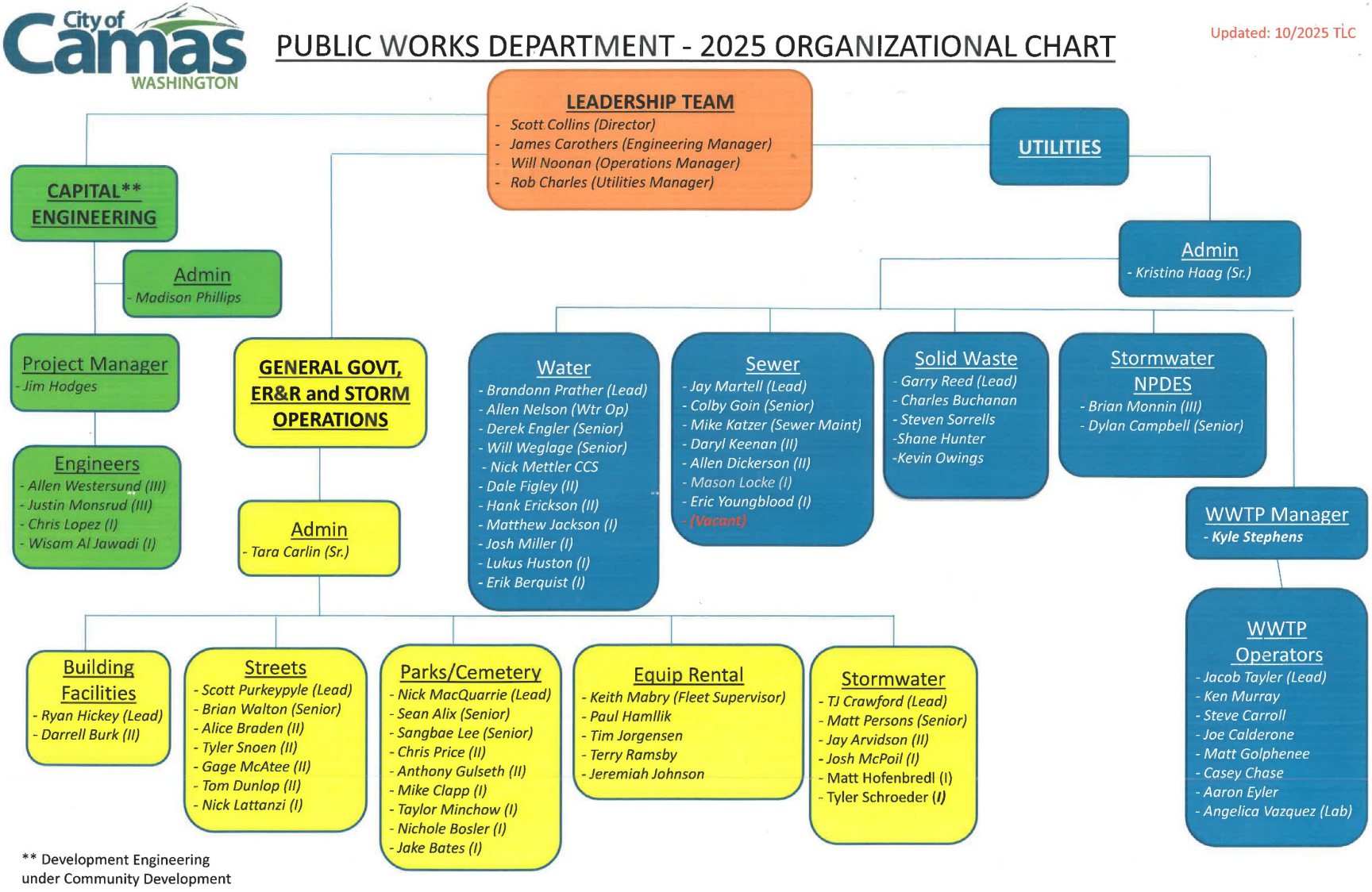


Figure 8 1 Organization Structure Chart

Table 8.2 Summary of WWTF and Sewer Lift Station Maintenance

Frequency	Component	Activity
Daily	SCADA	Review lift station alarm history. Check pump/level/pressure/flow trend charts.
	Record Keeping	Update pump runtime tracking spreadsheets. Review updated sheets for anomalies. Submit requests for any necessary maintenance via CMMS.
Weekly	Controller	Check for active alarms. Verify pumps, level indicator, and other controller-monitored equipment is operating normally in "AUTO". Document pump run hours. Verify no tripped breakers.
	Pumps	Run pumps in hand to verify proper operation. Inspect for unusual sounds, vibration, or leaks.
	Generator Set	Check ATS status and verify there are no faults and system is ready for emergency operation. Check generator fuel. Check generator for leaks or signs of mechanical failure. Check generator control paned for faults. Generator auto-exercises on Thursdays.
	Dry Well	Verify dry well is dry. Verify sump pump or floor drain is functioning properly. When running pumps, verify check valves open/close. Verify force main pressure (static and pumping). Check for piping leaks.
	Wet Well	Inspect influent flow, verifying it is not abnormally high or low, color, odor, etc. Inspect for excess debris or grease accumulation. If able, break up FOG and pump out. Verify level sensors are free of debris or obstructions, clean, as necessary.
	Odor Control System	Verify proper operation and odor level. Inspect for unusual sounds, vibration, odor, and leaks.
	Surge Tank	Verify proper operation, checking controller for any faults.
	Grounds	Monitor physical appearance of station. Remove any accumulated trash or debris. Monitor and control vegetation. Monitor for odors emanating from station.
Quarterly	Pumps	Perform drawdown testing for each pump.
	Record Keeping	Update pump tracking spreadsheet with draw down test results.
	Odor Control System	Change out carbon media at Lacamas Meadows Lift Station. In depth check of biofilter systems.
Bi-Annually	Gas Sensors	Calibrate lower explosive limit meters.
	Grounds	Herbicide application, where necessary.
	Odor Control System	Change out odor control media on carbon absorber units.
	Isolation Valves	Exercise isolation valves at all lift stations to maintain operability.
Annually	Generator	Third-party preventative maintenance.
	Pumps	Pull pumps for visual inspection.
	Main Pump Station Pumps	Third-party preventative maintenance.
	Piping	Winterize any water piping.
	Odor Control System	Winterize biofilters prior to freezing weather. Turn off odor control units that are not operated during winter months. Turn on odor control units that are operated during summer months.
	Wet Well	Cleaning of any wet wells that have accumulated excessive FOG/floatables/debris.
Every 3 Years	Pumps	Third-party pump inspections and testing.

8.5.1.2 Pipeline Video Inspection

A CCTV inspection of the gravity main by push camera was completed in 2013. For future pipe and manhole inspections, the City purchased a CCTV van in 2024 and is currently televising gravity mains in the system. The City uses Granite data management software along with GIS to manage the CCTV data. The City's goal is to CCTV all 45 miles of gravity pipe over the next two years. Once the baseline data is collected and hot spots are identified a maintenance schedule can be developed. Inspections will be performed in accordance with all industry standards and best practices.

8.5.1.3 Manhole Inspection and Maintenance

The City inspects manholes on an as-needed basis. The City may choose to implement their own standards for manhole inspections, rather than rely on the National Association of Sewer Service Companies standards.

8.5.1.4 Root Cutting

Root maintenance is completed as needed. It is anticipated that additional root cutting tasks may be identified through contracted video inspection on an as needed basis.

8.5.1.5 Grease Removal

The City educates customers on FOG as part of their general education program. The City is also using the FOG Best Management Practices platform to administer and oversee ongoing FOG management and handling practices. Through video inspection, the City has identified pipes with heavy FOG. These hot spots are shown in Figure 8.2.

8.5.1.6 Hydraulic Line Cleaning

Flushing is done every month for flat areas in the system. Where normal flushing is insufficient to address known problem areas, pipe jetting is completed either as preventative maintenance or on an as needed basis.

8.5.1.7 Repair Sewers

Point repairs are conducted to address pipe deficiencies identified through CCTV inspection and are undertaken as required and as resources allow. Work may be completed by City staff or through a small works type contract.

8.5.1.8 STEP Maintenance

The City owns and maintains the STEP system. Currently, the City conducts solids pumping from about 5,000 STEP tanks annually through city staff and contractors. Additionally, it maintains the STEP tanks, pumps, and telemetry concurrently. The City has an active STEP tank education program with customers. It is recommended to conduct a STEP tank condition assessment to identify repair and replacement needs including inspection of the STEP tank and connections to the STEP tank as well as an inspection of the proper function of the STEP tank. From this condition assessment, a STEP repair and replacement program should be developed and included in the City's CIP. Current STEP tank replacement costs are about $11,000 per STEP tank to be installed by a contractor.

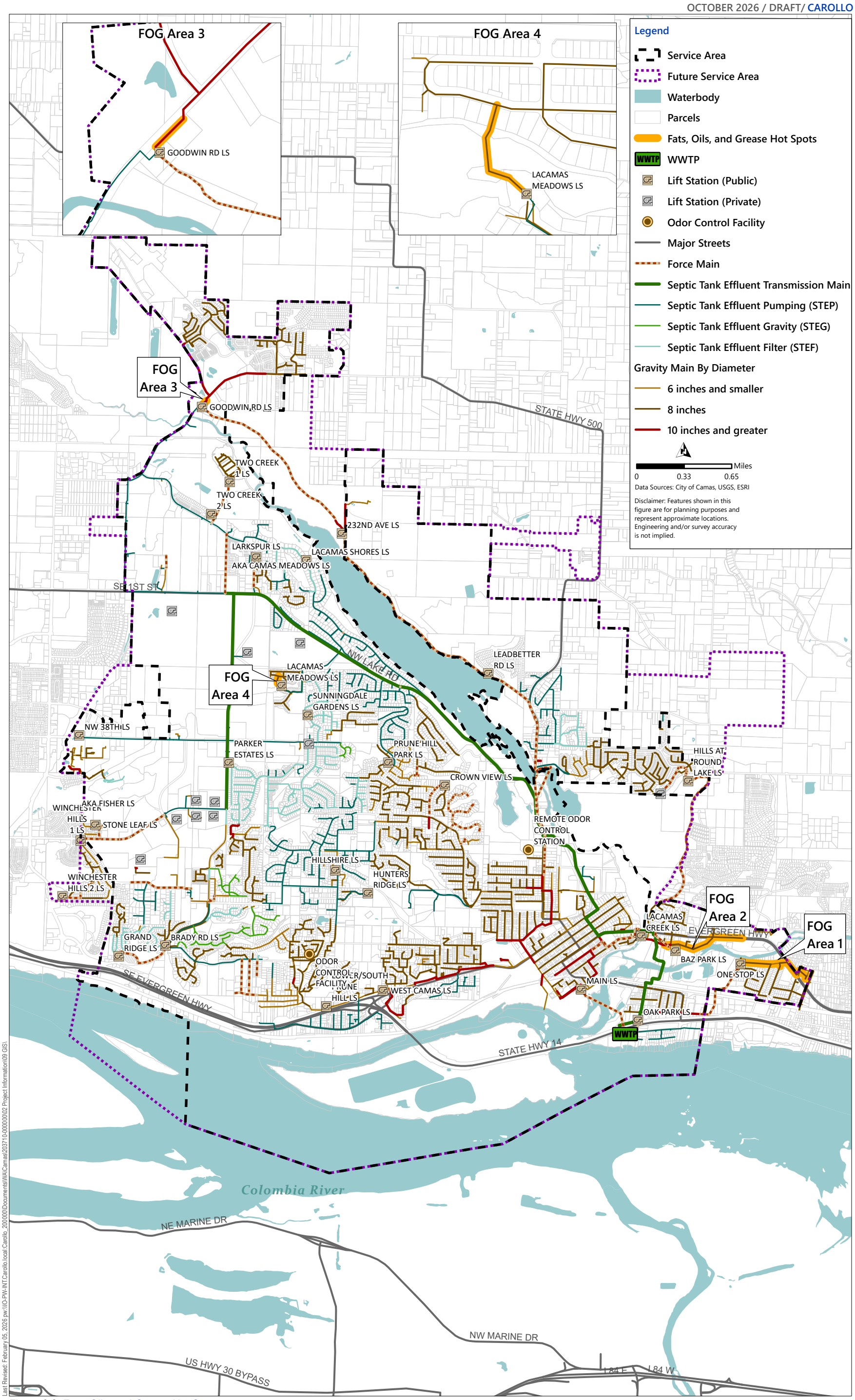


Figure 8.2 Fats, Oils, and Grease Hot Spots

8.5.2 Operations

The City operations group are generally divided into treatment, pump stations, and pipes. The City operators at the WWTF conduct various activities, including monitoring and adjusting treatment parameters, conducting water quality measurements and other related lab tests, and managing the City's Class A, Exceptional Quality Biosolids program. The WWTFOs are also responsible for monitoring the pump stations throughout the collection system. The treatment facility operators monitor the sanitary pump stations while the water/sewer staff monitor the septic tank effluent systems throughout the City. Water/sewer staff are responsible for pipe activities associated with operating the collection system, including repairing pipelines. City staff also lead operations during emergencies or natural disasters. Emergency operations include preparing and planning for emergencies and conducting drills.

Individual staff duties and operations include administration tasks, training, and tool maintenance. Staff have their own administrative duties to complete weekly as well as meetings to attend in addition to their normal operator duties. They are also in charge of maintaining and cleaning their tools and equipment. The City values the importance of training staff; thus, staff will also allocate time annually to training and conferences as a means to further develop their skills.

8.6 Future Operation and Maintenance Needs

The WWTF plans to expand their internal maintenance capabilities while reducing dependency on third-party maintenance contracting. The WWTF is working to develop deeper pump, clarifier and instrumentation inspection and maintenance skills. The WWTF plans to constantly expand and improve their usage of the CMMS and its work ordering and tracking capabilities. Furthermore, the WWTF has an ongoing effort to develop an extensive set of Standard Operating Procedures for common operations, maintenance, safety, and administrative tasks.

As stated above, the City purchased a CCTV van to complete video inspection of the collection system and is developing a hydraulic line cleaning program while completing the video inspection. The hydraulic line cleaning program can be completed by the City or third-party contractors. With this inspection and cleaning program, it is expected that other repair needs will be identified for roots, FOG, and point repairs.

Currently the City's staffing focus is to fill the current vacant water/sewer staff position. In the future, to aid in the development of non-capital utility projects, the City would like to add a staff civil engineer and an electrician to the utility team.

CHAPTER 9 CAPITAL IMPROVEMENT PLAN

9.1 Introduction

This chapter summarizes the Capital Improvement Plan (CIP). The CIP includes projects needed to accommodate growth, repair and replace aged infrastructure, and attain level of service goals. The CIP is arranged in terms of short-term (2027 to 2036) and long-term (2037 to 2045) periods. Projects are grouped into pipelines, lift stations, STEP mains, Rehabilitation and Replacement (R&R), treatment plant, and general types of infrastructure work. The CIP consists of the cost estimates and schedules for the recommended improvements.

The following sections present cost estimating assumptions, recommended projects, estimated costs for each project, and a summary of the CIP.

9.2 Cost Estimating Assumptions

Cost estimates were developed for each of the recommended projects in the CIP for budgeting purposes. The CIP costs are planning level estimates only and should be refined during pre-design of the projects as final costs of a project with depend on actual labor and materials costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. The CIP cost estimates presented in this GSP do not include future inflation and should be reevaluated and updated as part of future CIP updates to account for changes in construction costs and inflation.

All costs are given in 2025 dollars. The Handy-Whitman Index for Water Utility Construction in the Pacific Region for January 2025 is 1,401. The CIP cost estimates in this chapter are Class 5 (budget-level estimates and has an expected accuracy range of -50 percent to +100 percent.

9.2.1 Conveyance Cost Assumption

This section provides the CIP for pipelines, lift stations, and STEP system. Cost estimates for conveyance infrastructure represent total project cost including materials, construction, engineering, legal, and administrative costs. Costs were represented as unit costs, as described in subsequent sections. Costs are based on costs provided by the City or similar projects completed by Carollo. The following are the total mark-ups to direct costs: 30 percent for construction contingency, 25 percent for general conditions and overhead, 20 percent for engineering, legal, and design costs (ELA), 5 percent for City administration, and 8.8 percent (applied to 65 percent of the construction cost) to account for Camas' sales tax.

9.2.1.1 Total Conveyance Project Capital Improvement Cost

The costs presented in this Plan are high-level planning costs to help the City in making financial decisions.

As shown in the following sample calculation of the conveyance projects capital improvement cost, the total cost of all project contingencies (construction and planning) and allied costs (engineering services, construction management, project administration and sales tax) is 106 percent of the baseline project cost.

Example:

Baseline Project Cost	**$1,000,000**
Construction Management Contingency (30%)	$300,000
Construction Cost	**$1,300,000**
General Conditions and Overhead (25%)	$325,000
Engineering, Legal, Design (20%)	$260,000
Administration (5%)	$65,000
Sales Tax (8.8%)	$114,400
Total Capital Improvement Cost	**$2,064,400**

9.2.1.2 Gravity Pipeline Unit Costs

For gravity pipes, baseline project costs are calculated by multiplying the estimated new pipe length by a proposed unit cost. All of the known pipelines involved in this CIP are between 8-inch and 36-inch. Pipeline unit costs are available in Table 9.1, broken down by pipeline diameter. These unit costs were used to estimate the baseline construction costs. The unit costs assume open-trench construction in improved areas. Costs include pavement cutting, excavation, hauling, shoring, pipe materials and installation, backfill material and installation, and pavement replacement.

Table 9.1 Pipeline Unit Costs

Pipe Size (inches)	Pipe Unit Cost(1) ($/linear foot)
8	$236
10	$268
12	$300
15	$378
16	$404
18	$443
20	$481
21	$505
24	$575
27	$736
30	$897
36	$1,203

Notes:
(1) Unit costs represent baseline construction costs and do not include additional cost factors for contingency, general conditions and overhead, engineering/planning, and City admin.

9.2.1.3 Lift Station Unit Costs

Lift station unit costs were based on costs of similar projects Carollo has completed in the past. Lift station upgrades include repair and replacement of the station itself and force main cleaning. LS telemetry includes upgrading or updating the SCADA system at the lift stations.

9.2.1.4 Force and STEP Main Unit Costs

Unit costs for force and STEP mains were based on the gravity pipeline unit costs presented in Table 9.1. These costs were used as a basis for estimating force and STEP main improvements, as the installation costs are generally similar to those of gravity pipelines of comparable diameter. Additional costs associated with appurtenances or other project-specific requirements were considered separately, where applicable.

9.2.2 Treatment Cost Assumptions

Cost estimates for treatment projects include 30 percent for construction contingency, 25 percent for general conditions and overhead, 25 percent for ELA, 5 percent for City administration, and 8.8 percent (applied to 65 percent of the construction cost) to account for Camas' sales tax.

9.2.2.1 Total Treatment Project Capital Improvement Cost

The costs presented in this GSP are high-level planning costs to help the City in making financial decisions.

As shown in the following sample calculation of the capital improvement cost, the total cost of all project contingencies (construction and planning) and allied costs (engineering services, construction management, and project administration) is 113 percent of the baseline project cost.

Example:

Baseline Project Cost	**$1,000,000**
Overall Construction Adjustment Factor (30%)	$300,000
Construction Cost	**$1,300,000**
General Conditions and Overhead (25%)	$325,000
Engineering, Legal, Design (25%)	$325,000
City Admin (5%)	$65,000
Sales Tax (8.8%)	$114,400
Total Capital Improvement Cost	**$2,129,400**

9.3 Capital Improvement Plan

As discussed, the CIPs are prioritized based on their urgency and risk to mitigate deficient systems. The timing for implementing these improvement projects is based on the affordability and urgency of the project. It is recommended that the City monitor growth and adjust project implementation accordingly.

9.3.1 Planning Periods

The following planning periods are used to define timing and prioritization of projects:

- **Short-term (2027 to 2035).** Proposed facilities determined to be a high priority.
- **Long-term (2036 to 2045).** Proposed facilities determined to be a low priority or proposed facilities to service major growth areas to be developed in the long-term.

The proposed project timing was based on existing deficiencies, City input, future growth, and the timing of other recommended improvements. Short-term projects generally include improvements needed to address existing deficiencies, projects identified by the City as a high priority, and general improvement projects such as flow monitoring and I/I studies. Some of these studies are scheduled in the short-term because the results may be used to further evaluate the need, timing, or scope of other recommended improvements, including pipeline capacity projects.

Long-term projects generally include improvements needed to address future growth and projects that are dependent on other improvements being completed first. Some projects that show deficiencies under future conditions are scheduled for the long-term because additional development is needed before the deficiency is expected to occur or because upstream improvements should be completed first. Project timing may be adjusted as the results of monitoring and other studies become available and as development and system conditions change.

9.3.2 Project Types

Projects are categorized by type. These types include the following:

- "Growth"
- "Upgrade"
- "R&R"
- "General"

Growth projects are focused on updating infrastructure to address the needs of expanding. Upgrade projects are focused on upgrading infrastructure to address level of service concerns. R&R projects are focused on renewing or replacing infrastructure in poor condition. General projects include studies and assessments. The types aid the City in determining the appropriate funding sources.

9.3.3 Project and Program Naming

An individual Project Sheet was generated for each CIP project and includes project identifiers, description, costs, project type, and comments to aid in future implementation. Project are separated into the following categories:

- "P" = Gravity and Force Main
- "LS" = Lift Station.
- "G" = General.
- "S" = STEP.
- "TP" = Treatment Plant.

A summary of all CIP projects by facility types and project type is shown in Table 9.2. A summary of costs by project category and type is presented at the end of the chapter.

9.4 Lift Station Projects

Lift stations in the CIP are recommended to be upgraded to provide pump redundancy and address PWWF greater than firm capacity during existing and future conditions. Some lift stations also have PWWF that exceeds their total pumping capacity and will require additional capacity improvements. Additional project details can be found in Chapter 6 Collection System and in the Capital Improvement Project Sheets in Appendix L.

- **LS-01: Lower/South Prune Hill LS Improvements**
  - **Description**: Upgrade the Lower/South Prune Hill LS to increase firm capacity from 0.86 mgd to 2.93 mgd, including an allowance for odor control improvements.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,381,000.
  - **Year:** 2033 and 2034. The timing should follow completion of G-02 (Basin 5-1-2 flow monitoring) so that the I/I evaluation can inform the need and scope of the proposed improvements. This project is also aligned with the P-01 (NW 6th Place West Improvements) and P-07 (Lower/South Prune Hill Force Main Improvements).
- **LS-02: West Camas LS Improvements**
  - **Description**: Upgrade West Camas LS to increase firm capacity from 1.44 mgd to 3.24 mgd, including an allowance for removal of existing asbestos cement force main.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,204,000.
  - **Year:** 2031. The timing of this project should follow completion of LS-01 (Main LS improvements), G-02 (Basin 5-1-2 flow monitoring), P-01 (NW 6th Place West Improvements), P-02 (NW 6th Place East Improvements) and P-07 (Lower/South Prune Hill Force Main Improvements). The additional downstream capacity provided by Main LS improvements should be in place before increasing pumping capacity at West Camas LS, and the G-02 I/I evaluation may reduce the scope or timing of the proposed improvements.
- **LS-03: Crown View LS Improvements**
  - **Description**: Upgrade the Crown View LS to increase firm capacity from 0.32 mgd to 0.85 mgd.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $4,290,000.
  - **Year:** 2035. The timing of this project should follow completion of G-01 (Basin 5-1-2 flow monitoring), P-05 (NW Fargo Street, NW 18th Loop, and NW 18th Avenue Improvements), and P-11 (Division Street Improvements) so that the flow monitoring and I/I evaluation can inform the need and scope of the proposed improvements. Upstream I/I reduction may reduce the scope or timing of this project and downstream improvements, and the downstream improvements should be completed first to provide adequate capacity for increased flows from the Crown View LS.

- **LS-04: Lacamas Creek Lift Station Improvements**
  - **Description**: Replace the two existing pumps at the Lacamas Creek LS to increase firm capacity from 1.37 mgd to 2.13 mgd.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $1,222,000.
  - **Year:** 2045. The timing of this project is primarily driven by future flows from the Hills at Round Lake service area and should be done following the completion of LS-09 (Hills at Round Lake LS Improvements) and P-13 (SE 283rd Avenue to NE Woodburn Drive Extension). The pump replacement should follow completion of the Hills at Round Lake LS improvements to provide adequate downstream capacity and avoid creating a downstream capacity constraint.
- **LS-05: Main Lift Station Improvements**
  - **Description**: Construct a new wet well and associated pumping facilities with a minimum firm capacity of 21 mgd. Evaluate long-term conveyance and pumping options, including the existing 18-inch force main. Include a $150,000 planning-level allowance for odor control.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $10,640,000.
  - **Year:** 2040. The timing of this project depends on implementation of the recommended improvements to upstream collection system. As upstream capacity deficiencies are addressed and additional flows are conveyed through the collection system, the resulting flows will reach Main LS and increase demands on the station. The station upgrade should be evaluated following implementation of the upstream improvements to confirm the need and timing of the proposed upgrades.
- **LS-06: Goodwin Road Lift Station Improvements**
  - **Description**: Add a third pump to the Goodwin Rd LS to increase firm capacity from 0.49 mgd to 0.71 mgd.
  - **Reasoning:** Capacity Upgrade/Growth.
  - **Estimated Cost:** $502,000.
  - **Year:** 2043. The timing of this project is primarily driven by future development in the North Shore area. An additional pump should be added to the available third pump pad as development occurs, and flows increase within the upstream service area.
- **LS-07: 232nd Avenue Lift Station Improvements**
  - **Description**: Add a third pump to 232nd Avenue LS to increase firm capacity from 0.53 mgd to 2.60 mgd.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $502,000.
  - **Year:** 2042. The timing of this project is primarily driven by future development within the 232nd Avenue LS service area, additional flows from the upstream Goodwin Road LS, and projected large user flows. The additional pump should be added to the available third pump pad as development occurs and flows increase within the service area.

- **LS-08: Leadbetter Road Lift Station Improvements**
  - **Description**: Activate the existing 8-inch dual force main and add a third pump to the available third pump pad at Leadbetter Road LS in the short-term. Upgrade the three existing pumps for buildout conditions in the long-term.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $2,379,000.
  - **Year:** 2041. The long-term pump upgrades are primarily driven by future development, additional flows from the upstream Goodwin Rd and 232nd Avenue LS service areas, and a future airport connection. This project should align with P-10 (Leadbetter Road LS Dual Force Main Improvements) and P-12 (SE Everett Road to Leadbetter Road Extension). The long-term improvements should be implemented as development occurs and additional flows increase demands at the Leadbetter Road LS.
- **LS-09: Hills at Round Lake Lift Station Improvements**
  - **Description**: Replace the two existing pumps at the Hills at Round Lake LS to increase firm capacity from 0.96 mgd to 1.21 mgd.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $1,504,000.
  - **Year:** 2044. The timing of this project is primarily driven by future development in the Hills at Round Lake service area and should be align with P-13 (SE 283rd Avenue to NE Woodburn Drive Extension). The pump replacement should be completed as development occurs and flows increase within the service area.

9.5 STEP Projects

The hydraulic model included the STEP main trunklines due to limited information available for the remaining components of the STEP system. Based on the model results, an improvement project was developed for the STEP main trunkline where deficiencies were identified. The individual STEP system components, including STEP tanks and associated infrastructure, could not be fully evaluated due to limited information. Future CIP projects should include monitoring, modeling, and condition assessments to collect additional information and support a more comprehensive evaluation of the STEP system.

- **S-01: NW Parker Street to NW Lake Road STEP Main**
  - **Description**: Install parallel STEP mains consisting of:
    - 14,002 LF of 30-inch pipe from Node 9 to Node J176 and;
    - 4,061 LF of 30-inch pipe from Node 13 to Node 15.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $32,764,000.
  - **Year:** 2038. The timing of this project is primarily driven by future flows from the STEP basin area. The project should be implemented as development occurs and flows increase within the STEP basin to provide sufficient conveyance capacity for future system conditions. The parallel configuration will also provide operational flexibility by allowing one STEP main to remain in service while the other is taken out of service for maintenance and can provide additional conveyance capacity during peak wet weather conditions.

9.6 Pipeline Projects

CIP pipeline projects were determined from the results of a skeletonized model evaluation. Most pipeline projects address level of service concerns, and some are combined with growth and level of service projects.

- **P-01: NW 6th Place West Improvements**
  - **Description**:
    - Upsize 422 LF of 8-inch pipe to 12-inch;
    - 809 LF of 8-inch pipe to 15-inch, and;
    - 472 LF of 12-inch pipe to 18-inch gravity pipe.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $1,298,000.
  - **Year:** 2034. The timing of this project should follow completion of G-02 (flow monitoring in Basin 5-1-2). The flow monitoring and I/I evaluation may reduce the scope or timing of the proposed improvements.
- **P-02: NW 6th Place East Improvements**
  - **Description**:
    - Upsize 682 LF of 8-inch pipe to 21-inch gravity pipe.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $695,000.
  - **Year:** 2032. The timing of this project should follow completion of P-01 and LS-01 improvements. The proposed improvements should be evaluated after these projects are completed to confirm the need and scope of the upsizing.
- **P-03: NW 6th Place Avenue West Improvements**
  - **Description:**
    - Upsize 1,943 LF of 12-inch pipe to 24-inch, and;
    - 592 LF of 12-inch pipe to 21-inch gravity pipe.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,869,000.
  - **Year:** 2031. The timing of this project should follow completion of LS-02 (West Camas LS). The proposed improvements should be evaluated after the lift station upgrade is completed to confirm the need and scope of the downstream upsizing.

- **P-04: NW 6th Place Avenue East Improvements**
  - **Description:**
    - Upsize 446 LF of pipe between MHs 3-1-1 and 5-8-1 from 18- to 27-inch;
    - 260 LF of pipe between MHs 5-8-1 and 5-1-12 from 21- to 30-inch;
    - 402 LF of pipe between MHs 2-1-1 and 5-1-12 from 12- to 30-inch;
    - 545 LF between MHs 5-1-12 and manhole 5-1-11 from 21- to 36-inch;
    - 947 LF between MHs 5-1-10 and 5-1-7 from 24- to 36-inch;
    - 1,126 LF of pipe between MHs 5-1-8 and 5-1-2 from 21- to 36-inch, and;
    - 34 LF between MHs 5-1-2 and 5-1-1 from 24- to 36-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $8,329,000.
  - **Year:** 2030. The timing of this project should follow completion of the upstream lift station, force main, and gravity sewer improvements. The proposed improvements should be evaluated after the upstream projects are completed to confirm the remaining need and scope.
- **P-05: NW Fargo, NW 18th Loop, NW 18th Avenue Improvements**
  - **Description:**
    - Upsize 2,744 LF of 8-inch pipe to 15-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,099,000.
  - **Year:** 2028. The timing of this project should follow completion of G-02 flow monitoring study in Basin 5-1-2 and LS-03 (Crown View LS) improvements. The proposed improvements should be evaluated after these projects are completed to confirm the need and scope of the upsizing.
- **P-06: NE Garfield Street to NE 15th Avenue to NE Franklin Street along the Mill Ditch Improvements**
  - **Description:**
    - Upsize 282 LF of pipe between manholes 4-2A-2 to 4-2A-Q from 8- to 12-inch;
    - 115 LF of pipe between manholes 4-2A-Q and 4-2A-1 from 8- to 15-inch;
    - 795 LF of pipe between manholes 4-2A-1 and 4-2-2 from 8- to 18-inch;
    - 427 LF of pipe between manhole 4-2-2 and 4-2-1 from 8- to 24-inch;
    - 256 LF of pipe between manholes 4-2-1 and 4-1-2 from 8- to 27-inch;
    - 254 LF of pipe between manholes 4-1-2 and 4-1-1 from 21- to 30-inch;
    - 158 LF of pipe between manholes 4-1-1 and 3-2-6 from 21- to 30-inch, and;
    - 347 LF of pipe between manholes 4-1-1 and 3-2-4 from 15- to 36-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $3,543,000.
  - **Year:** 2037. The timing of this project should follow completion of G-01 in Basin 4-1-3, which includes an I/I pilot study. The I/I evaluation may reduce the scope or timing of the proposed improvements.

- **P-07: Lower/South Prune Hill Lift Station Force Main Improvements**
  - **Description:**
    - Upsize 925 LF of force main between the Lower/South Prune Hill LS wet well and MH 10-1-3 from 10- to 18-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $828,000.
  - **Year:** 2033. The timing of this project should follow completion of P-01 (NW 6th Place West Improvements) and coincide with LS-01 (Lower/South Prune Hill LS Improvements).
- **P-08: West Camas Lift Station Force Main Improvements**
  - **Description:**
    - Upsize 574 LF of the existing force main from 6- to 15-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $556,000.
  - **Year:** 2031. The timing of this project should follow completion of LS-01 (Lower/South Prune Hill Lift Station Improvements), P-01 (NW 6th Place West Improvements, and P-02 (NW 6th Place East Improvements). The project should coincide with LS-02 (West Camas Lift Station Improvements).
- **P-09: Main Lift Station Force Main Improvements**
  - **Description:**
    - Upsize 2,348 LF of the existing force main from 18- to 24-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,379,000.
  - **Year:** 2030. The timing of this project should coincide with LS-04 (Main LS Phase 1 Improvements) and be completed after upstream improvements. The proposed force main improvement should be evaluated after the upstream projects are completed to confirm the need and scope of the replacement.
- **P-10: Leadbetter Road Dual Force Main Improvements**
  - **Description:**
    - Activate the existing parallel 8-inch force main.
    - Install approximately 6,500 LF of parallel 10-inch force main between Node_161 to Node_27.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $3,526,000.
  - **Year:** 2041. The timing of this project should coincide with LS-08 (Leadbetter Road Lift Station Improvements) and be completed after the upstream improvements. The proposed force main improvement should be evaluated after the upstream projects are completed to confirm the need and scope of the improvement.

- **P-11: Division Street Improvements**
  - **Description:**
    - Upsize 827 LF of pipe between MHs 3-1-14 and 3-1-11 from 8- to 15-inch;
    - 505 LF of pipe between MHs 3-1-11 and 3-1-9 from 8- to 21-inch, and;
    - 1,526 LF of pipe between MHs 3-1-9 and 3-1-2 from 8- to 18-inch.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,514,000.
  - **Year:** 2032. The timing of this project should follow completion of P-05 and the other upstream improvements. The proposed improvements should be evaluated after the upstream projects are completed to confirm the need and scope of the upsizing.
- **P-12: SE Everett Road to Leadbetter Road Extension**
  - **Description:**
    - Install 2,031 LF of 8-inch pipe;
    - Install 692 LF of 12-inch pipe, and;
    - Install 6,036 LF of 18-inch pipe.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $6,792,000.
  - **Year:** 2045. Project timing and implementation will be driven by development needs and coordinated with the developer.
- **P-13: SE 283rd Avenue to NE Woodburn Drive Extension**
  - **Description:**
    - Install 6,782 LF of 12-inch pipe.
  - **Reasoning:** Growth.
  - **Estimated Cost:** $4,119,000.
  - **Year:** 2045. Project timing and implementation will be driven by development needs and coordinated with the developer.

9.7 Treatment Plant Projects

Treatment plant projects in the CIP occur at the WWTF. The projects aim to mitigate capacity limitations over the next 19 years and address current condition issues that prohibit reliability or performance. Projects were grouped together to consider construction sequencing and project timing.

- **TP-01: Parshall Flume Replacement**
  - **Description:** Replace the existing Parshall Flume with a higher-capacity flume and make structural modifications to prevent influent wastewater from spraying during peak flow conditions.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $277,400.
  - **Year:** 2029. This project is timed to align with TP-04 (Replace Screens and Slide Gates).

- **TP-02: Primary Clarifier Bypass**
  - **Description:** Construct a bypass around Primary Clarifiers No. 1 and 2, including a new 30-inch bypass pipeline, structural modifications at the plant headworks effluent, and weir gates to control and direct flow.
  - **Reasoning:** Capacity Upgrade and Growth.
  - **Estimated Cost:** $816,000.
  - **Year:** 2030. This project is timed to align with TP-03 (Aeration Basin Flow Splitter Box).
- **TP-03: Aeration Basin Influent Flow Splitter Box**
  - **Description:** Construct a new aeration basin influent flow splitter box to improve mixing and flow distribution to the aeration basins and address limited head between the primary clarifiers and aeration basins.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $3,507,000.
  - **Year:** 2030. This project is timed to align with TP-02 (Primary Clarifier Bypass).
- **TP-04: Plant Headworks**
  - **Description:** Replace the existing headworks screens/washer compactors and slide gates, including associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,696,000.
  - **Year:** 2029.
- **TP-05: Relocating Internal Recycle Piping**
  - **Description:** Relocate the internal recycle piping at the three existing aeration basins at the beginning of the anoxic selector, upstream of the first anoxic zone. Include associated electrical, instrumentation, and controls improvements. Work can be performed in-house.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $0
  - **Year:** 2027. The City should monitor treatment performance before and after the change to confirm the effectiveness of the modification. The project could potentially be completed in-house.
- **TP-06: Modifying Anaerobic Selectors Baffle Wall**
  - **Description:** Modify the existing baffle walls within the aeration basins, including repouring the baffle walls between the anoxic and anaerobic zones and replacing existing plywood baffle walls with 316 stainless steel baffle plates.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $70,200
  - **Year:** 2027.
- **TP-07: Replace Secondary Clarifier No. 1**
  - **Description:** Demolish and replace Secondary Clarifier No. 1 with a new 75-foot-diameter clarifier, including new clarifier internals, RAS and WAS pumps, structures, and associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,329,000
  - **Year:** 2027. The City is currently evaluating this project.

- **TP-08: Secondary Clarifier No. 2 RAS Pump Replacement**
  - **Description:** Replace the RAS pumps serving Secondary Clarifier No. 2 with two new 1,400-gpm non-clog submersible pumps, including associated electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $440,000
  - **Year:** 2030.
- **TP-09 Replace Plant Drain Lift Station No. 1**
  - **Description:** Rehabilitate Plant Drain LS No. 1, including replacement of the existing pumps, wet well liner, control panel, guide rails, and discharge piping, and installation of a totalizing flow meter and composite sampler with associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $965,000
  - **Year:** 2030. This project is timed to align with TP-02 (Primary Clarifier Bypass).
- **TP-10: Replace Plant Drain Lift Station No. 2**
  - **Description:** Rehabilitate Plant Drain LS No. 2, including replacement of the existing pumps, wet well liner, control panel, guide rails, and discharge piping, and installation of a totalizing flow meter and composite sampler with associated electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $965,000
  - **Year:** 2030. The City may consider constructing a single Plant Drain LS to replace No. 1 and 2. This project is timed to align with TP-02 (Primary Clarifier Bypass).
- **TP-11: PLANTWIDE: Electrical Conduit and Stand Replace**
  - **Description:** Replace existing electrical conduit and support stands throughout the plant, including demolition of existing components and reuse of existing conductors where feasible.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $328,000.
  - **Year:** 2030.
- **TP-12: NETWORK: Equipment Enclosure and Cabled Protect Upgrade**
  - **Description:** Install new instrumentation and control cabinets and de-terminate and re-terminate existing conductors as needed to improve equipment protection and system reliability.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $44,000
  - **Year:** 2030.
- **TP-13: MCC-A Replace and Electric Equip Relocate**
  - **Description:** Replace MCC-A and relocate associated electrical equipment from the Old Controls Building, including removal and re-feeding of existing loads and transfer of PLC-A loads to another nearby PLC.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $491,000
  - **Year:** 2030. The City is currently evaluating this project.

- **TP-14: Replacement of Aeration Basin Diffusers and Additional Diffusers to Anoxic Zones**
  - **Description:** Replace the existing diffusers in the three aeration basins and install additional diffusers in the second anoxic zone of each basin, including new diffuser supports.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $888,000
  - **Year:** 2032.
- **TP-15: Disk Filtration Replacement**
  - **Description:** Replace the two existing disk filtration units with new 6.0-mgd units, including associated electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $2,528,000
  - **Year:** 2032.
- **TP-16: Second UV Channel**
  - **Description:** Rehabilitate the existing UV disinfection channel and install new UV equipment, including associated electrical, instrumentation, and controls improvements, to provide sufficient disinfection capacity for peak hour flows of 22.2 mgd.
  - **Reasoning:** Capacity Upgrade.
  - **Estimated Cost:** $5,040,100
  - **Year:** 2032.
- **TP-17: Effluent Transfer Pump Replacement**
  - **Description:** Replace the existing effluent transfer pump impellers, motors, and associated VFDs and complete the required structural, mechanical, electrical, instrumentation, and controls improvements to provide sufficient capacity for the full 22.2-mgd plant effluent flow.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $2,287,000
  - **Year:** 2035. This project is timed to align with TP-18 (Construct a New Plant Outfall).
- **TP-18: Construction of an Additional Outfall**
  - **Description:** Construct a second outfall to the Columbia River, including approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser and associated site, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $20,387,000
  - **Year:** 2035. This project is timed to align with TP-17 (Effluent Transfer Pump Replacement).
- **TP-19: Construction of a New Digester Electrical Building**
  - **Description:** Construct a second outfall to the Columbia River, including approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser and associated site, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $1,267,000
  - **Year:** 2030. This project is timed to align with TP-09 (Replace Plant Drain LS No. 1) and TP-10 (Replace Plant Drain LS No. 2).

- **TP-20: Construction of New Secondary Rotary Drum Thickener**
  - **Description:** Construct a second RDT for WAS thickening, including a polymer blending unit, thickened sludge pump, access platform, stairs, supporting structures, and associated electrical, instrumentation, and controls improvements.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $1,693,000
  - **Year:** 2030. This project is timed to align with TP-09 (Replace Plant Drain LS No. 1) and TP-10 (Replace Plant Drain LS No. 2).
- **TP-21: Construction of a New Primary Clarifier No. 3**
  - **Description:** Construct a new 60-foot-diameter Primary Clarifier No. 3 with associated sludge pumping, structures, equipment, electrical, instrumentation, controls, and site work.
  - **Reasoning:** Capacity Upgrade and Growth
  - **Estimated Cost:** $6,327,000
  - **Year:** 2039.
- **TP-22: Construction of a New Secondary Clarifier No. 4**
  - **Description:** Construct a new 75-foot-diameter Secondary Clarifier No. 4 with associated RAS and WAS pumps, 36-inch connecting piping, structures, equipment, electrical, instrumentation, controls, and site work.
  - **Reasoning:** Growth
  - **Estimated Cost:** $11,692,000
  - **Year:** 2039.
- **TP-23: Centrifugal Blower Replacement**
  - **Description:** Replace the two existing 150-hp multistage centrifugal blowers with two new 150-hp HST blowers, including associated installation, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Growth
  - **Estimated Cost:** $1,261,000
  - **Year:** 2027. The City is currently working on a project to increase capacity of Blowers No. 3 and 4.
- **TP-24: Sludge Dryer Replacement**
  - **Description:** Replace the existing sludge dryer with new sludge drying equipment, including associated building modifications, site work, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Growth
  - **Estimated Cost:** $22,726,000
  - **Year:** 2042. The project timing allows for the City's ongoing evaluation of the dryer and solids handling alternatives and consideration of evolving biosolids regulations.
- **TP-25: Biofilter Replacement**
  - **Description:** Replace the existing sludge dryer with new sludge drying equipment, including associated building modifications, site work, electrical, instrumentation, and controls improvements.
  - **Reasoning:** Growth
  - **Estimated Cost:** $3,802,000
  - **Year:** 2043.

9.8 Annual Projects

- **R-01: Sewer Main Repair and Replacement**
  - **Description:** Replace wastewater pipelines constructed prior to the 1940s that are approaching the end of their useful life. The identified pipelines will be prioritized over the 19-year planning horizon based on age, condition, system needs, and results of I/I studies. A summary of identified pipeline lengths and unit costs are presented in Table 9.2.
  - **Reasoning:** R&R.
  - **Estimated Cost:** Approximately 20.8 million or $1,100,000 per year over the planning horizon.
  - **Year:** 2027 through 2045. Improvements will be prioritized and implemented throughout the planning horizon based on pipeline condition, system needs, and I/I study results.

Table 9.2 Sewer Main Repair and Replacement Cost Estimate

Diameter (inches)	Length (feet)	Cost ($)
8	23,341	$11,151,000
10	1,853	$1,005,000
12	953	$580,000
15	5,376	$4,117,000
18	1,175	$1,053,000
20	113	$110,000
21	872	$891,000
24	1,265	$1,473,000
Total	34,948	**$20,380,000**

- **R-02: Miscellaneous Lift Station Repair and Replacement**
  - **Description:** Complete miscellaneous improvements at existing lift stations to address operational and maintenance needs. Improvements may include pump and piping replacement, electrical and controls upgrades, instrumentation, wet well improvements, odor control, and other equipment or site improvements as needed.
  - **Reasoning:** R&R.
  - **Estimated Cost:** Approximately 38 million or $2,000,000 per year over the planning horizon. No construction, engineering, legal, or administrative costs are applied because the annual amount is based on the City's sewer capital budget.
  - **Year:** 2027 to 2045. Ongoing improvements will be implemented throughout the planning horizon based on operational and maintenance needs.

- **R-03: Miscellaneous WWTF Repair and Replacement**
  - **Description:** Complete miscellaneous improvements at the existing WWTF to address operational, maintenance, and reliability needs. Improvements may include replacement or rehabilitation of process equipment, electrical and controls upgrades, instrumentation, piping, structural improvements, and other equipment or site improvements as needed.
  - **Reasoning:** R&R.
  - **Estimated Cost:** Approximately 9.5 million or $500,000 per year over the planning horizon. No construction, engineering, legal, or administrative costs are applied because the annual amount is based on the City's sewer capital budget.
  - **Year:** 2027 to 2045. Ongoing improvements will be implemented throughout the planning horizon based on operational and maintenance needs.

9.9 General Projects

- **G-01: Basin 4-1-3 Pilot I/I Study**
  - **Description:** Investigate the source and magnitude of inflow and infiltration (I&I) of storm and groundwater into the wastewater system at locations where suspected high I&I may exceed conveyance and/or lift station capacity. Identify opportunities to reduce non-sewage flow and potentially avoid costly capacity improvements.
  - **Reasoning:** General.
  - **Estimated Cost:** $200,000.
  - **Year:** 2027.
- **G-02: Basin 5-1-2 Flow Monitoring**
  - **Description:** Install temporary flow meters in Basin 5-1-2 to separately monitor flows from the Camas LS and Upper Prune Hill contributing areas and evaluate I/I.
  - **Reasoning:** General.
  - **Estimated Cost:** $300,000.
  - **Year:** 2027.
- **G-03: Geographic Information System (GIS)**
  - **Description:** Implement ongoing enhancements to the Geographic Information System (GIS), including asset mapping, data collection, database maintenance, and integration with utility management systems.
  - **Reasoning:** General.
  - **Estimated Cost:** $250,000.
  - **Year:** 2027.
- **G-04: Hydraulic Modeling**
  - **Description:** Expand the City's collection system hydraulic model to include additional system pipes and reduce the existing level of model skeletonization. Accurate and updated GIS information will be used to support the model expansion.
  - **Reasoning:** General.
  - **Estimated Cost:** $200,000.
  - **Year:** 2029. The timing of this project should follow completion of G-03 (Geographic Information Systems (GIS).

- **G-05: Electrical System Arc Flash Study**
  - **Description:** Complete an Electrical System Study and install arc flash labels on the plant's distribution equipment.
  - **Reasoning:** General.
  - **Estimated Cost:** $75,000.
  - **Year:** 2027.
- **G-06: Hazardous Area Classification Study**
  - **Description:** Conduct a hazardous area classification study in accordance with NFPA 820 and upgrade areas that do not meet applicable requirements.
  - **Reasoning:** General.
  - **Estimated Cost:** $50,000.
  - **Year:** 2027.
- **G-07 Flood Risk Assessment**
  - **Description:** Conduct a comprehensive flood risk analysis of major electrical and control systems at the WWTF to assess vulnerabilities and improve flood resilience.
  - **Reasoning:** General.
  - **Estimated Cost:** $100,000.
  - **Year:** 2027.
- **G-08: General Sewer Plan**
  - **Description:** Implement the General Sewer Plan twice over the 20-year planning horizon, with each occurrence approximately 10 years apart.
  - **Reasoning:** General.
  - **Estimated Cost:** $700,000 per occurrence.
  - **Year:** 2035 and 2045.

9.10 Summary of CIP

Recommended improvements include 10 LS projects, one STEP project, 13 pipeline projects, three rehabilitation and replacement programs, 25 treatment plant projects, and eight general projects. Breakdown by project category is shown in Figure 9.1. The largest portion of the CIP are allocated to treatment plant projects and the annual programs at $95.8 M and $67.9 M, respectively. Gravity and force main, STEP main, and lift station projects have a combined estimated cost of $104.0 M, while general projects have the lowest allocation at $2.6 M. The total recommended CIP is estimated $270.3 M.

The CIP recommends budgeting $132.4 M in the short-term, inclusive of annual project costs. The average annual short-term cost for all recommended projects is approximately $14.7 M per year from 2027 through 2035. The CIP recommends $137.8 M in the long-term with an average annual long-term cost of approximately $13.8 M per year from 2036 through 2045. The average annual cost over the 19-year planning horizon from 2027 through 2045 is $14.2 M. Figure 9.2 presents annual costs for the City's CIP for each year of this GSP, while Figure 9.3 illustrates annual cost breakdowns for projects funded by rates and SDCs. Annual program costs are assumed to be funded by rates.

Detailed sheets for each CIP project presented in this chapter can be found in Appendix K of the GSP. Table 9.3 summarizes the total cost and annual cost for each planning period.

Table 9.3 CIP Planning Period Summary

Planning Period	Total Cost (million $)	Annual Cost (million $)
Short-term (2027 to 2035)	$132.4	$14.7
Long-term (2036 to 2045)	$137.8	$13.8
Total	**$270.3**	**$14.2**

Notes:
(1) Totals may not sum due to rounding.

Treatment plant projects and annual programs account for 35.5 percent and 25.1 percent, respectively, followed by the gravity and force main projects at $40.0 M (14.6 percent), STEP Main projects at $32.8 M (12.1 percent), lift station projects at $31.6 M (11.7 percent), and general projects at $2.6 M (1.0 percent). Table 9.4 summarizes the total estimated capital costs by facility type. Figures 9.4 and 9.5 show the short-term and long-term projects, including the year each CIP project is scheduled for implementation.

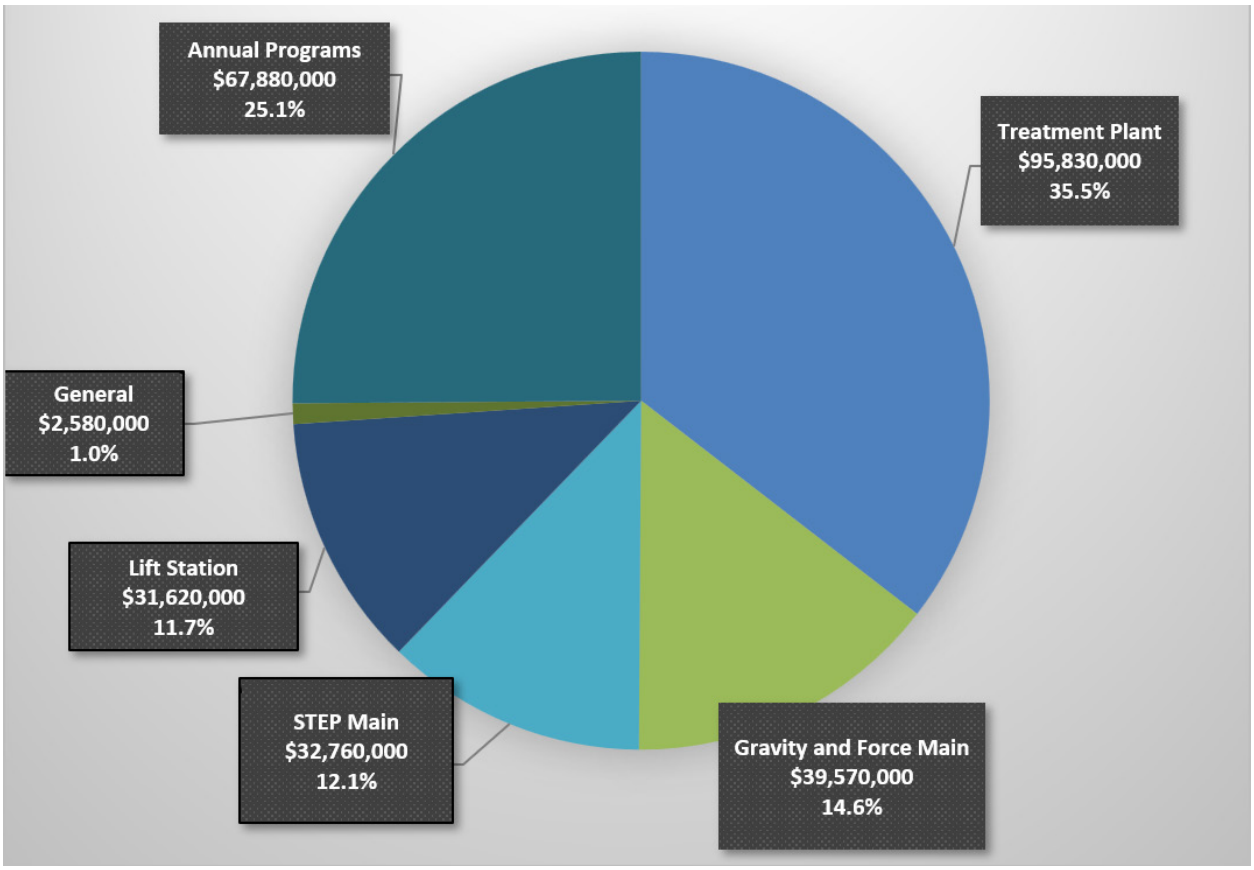


Figure 9.1 Cost by Project Category

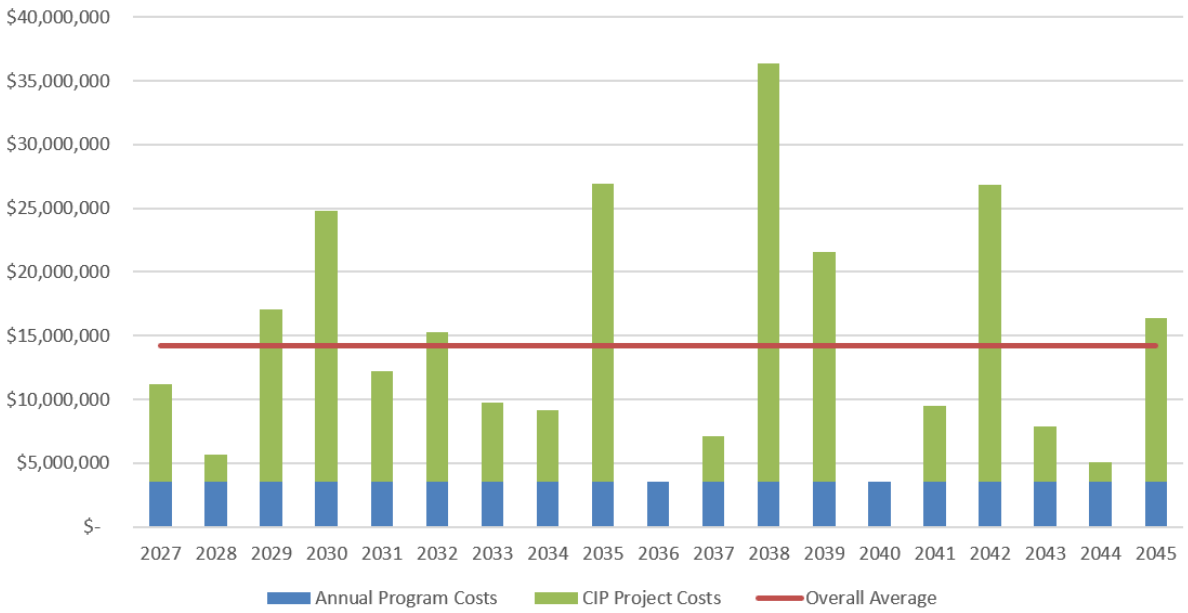


Figure 9.2 Overall CIP Annual Cost

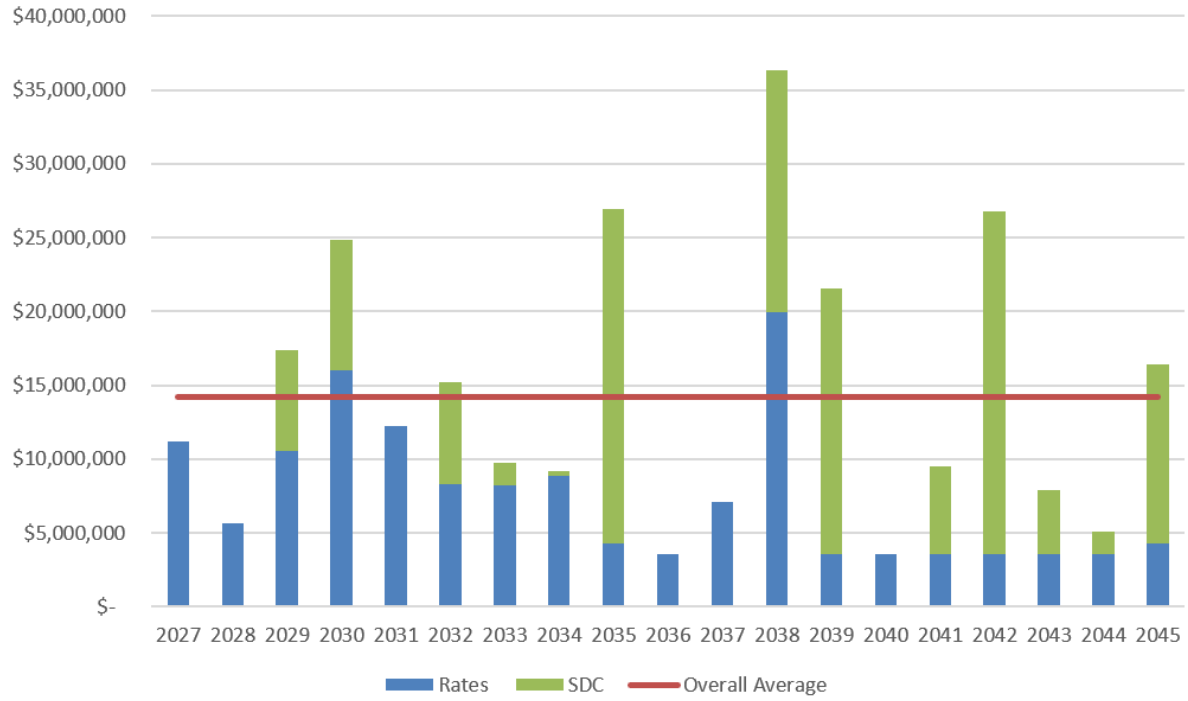


Figure 9.3 CIP Annual Cost by Project Allocation

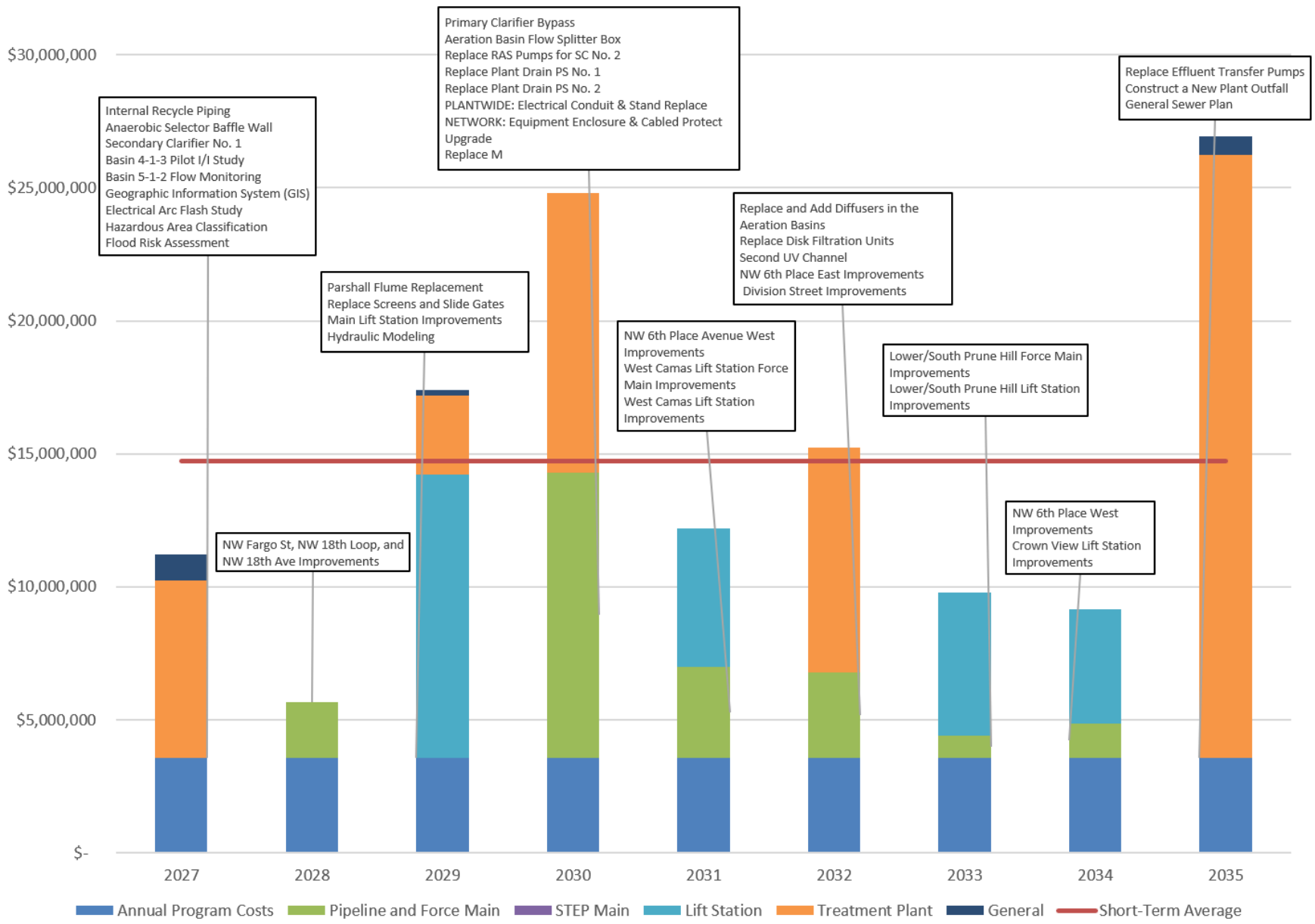


Figure 9.4 Short-term CIP Annual Cost

2030 Projects: Primary Clarifier Bypass, Aeration Basin Flow Splitter Box, Replace RAS Pumps for Secondary Clarifier No. 2, Replace Plant Drain LS No. 1, Replace Plant Drain LS No. 2, PLANTWIDE: Electrical Conduit and Stand Replace, NETWORK: Equipment Enclosure and Cabled Protect Upgrade, Replace MCC-A and Relocate Electric Equipment, Construct a New Electrical Building, Construct a Second RDT for WAS Thickening, NW 6th Place Avenue East Improvements, Main LS Dual Force Main Improvements.

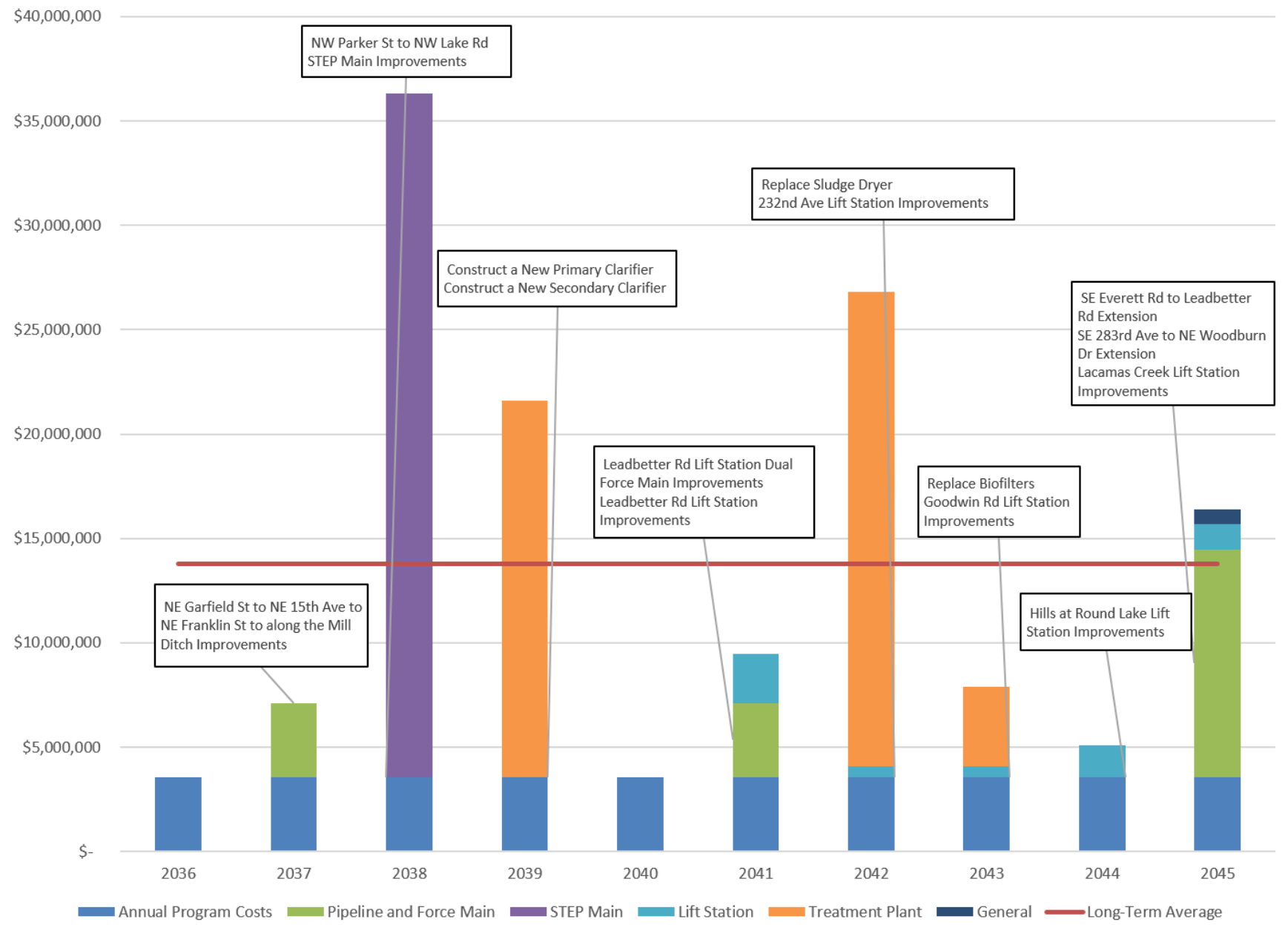


Figure 9.5 Long-term CIP Annual Cost

Table 9.4 CIP Summary by Project Type

Project ID	Title	Total Capital Cost (rounded)	Planning Period	
			Short-term (2027-2036)	Long-term (2037-2045)
Lift Station				
LS-01	Lower/South Prune Hills Lift Station Improvements	$5,400,000	X	
LS-02	West Camas Lift Station Improvements	$5,200,000	X	
LS-03	Crown View Hill Lift Station Improvements	$4,300,000	X	
LS-04	Lacamas Creek Lift Station Improvements	$1,200,000		X
LS-05	Main Lift Station Phase 2 Improvements	$10,600,000	X	
LS-06	Goodwin Road Lift Station Improvements	$500,000		X
LS-07	232nd Avenue Lift Station Improvements	$500,000		X
LS-08	Leadbetter Road Lift Station Improvements	$2,400,000		X
LS-09	Hills at Round Lake Lift Station Improvements	$1,500,000		X
STEP				
S-01	NW Parker Street to NW Lake Road STEP Main Improvements	$32,800,000		X
Pipeline				
P-01	NW 6th Place West Improvements	$1,300,000		X
P-02	NW 6th Place East Improvements	$700,000	X	
P-03	NW 6th Place Avenue West Improvements	$2,900,000	X	
P-04	NW 6th Place Avenue East Improvements	$8,300,000		X
P-05	NW Fargo Street, NW 18th Loop, NW 18th Avenue to Division Street Improvements	$2,100,000	X	
P-06	NE Garfield Street to NE 15th Avenue to NE Franklin Street to along the Creek Improvements	$3,500,000		X
P-07	Lower/South Prune Hill Force Main Improvements	$830,000	X	
P-08	West Camas Force Main Improvements	$560,000	X	
P-09	Main Lift Station Force Main Improvements	$2,400,000		X
P-10	Leadbetter Road Dual Force Main Improvements	$3,500,000		X
P-11	Division Street Improvements	$2,500,000	X	
P-12	SE Everett Road to Leadbetter Road Extension	$6,800,000		X
P-13	SE 283rd Avenue to NE Woodburn Drive Extension	$4,200,000		X
Treatment Plant				
TP-01	Parshall Flume Replacement	$280,000	X	
TP-02	Primary Clarifier Bypass	$820,000	X	
TP-03	Aeration Basin Influent Flow Splitter Box	$3,500,000	X	
TP-04	Plant Headworks	$2,700,000	X	
TP-05	Anoxic Selector Internal Recycle-Piping	$0	X	

Project ID	Title	Total Capital Cost (rounded)	Planning Period	
			Short-term (2027-2036)	Long-term (2037-2045)
TP-06	Anaerobic Selectors Baffle Wall	$70,000	X	
TP-07	Replace Secondary Clarifier No. 1	$5,300,000	X	
TP-08	Secondary Clarifier No. 2 RAS Pump Replacement	$400,000	X	
TP-09	Replace Plant Drain Lift Station No. 1	$1,000,000	X	
TP-10	Replace Plant Drain Lift Station No. 2	$1,000,000	X	
TP-11	PLANTWIDE: Electrical Conduit and Stand Replace	$330,000	X	
TP-12	NETWORK: Equip Enclosure and Cabled Protect Upgrade	$44,000	X	
TP-13	MCC-A Replace and Electric Equip Relocate	$500,000	X	
TP-14	Replace Aeration Basin Diffusers	$900,000	X	
TP-15	Disk Filtration Replacement	$2,500,000	X	
TP-16	Second UV Channel	$5,000,000	X	
TP-17	Effluent Transfer Pump Replacement	$2,300,000	X	
TP-18	Outfall	$20,400,000	X	
TP-19	Digester Electrical Building	$1,300,000	X	
TP-20	New Rotary Drum Thickener	$1,700,000	X	
TP-21	Primary Clarifier No. 3	$6,300,000		X
TP-22	Primary Clarifier No. 4	$11,700,000		X
TP-23	Centrifugal Blower Replacement	$1,300,000	X	
TP-24	Sludge Dryer Replacement	$23,000,000		X
TP-25	Biofilter Replacement	$3,800,000		X
General				
G-01	Basin 4-1-3 Pilot I/I Study	$200,000	X	
G-02	Basin 5-1-2 Flow Monitoring	$300,000	X	
G-03	Geographic Information System (GIS)	$250,000	X	
G-04	Hydraulic Modeling	$200,000	X	
G-05	Electric System Arc Flash Study	$75,000	X	
G-06	Hazardous Area Classification Study	$50,000	X	
G-07	Flood Risk Assessment	$100,000	X	
G-08	General Sewer Plan (2035 and 2045)	$1,400,000	X	X

APPENDIX A

SEPA CHECKLIST/APPROVALS

~ To be included in a future submittal. ~

APPENDIX B

REFERENCES

~ To be included in a future submittal. ~

APPENDIX C

DEMOGRAPHIC PROJECTIONS



ourCamas 2045

DRAFT - *Last Updated July 2025*

Comprehensive Plan

ourCamas 2045

Acknowledgements

Thank you to the members of the Camas community for sharing your time and insights in the development of Our Camas 2045.

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ourCamas 2045



Vision

01

01. Vision

Our Camas Vision Statement

This vision is written in the present tense, as if describing the city as it exists in 2045. Some aspects of the vision can be found in Camas today, while others represent aspirations. The vision provides a framework for the goals and policies of every element of Our Camas 2045.

Our Community



Camas is an inclusive community where residents experience a sense of belonging and connection. Community-wide events foster civic pride, strong bonds among neighbors and a welcoming atmosphere for new residents. Community amenities and recreation facilities throughout Camas promote active lifestyles and social interaction. Camas is recognized for excellent schools and its commitment to lifelong learning. The City promotes a strong culture of public safety, transparent communication, and good governance, allowing residents to thrive in their neighborhoods and engage in decision-making that shapes their community.

Our Environment



Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Our Neighborhoods



Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Our Downtown



Charming, vibrant, and walkable, Downtown Camas is the city's living room. Downtown's history is complemented by new businesses and inclusive housing options. Expansion, resiliency and a dynamic economic landscape are critical to its success. Downtown Camas anchors the community while fostering a culture of pride, support, and connection.

ourCamas 2045



Introduction

02

02. Introduction

Our Camas 2045

Our Camas 2045 is a roadmap for the future of the city and guides land use development and public facility investment decisions between now and 2045.

Camas has a long and rich history. More than 10,000 years ago, Native Americans occupied the Columbia River Valley. The Lewis and Clark Corps of Discovery camped by the river in 1806. In the late 1800s, the La Camas Colony Company of Portland purchased 2,600 acres and began planning the construction of a paper mill to supply newsprint for The Oregonian. The construction of the mill brought the platting of the town and the City of Camas was incorporated in 1906. Today, Camas is a vibrant and diverse community that occupies approximately 16 square miles and is home to over 27,000 people.

Our Camas 2045 is an update to the prior City of Camas comprehensive plan, Camas 2035. This update incorporates new state legislation to support additional housing and climate planning and establishes a new vision for the community's future.

The history of Camas comprehensive planning dates back to 1963 when the first plan was prepared. In 1990, the state adopted the Growth Management Act (GMA) with the goal of managing the growth of cities that had previously grown in an uncoordinated fashion. GMA requires municipalities to update their comprehensive plans every 10 years to ensure future growth can be accommodated with housing and jobs, and public services and facilities are available to serve new residential, commercial, and employment areas.

The last major update to the City's comprehensive plan was in 2016. Since that time, the city has grown by over 5,000 people, added new residential areas in Grass Valley and Green Mountain, and completed the North Shore Subarea Plan, which established a new vision and zoning for the North Shore of Lacamas Lake and sets the stage for future residential, mixed use, and employment development. In conjunction with Our Camas 2045, the city prepared a downtown subarea plan. Our Downtown 2045 establishes a detailed vision and action plan to catalyze public and private investment in the historic downtown. Both plans work together to guide future development and ensure Camas' future remains as vibrant as its past.

What is a Comprehensive Plan?

Our Camas 2045 guides land use development and public facility investment decisions between now and 2045. Our Camas 2045 has eight elements that work together to achieve the community's vision and ensure long-term economic vitality:

- Community Character
- Land Use
- Housing
- Natural Environment
- Climate Change & Resiliency
- Transportation
- Public Facilities & Services
- Economic Development

Each element sets goals that will implement the vision and expresses policies that will guide land use and infrastructure decisions for the 20-year planning horizon. The elements are supported by the comprehensive plan map, which identifies land use designations throughout the City and within its urban growth area.1

Why Plan?

Planning is choosing what to do and how and when to do it. Planning is part of our everyday lives. We plan our vacations, our budgets, and even our trips to the grocery store. The detailed planning of our daily lives derives from a set of goals that we want to accomplish – in a day, in the next six months, or the next two years.

In the same way and for the same purpose, the City's plan is the basis of coordinated action – it enables public and private interests to undertake projects with a clear understanding of community goals and policies.

Our Camas 2045 helps the City identify deficiencies and take steps to remedy them. Planning can find desirable and reasonable solutions before the problem is beyond the community's economic capabilities. The plan is crucial to avoiding uncoordinated activities as the City adapts to changing conditions and experiences the population growth that is anticipated.

The plan is not intended as a rigid system of goals and development policies; rather, it is:

- Long range – looks ahead 20 years to anticipate growth and resulting community needs.
- Comprehensive – relates and integrates all types of uses and necessary public facilities.
- General – establishes general locations and areas for the elements and indicates their relationships to each other and the population they serve.
- Responsive – through regular updates, adjusts to changing conditions, unforeseen circumstances, and local and regional trends.

How is a Comprehensive Plan Related to Other Plans?

Our Camas 2045 is part of a family of state, regional, and local plans. Some, like statewide GMA and Clark County's Comprehensive Growth Management Plan, set the overall planning framework and guide the content of the Camas comprehensive plan.

Others, like plans that are specific to particular subareas, supply more detailed information about individual topics or smaller parts of the City.

Growth Management Act

The GMA establishes state goals, sets deadlines for compliance, and offers direction on how to prepare comprehensive plans and development regulations. GMA also establishes requirements for early and continuous public participation. GMA requires state and local governments to manage growth by identifying and protecting critical areas and natural resource lands, designating urban growth areas, and preparing comprehensive plans and implementing them through capital investments and development regulations.

The GMA legislation, which is Chapter 36.70A of the Revised Code of Washington (RCW), contains 15 goals.

For a community's plan to be valid, it must meet the requirements of the GMA through consistency with state statutory goals, countywide policies, and the plans of adjacent jurisdictions.

The fifteen statutory goals identified in the GMA (RCW 36.70A) are:

1. **Urban growth**. Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
2. **Reduce sprawl.** Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
3. **Transportation.** Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.
4. **Housing.** Plan for and accommodate housing affordable to all economic segments of the population of this state, promote a variety of residential densities and housing types, and encourage preservation of existing housing stock.
5. **Economic development.** Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, promote the retention and expansion of existing businesses and recruitment of new businesses, recognize regional differences impacting economic development opportunities, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
6. **Property rights.** Private property shall not be taken for public use without just compensation having been made. The property rights of landowners shall be protected from arbitrary and discriminatory actions.
7. **Permits.** Applications for both state and local government permits should be processed in a timely and fair manner to ensure predictability.

8. **Natural resource industries.** Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forestlands and productive agricultural lands, and discourage incompatible uses.
9. **Open space and recreation.** Retain open space and green space, enhance recreational opportunities, enhance fish and wildlife habitat, increase access to natural resource lands and water, and develop parks and recreation facilities.
10. **Environment.** Protect and enhance the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.
11. **Citizen participation and coordination.** Encourage the involvement of citizens in the planning process, including the participation of vulnerable populations and overburdened communities, and ensure coordination between communities and jurisdictions to reconcile conflicts.
12. **Public facilities and services.** Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.
13. **Historic preservation.** Identify and encourage the preservation of lands, sites, and structures, that have historical or archaeological significance.
14. **Climate change and resiliency.** Ensure that comprehensive plans, development regulations, and regional policies, plans, and strategies under RCW 36.70A.210 and chapter 47.80 RCW adapt to and mitigate the effects of a changing climate; support reductions in greenhouse gas emissions and per capita vehicle miles traveled; prepare for climate impact scenarios; foster resiliency to climate impacts and natural hazards; protect and enhance environmental, economic, and human health and safety; and advance environmental justice.
15. **Shorelines of the state.** For shorelines of the state, the goals and policies of the shoreline management act as set forth in RCW 90.58.020 shall be considered an element of the county's or city's comprehensive plan.

Urban Growth Areas

An urban growth area is a defined area of land adjacent to city limits within which urban growth is encouraged and beyond which growth can occur only if it is not urban in nature.

Each county that adopts a comprehensive plan under the GMA must designate urban growth areas. The City of Camas has 11,848 acres of land within the urban growth areas. This land, combined with the vacant land available within the City limits, must accommodate the City's population and employment projections as established by the state's Office of Financial Management. The population and employment projections for the City for the year 2045 are 37,080 people and 11,615 jobs. The City is proposing urban growth area expansion to accommodate increased job capacity (see the Land Use Element for additional details).

County Planning Goals and Policies

The Comprehensive Growth Management Plan, adopted by Clark County and its cities and last updated in 2016, guides local jurisdictions as they work to decide questions of regional land use and services.

Clark County is in the final stages of fully updating this plan for 2025 through 2045. As County and city plans were developed, representatives of the City of Camas met on a regular basis over the span of two years with officials of the County and its cities to coordinate efforts. This level of communication helps ensure that the plans and capital projects of these jurisdictions are consistent when adopted. Our Camas 2045 is consistent with the concepts put forward in the County's Comprehensive Growth Management Plan, and the initial drafts of its pending comprehensive plan, and the countywide planning policies as required by RCW 36.70A.100 and 210, WAC 365-196-305; 400(2)(c); 510 and 520.

Local Plans

The goals and policies included in Our Camas 2045 are implemented through development regulations established in the Camas Zoning Code (Title 18 of the Camas Municipal Codes) as well as the standards set forth in existing plans and policy documents.

Our Camas 2045 has been developed to ensure consistency with all other relevant local plans as listed below:

- Strategic Plan (updated annually)
- Legacy Lands Master Plan (in development)
- Lake Management Plan (2024)
- North Shore Subarea Plan (October 2022)
- Camas Water System Plan (October 2019)
- Camas General Sewer Plan (June 2022)
- Camas General Sewer/Wastewater Facility Plan (November 2011)
- City of Camas Parks, Recreation, and Open Space Comprehensive Plan (March 2022)
- Camas Design Standards Manual–Engineering (adopted October 20, 2014, Res. 1308, updated annually)
- Camas Design Review Manual (May 2, 2016)
- Camas Shoreline Master Program (spring 2021)
- Downtown Design Manual (revision in process, to be adopted with Our Downtown Camas 2045, the Downtown Subarea Plan)
- Camas Stormwater Design Standards Manual (June 2022)
- Six-Year Street Plan (Updated annually)
- 2025–2030 Capital Facilities Plan Project List (to be updated with Our Camas 2045)
- Transportation Impact Fee Update (May 2012)

Amending a Comprehensive Plan

The City is required to review its comprehensive plan at least every ten years. However, the City's comprehensive plan and development regulations are reviewed and evaluated regularly.

Our Camas 2045 is based on the best available information. As years go by, new information or changing circumstances – for instance, a revised sewer or water plan – may prompt changes to this plan. By state law, amending a comprehensive plan can occur only once a year and must follow the procedures that are set forth in RCW 36.70A.130.

Amendments to a comprehensive plan require legislative action, which entails the adoption of a resolution or ordinance following notice and public hearing indicating, at a minimum, a finding that a review and evaluation has occurred and identifying the revisions made, or that a revision was not needed and the reasons.

The review and evaluation must include the consideration of critical area ordinances, population projections, and other plans and policies in effect.

Under certain circumstances, amendments can occur more frequently:

- The initial adoption of a subarea plan. Subareas must clarify, supplement, or implement jurisdiction-wide comprehensive plan policies, and may only be adopted if the cumulative impacts of the proposed plan are addressed by appropriate environmental review under chapter 43.21C RCW.
- The development of an initial subarea plan for economic development located outside of the 100 year floodplain in a county that has completed a state-funded pilot project that is based on watershed characterization and local habitat assessment
- The adoption or amendment of a shoreline master program under the procedures set forth in Chapter 90.58 RCW.
- The amendment of the capital facilities element of a comprehensive plan that occurs concurrently with the adoption or amendment of a county or city budget.
- The adoption of comprehensive plan amendments necessary to enact a planned action under RCW 43.21C.440, provided that amendments are considered in accordance with the public participation program established by the county or city under this subsection (2)(a) and all persons who have requested notice of a comprehensive plan update are given notice of the amendments and an opportunity to comment.

Developing Our Camas 2045

Our Camas 2045 began with a citywide outreach process to better understand the community's vision and priorities related to Camas' future. The Our Camas Visioning process reached over 1,000 community members through community conversations, community events, an online survey, online mapping tools, and the project website.

The City hosted two Community Summits. The first, held in June 2024, was an open house event where members of the public could provide feedback on the draft vision statement and goals, as well as provide ideas to achieve the vision and goals. The second Community Summit was held in October 2024 and provided a forum for community members to provide feedback on the draft land use alternatives, development scales, review development concepts for downtown, and learn about the County's climate planning efforts and greenhouse gas inventory.

There were several advisory committees that participated in the development of the plan.

- Project Advisory Committee (PAC) – technical stakeholders, agency partners, service providers
- Community Advisory Community (CAC) – broad cross-section of community interests

- Climate Policy Advisory Team (CPAT) – community members advising on climate goals and policies
- Existing advisory bodies that consulted on the vision, goals, policies, and plan:
    - Downtown Camas Association (DCA)
    - City Council
    - Planning Commission

Following preparation of the draft plan, the City hosted pop-up events throughout the summer and fall of 2025 to seek input on the preferred alternative map and draft goals and policies.

In addition to the outreach efforts described above, the City maintained a public engagement website throughout the visioning process and the development of Our Camas 2045. During spring 2024, a community survey and interactive map gathered feedback from the community on things they like about Camas, things they would change in the future, important topics to address in the plan, and areas of opportunity or concern both downtown and in the wider Camas community. A second online survey accompanied the second community summit to seek input on the draft land use alternatives and development concepts for downtown. The City prepared a Story Map in Spring 2025 to present and obtain feedback on the preferred land use alternative and proposed zoning and comprehensive plan land use designation changes.

The City of Camas values residents' opinions and is committed to being responsive. The final comprehensive plan incorporates the contributions and comments from those who participated in the project engagement. A summary of all engagement activities is included in Appendix X.

ourCamas 2045



Community Character

03

Community Character

This element integrates art, culture, growth and identity into the comprehensive plan, while ensuring community engagement is inclusive and open.

03. Community Character

Vision

In 2045, Camas is an inclusive community where residents experience a sense of belonging and connection. The city's unique identity is defined by its small-town feel and the incorporation of the natural landscape into walkable neighborhoods and high-quality development. Camas maintains its distinct sense of place through inclusive community engagement, sustainable development practices, and intentional placemaking that reinforces Camas' beauty, livability, and lasting connection to nature.

Introduction

The community character element establishes a framework for preserving and enhancing the physical, cultural, and social characteristics that make Camas feel like Camas. Community character is shaped not only by the built environment, but also by the natural landscape, cultural identity, historic context, and the ways in which people engage with their surroundings. As Camas plans for continued growth through the 2045 horizon, this element ensures that the qualities residents value—such as the City's small-town atmosphere, its connection to nature, and its strong civic identity—are maintained and reinforced through thoughtful development, design standards, public investment, and public engagement.

Camas' natural and built environment is defined by its integration of the natural features of the land with the development of housing, commercial buildings and its connecting infrastructure. In 2025, the City of Camas is home to 16 parks, 12 miles of scenic trails, and over 1,060 acres of parks and open space. From the forested paths around Lacamas Lake to the many playgrounds throughout the city, the natural beauty of Camas is a defining part of community life.

Camas' diversifying community is comprised of just over 27,000 people and expected to grow to over 37,000 by 2045. While most people who live in Camas commute to nearby cities for employment, in 2025, there are approximately 9,550 jobs within the city with the largest employment sectors being education and

healthcare, followed by professional services. The Georgia Pacific Mill remains a significant part of the city's economic history and a symbol of Camas' working roots.

The majority of housing in Camas is single family detached homes. Most residents own their home, with renters making up 20% of residents. There are approximately 10,000 housing units in Camas in 2025. By 2045, the city needs to add 4,226 new units to support the growing population. Camas also needs a greater variety of housing types at a range of price points to meet residents' diverse needs. By 2045, new multifamily and mixed-use buildings near transit, in Downtown, North Shore, and along NW Parker Street and Pacific Rim Boulevard will expand options for existing and new residents. These future developments will complement the strong sense of place already present in Camas' established neighborhoods like Prune Hill, Crown Park, and Evergreen Terrace.

Access to public art and community events is an important priority to define and enhance the identity of Camas. Beloved local traditions like Camas Days, the Camas Farmers Markets, and seasonal parades and festivals foster a deep sense of connection and pride. New development will include and support inclusive public gathering spaces to host events, ensuring that the community spirit thrives as the city grows.

Key community resources to preserve and enhance include the existing built infrastructure, high quality schools, access to living wage jobs, parks, open space and recreational amenities, and the distinctive Downtown area, where historic storefronts, local restaurants, and venues like the Liberty Theatre draw residents and visitors alike.

The community will connect with city government and processes through accessible engagement and neighborhood leadership. Ongoing collaboration will help ensure that Camas remains a place where people feel heard, welcomed, and at home.

Community Character Goals and Policies

Goal CC-1 Art, Culture, and Heritage

Camas is a city where history, art, and culture are celebrated and accessible to all. Camas events and activities will instill a sense of belonging among residents of all ages, making Camas an ideal place to live and work.

Policy CC-1.1 Encourage and promote a wide range of artistic and cultural activities by reducing barriers and increasing access to hosting and attending community events that define and enhance Camas' community identity.

Policy CC-1.2 Incentivize development sites to create spaces conducive to the provision of art and other cultural activities and amenities. Encourage murals, sculptures, interactive art installations, and

interpretive displays that celebrate the history, culture, and creativity of Camas.

Policy CC-1.3 Develop a process to memorialize historic sites and create and maintain an official inventory of Camas' historic and cultural resources.

Policy CC-1.4 Support the formation of a local arts commission that provides funding and support for local artists and artistic events in Camas.

Policy CC-1.5 Require a percentage of capital project budgets to be allocated for public art and design enhancements.

Policy CC-1.6 Prioritize naming streets, parks, and public facilities after historically significant people, events, geographic features, or native flora and fauna. Consider allowing naming rights in recognition of significant donations.

Goal CC-2 Sustainable Growth and Distinct Identity

Camas' unique identity is enhanced by high-quality urban design that respects the natural landscape, fosters a connection to nature, and integrates sustainable development.

Policy CC-2.1 Establish and enforce clear and objective design standards to ensure that new development respects and enhances Camas' architectural, historical, and natural character.

Policy CC-2.2 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features, and natural contours of undeveloped properties.

Policy CC-2.3 Promote and provide educational resources for tree-lined streets, rain gardens, and preservation and use of native landscaping to reinforce Camas' connection to nature.

Policy CC-2.4 Align development regulations and design guidelines with dark sky standards to encourage the preservation of the night sky.

Policy CC-2.5 Establish distinctive gateway features at major points of entry into Camas, including attractive signage, landscaping, and public art that reflect Camas' distinct identity.

Policy CC-2.6 Ensure that street signage, lighting, landscaping, and street furniture are designed and maintained with a cohesive aesthetic that enhances community identity.

Policy CC-2.7 Revise the City's sign standards to ensure that all permanent and temporary signage is attractive and well-maintained, with clear regulations and enforcement mechanisms.

Policy CC-2.8 Provide educational and volunteer programs related to climate science, the connections between habitat conditions and native species, and effective ways to mitigate the impacts of climate change.

Goal CC-3 Community Engagement

Camas will have a strong sense of community through open communication, inclusive and meaningful outreach efforts, and enduring partnerships throughout the community.

Policy CC-3.1 Increase access to public engagement by ensuring materials and procedures are accessible for all community members, especially vulnerable groups such as low-income, Limited English Proficiency (LEP) individuals, youth, elderly, and differently abled.

Policy CC-3.2 Utilize outreach strategies such as focus groups and listening posts that accommodate the needs of everyone and account for the broad spectrum of community members.

Policy CC-3.3 Develop and implement strategies to support neighborhood leadership and associations to increase community involvement and provide opportunities to participate in the development processes.

Policy CC-3.4 Regularly inform the community of activities and events through a range of outreach methods including traditional and social media, partnerships with schools, and information at fairs and events.

Policy CC-3.5 Develop a City education program to inform the community on the inner workings of their local government, city functions, and an opportunity to engage with staff.

ourCamas 2045



Land Use

04

Land Use Element

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past.

04. Land Use

Vision

Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Land Use Overview

The City of Camas is home to great schools, family-wage jobs, high quality neighborhoods, and an abundance of open space and recreational amenities. Camas has grown into a dynamic, vibrant city with diversified employment opportunities and services that cater to its residents' various needs. In 2025, Camas maintains its small town charm and character, and downtown remains the heart of the City with a mix of restaurants, shops, professional offices, and residential development. The Grass Valley area is home to several national and international technology and manufacturing firms. Newer residential development has occurred recently in the Green Mountain area, and planned transportation improvements in the North Shore area will improve connectivity and provide better transportation options throughout the City.

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past. The GMA identifies the land use element as the foundation of the comprehensive plan. GMA outlines the framework by which the plan will be implemented and establishes land use designations to accommodate the City's population and employment projections. The development of land in accordance with the goals and policies included in the land use element will ensure the achievement of an appropriate balance of public facilities, housing, employment, services, and recreational uses throughout the City.

Population Projections

GMA requires that each jurisdiction accommodate its share of the region's growth. The City of Camas is expected to have a population of 37,080 by 2045 (based on the County adopted growth rate of 1.2 percent per year), a 7,729-person increase from the 2023 population of 29,352. During the same period, Camas is expected to add 13,658 jobs.

Land Use Designations

In order to ensure the City's vision and land use goals are achieved, land use designations are used to assign a variety of development uses and building densities to land throughout the City. The plan identifies areas for residential, commercial, mixed use, mixed employment and industrial development. The plan also identifies areas for parks and open space to support recreation and enhance natural areas, including habitat and wildlife corridors.

Table 1 Land Use Designations

Comprehensive Plan Designation	Corresponding Zones	Total (Acres)[1]
Residential Low	Residential 15,000 (R-15)	407
	Residential 12,000 (R-12)	27
	Residential 10,000 (R-10)	280
	Residential 7,500 (R-7.5)	151
	Residential 6,000 (R-6)	19
	North Shore Lower Density (LD-NS)	145
	Downtown Residential (R-DT)	68
Residential Medium	Multi-Family 10 (MF-10)	37
Residential High	Multi-Family 18 (MF-18)	41
	Multi-Family 26 (MF-26)	33
	Multi-Family 34 (MF-34)	6
	North Shore Higher Density (HD-NS)	109
Mixed Use	Mixed Use (MX)	141
	North Shore Mixed-Use (MX-NS)	85
	Downtown Mixed-Use Low Rise (MX-LR)	41
	Downtown Mixed-Use Mid Rise (MX-MR)	55
Mixed Employment	Mixed Employment (ME)	235
	North Shore Mixed Employment (ME-NS)	99
Commercial	Neighborhood Commercial (NC)	2
	Community Commercial (CC)	63
	North Shore Commercial (C-NS)	54
	Regional Commercial (RC)	298

	Historic Main Street Core (HMSC)	17
Industrial	Heavy Industrial	545
Parks and Open Space	Neighborhood Park (NP) Special Use Park (SU) Open Space (OS)	1,343

[1]Total acres within each zoning designation are gross acres and inclusive of rights-of-way and infrastructure.

Overlays

In addition to the land use designations listed in Table 1, land use overlays further define appropriate uses and development standards for particular areas within the City. Overlays in Camas include an Airport Overlay and a Design Overlay. Development within all overlay areas must comply with the goals and policies of the underlying land use designation and the specific standards included in the overlay.

The Airport Overlay area applies to land adjacent to Grove Field, an airport owned and operated by the Port of Camas-Washougal and located northeast of Lacamas Lake. Grove Field adjoins the City's UGA and is proposed to be included in the UGA with this update. The Airport Overlay is designated to ensure land uses adjacent to the airport are compatible with air traffic and do not interfere with safe air navigation. For example, the comprehensive plan designation of lands adjacent to the airport is generally Mixed Employment, rather than residential, and the Airport Overlay area restricts uses tending to have higher concentrations of people, such as schools or hospitals.

The Design Overlay is a new overlay with the 2025 update and replaces the Gateways and Corridors Overlay included in the prior plan. The Design Overlay generally applies to the following locations. The specific extents of the overlay are included on the Camas Zoning Map.

- 6th Avenue
- 3rd Avenue
- Everett Street
- 38th Avenue
- Lake Road
- Green Mountain - Goodwin
- Brady Road
- Union Street
- Parker Street

The Design Overlay is intended to enhance the walkability, pedestrian experience, and design of the corridors it covers. Development/redevelopment within a designated Design Overlay must adhere to the Design Overlay goals and policies included in this element. See Goal LU-6 and Policies LU-6.1 – 6.7.

Figure 2 Comprehensive Plan Map

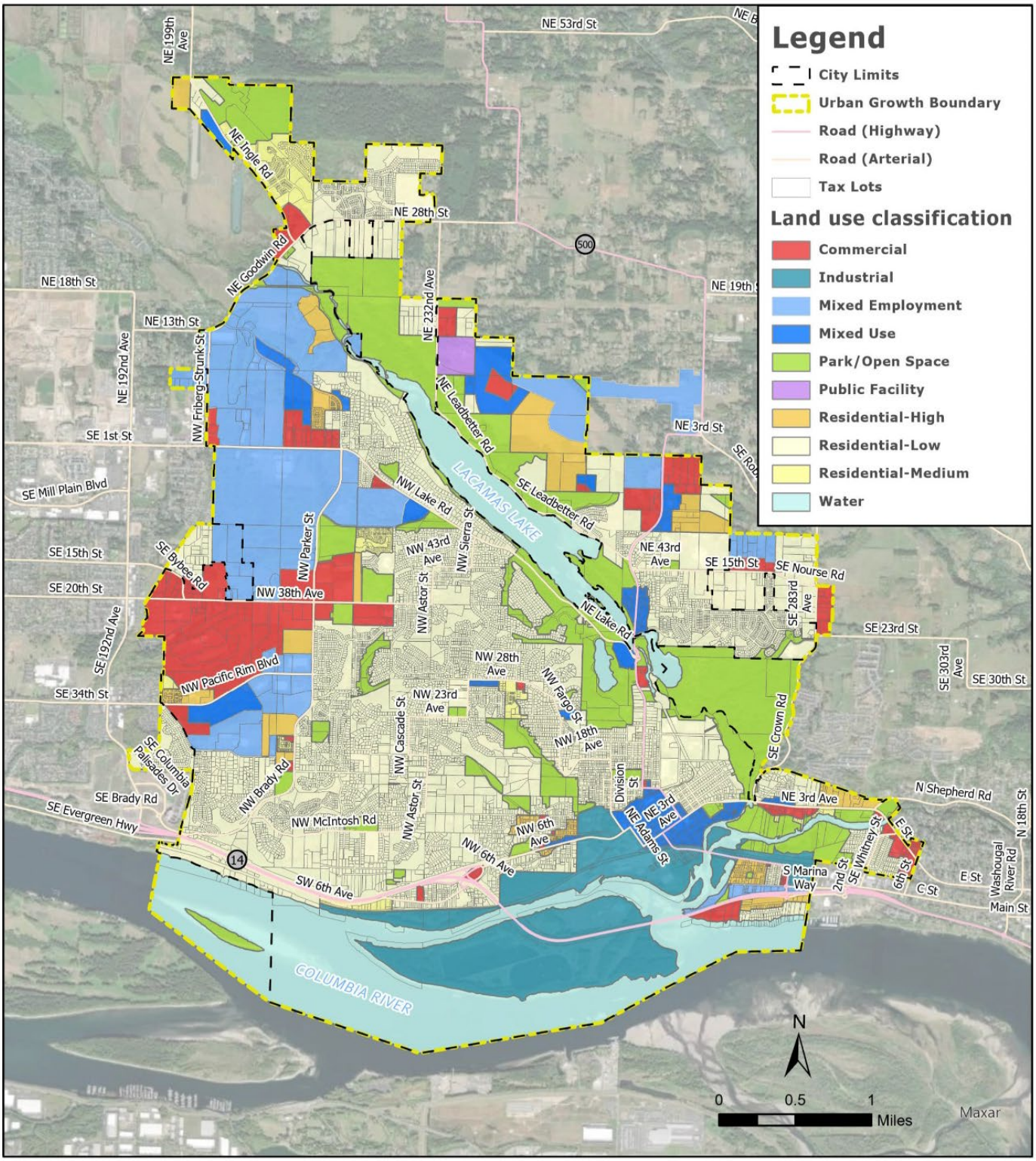
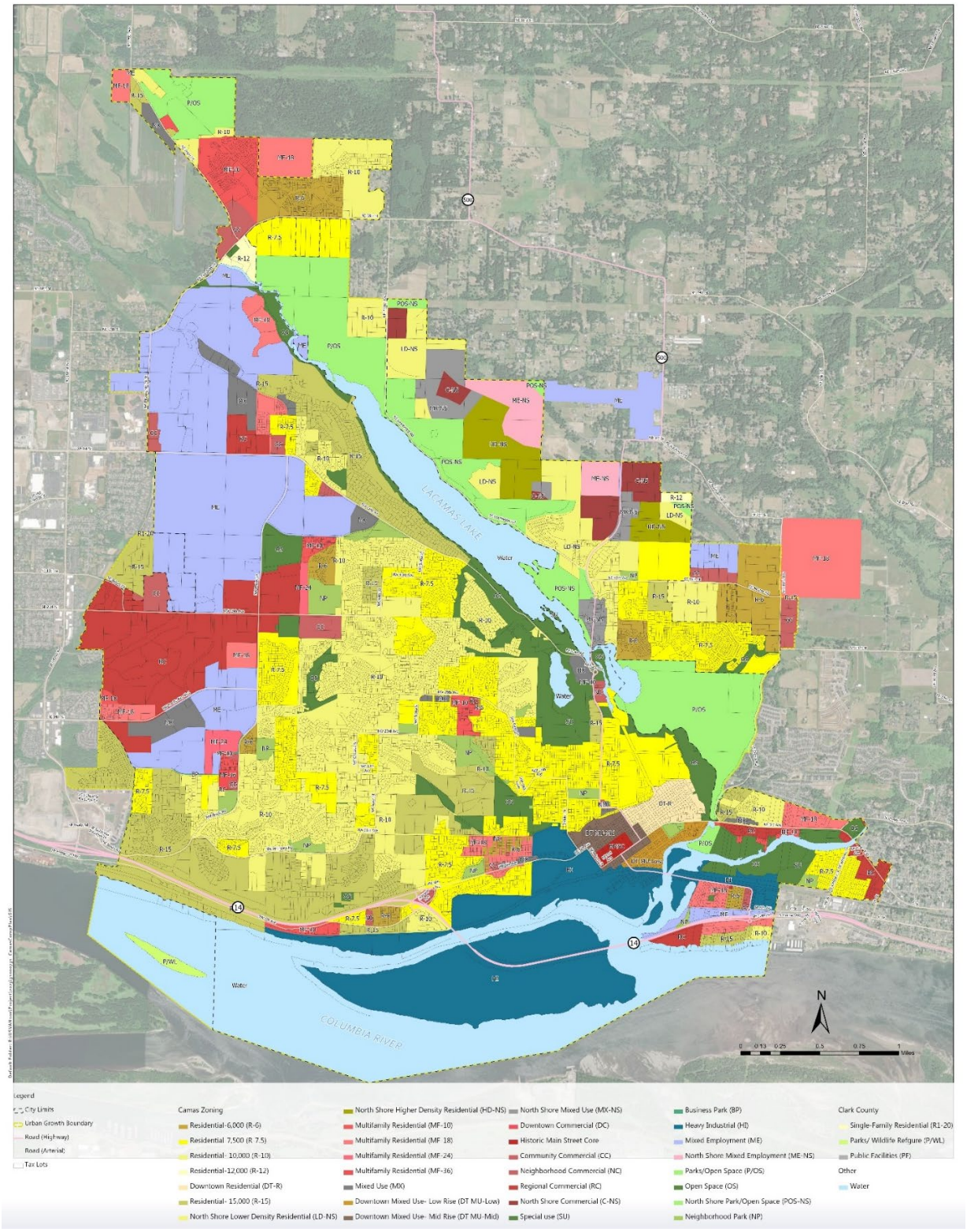


Figure 3 Zoning Map



Land Use Goals and Policies

Goal LU-1 Citywide Land Use

Maintain a land use pattern that respects the natural environment and existing uses while accommodating a mix of housing and employment opportunities to meet the City's growth projections in coordination with the capital improvement plan.

Policy LU-1.1 Ensure the appropriate mix of commercial, residential, and industrial zoned land accommodates the City's share of the regional population and employment projections for the 20-year planning horizon.

Policy LU-1.2 Coordinate with Clark County, the state, and special districts to identify future needs for essential public facilities such as airports, state education facilities, state and regional transportation facilities, state and local correctional facilities, solid waste handling facilities, regional parks and others as identified in RCW 36.70A.200. (See policies ED-3.1, 3.2, and 3.3 regarding Grove Field airport, policy TR-2.1 regarding transportation, and policy PFS-4.27 regarding solid waste.)

Policy LU-1.3 Implement design standards for new development, redevelopment, and infill that consider the surrounding built and natural environments and support a natural transition between uses.

Policy LU-1.4 Ensure that park and recreation land is distributed equitably throughout the City and work to achieve park and continuous trail corridors from Green Mountain to the Columbia River. (See policies PFS-2.1 and 2.4 regarding increasing connectivity to natural areas and continuous trail around Lacamas Lake.)

Policy LU-1.5 Ensure adequate public facilities, including roads, emergency services, utilities, and schools, exist to serve new development, and mitigate potential impacts to current residents. Establish and maintain policies for impact fees for new development.

Policy LU-1.6 Ensure consistency with County-wide planning policies.

Policy LU-1.7 Evaluate and improve design and building standards for new and redeveloped sites in high-risk natural hazard areas.

Policy LU-1.8 Incorporate sustainable and low climate impact design into development codes and standards.

Policy LU-1.9 Encourage high density concentrations of housing, commercial, and other uses needed in daily life along major transportation corridors to support the reduction in vehicle miles traveled and opportunities to increase physical activity.

Policy LU-1.10 Protect the viability of the airport as a significant economic resource to the community by encouraging compatible land uses and densities, and reducing hazards that may endanger the lives and property of the public and aviation users consistent with state laws RCW 36.701A.510 and RCW 36.70547.

Goal LU-2 Employment Land

Create a diversified economy and serve Camas residents, businesses, and tourists by providing sufficient land throughout the City to support a variety of business types and employment opportunities.

Policy LU-2.1 Protect employment land to ensure an adequate supply of commercial and industrial land to meet 20-year employment projections. Encourage a balance of new and existing commercial, light industrial, knowledge-based business, medical, and high-tech uses.

Policy LU-2.2 Encourage mixed-use developments (residential and commercial) that support adjacent uses, reduce vehicle miles traveled, and balance job creation.

Policy LU-2.3 Implement development and landscaping standards to ensure industrial development and other employment lands integrate with the surrounding neighborhoods.

Goal LU-3 Neighborhoods

Create vibrant, stable, and livable neighborhoods with a variety of housing choices that meet all stages in the life cycle and the range of affordability.

Policy LU-3.1 Encourage connectivity between neighborhoods and adjoining natural areas and trails to increase access to recreation amenities. (See policies PFS-2.1 and 2.2)

Policy LU-3.2 Discourage exclusive neighborhoods, privacy walls, and gated communities.

Policy LU-3.3 Provide commercial zoning within a half mile of residential areas for the development of food retailers (grocery stores and farmers' markets) to improve food access.

Goal LU-4 Natural Environment

Develop an interconnected network of parks, trails, and open space to enhance the quality of life for Camas residents and visitors and support and preserve wildlife corridors and natural resources.

Policy LU-4.1 Maintain development regulations that encourage the preservation of trees and natural areas, including the use of density bonuses and other tools to protect sensitive areas and encourage tree replacement. (See policy NE-4.1)

Policy LU-4.2 Support the purchase and preservation of open space by the City and private owners. Encourage careful consideration and integration of the natural environment in planning activities to maintain the park-like setting of Camas.

Policy LU-4.3 Encourage connectivity and increase access to regional trails throughout the City to support multi-modal transportation and physical activity. (See policies PFS-2.1)

Policy LU-4.4 Protect the quality and quantity of groundwater used for public water supplies through conservation of water usage and treatment of runoff.

Goal LU-5 Mixed-Use Areas

Foster economically and socially diverse mixed-use neighborhoods that meet the multi-modal transportation, housing, employment, education, recreation, and health needs of the community.

Policy LU-5.1 Mixed-use developments should be unique to the area in which they are located, encourage small business development, provide a mix of housing types to ensure affordability, increase pedestrian and transit connections, and include design that is sensitive to the natural environment.

Policy LU-5.2 Develop mixed-use areas that are oriented to the public street and scaled and designed to integrate with surrounding land uses.

Policy LU-5.3 Create a mixed-use zone that requires developments to include a minimum percentage of commercial space in both vertical and horizontal mixed-use settings.

Goal LU-6 Design Overlay Areas

Create attractive and welcoming areas in the City and distinguish Camas from adjacent jurisdictions through the development of design overlays.

Policy LU-6.1 Encourage development and redevelopment along the design overlay corridors that respects the historic character of the areas, improves pedestrian mobility/safety, and supports small-scale retail and commercial services.

Policy LU-6.2 Encourage development of commercial uses and multi-family residential within the NE 6th Avenue and NE 3rd Avenue design overlay corridors to support downtown businesses (such as through the Downtown subarea plan). Consider rezoning low-density residential land to support the downtown area. Consider rezoning low-density residential land to support the downtown area.

Policy LU-6.3 Orient building entrances toward the street and provide pedestrian connections from building entrances to the sidewalk. Encourage landscaping, rather than parking, between the building and the street to create a welcoming streetscape.

Policy LU-6.4 Collaborate with partners to support community events, public art, and infrastructure investments that celebrate cultural heritage, provide community amenities, and strengthen community branding. Develop area identities through events, festivals,

signage, and other improvements that help establish or enhance existing character within the overlay areas.

Policy LU-6.5 Encourage the designation and development of design overlay features in strategic areas to create a distinct pedestrian scale identity and attract visitors.

Policy LU-6.6 Identify streets in the design overlay areas as public places to encourage pedestrian and bicycle mobility and to reinforce the connection between the corridors and the surrounding neighborhoods.

Policy LU-6.7 Improve and increase wayfinding signage in design overlay areas to nearby recreational and other amenities.

ourCamas 2045



Housing

05

05. Housing

Vision

In the year 2045, residents of Camas continue to appreciate their safe, diverse, and welcoming community. Those raised in Camas will return for living-wage jobs and to ultimately retire here. Camas is a well-planned and connected city where residents enjoy pedestrian and bicycle paths between neighborhoods and to downtown. Camas provides a wide variety of housing options that meets the needs of all residents and provides a range of housing for all ages, abilities, needs, preferences, and income levels.

Background

This element of the comprehensive plan sets out the vision, goals, and policies to address current and projected housing needs for the next 20 years (2025 to 2045), inclusive of the diverse needs of the whole community across the income spectrum. Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

The housing element is supported by a housing needs assessment (provided below) that quantifies existing housing stock and projected housing needed to accommodate projected growth. Housing analysis is an important exercise as the housing needs in Camas tend to continually evolve based on changes in the broader economy, local demographics, and the regulatory environment. In addition to an assessment of housing needs based on the best available existing data, the housing element goals and policies reflect community input, state legislative requirements, and City of Camas' priorities.

The following section provides background on the planning framework and highlights the analytical findings associated with current and projected housing including details on Camas' community demographics, housing stock, housing market dynamics, expected housing demand, and special housing needs. The insights from this analysis help to build a factual basis for the housing policy updates.

Housing Challenges

Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

Planning Framework

In Clark County, RCW 36.70A.040 requires all cities to "fully plan" for the Elements of a Comprehensive Plan, including land use, housing, capital facilities, utilities, transportation, and climate change.[1] The current update process is part of a periodic update also required by the Growth Management Act (GMA), as part of an established schedule by the County.

At the state level, the GMA requires local jurisdictions to adopt Housing Elements that are consistent with statewide goals and objectives. The Housing Element must include an inventory and analysis of existing and projected housing needs that identifies the number of housing units by income level necessary to manage projected growth including permanent supportive and emergency housing.

Recent state legislation calls for cities to expand middle housing allowances in single family residential zones (HB 1110) and support Accessory Dwelling Unit development (HB 1337). These changes require cities to allow up to two Accessory Dwelling Units (ADUs) on all lots zoned to allow single-family homes. Lots with critical areas or their buffers are exempt from the requirements of both HB 1110 and HB 1337. In addition, via HB 1220, the Washington State Department of Commerce instructed local governments to "plan for and accommodate" housing affordable to all income levels.

MIDDLE HOUSING POLICY IN WA

'Middle housing' refers to moderate-density housing types between single-family detached homes and larger multifamily housing. HB 1110 became effective in July 2023 and requires that designated Growth Management Act (GMA) planning cities in Washington must allow certain minimum densities for middle housing within 6 months after their periodic update due date.

Camas is counted as a Tier 2 city under this policy, which must allow for 2 dwelling units per lot or higher in predominantly residential zones, as well as 4 dwelling units per lot within a quarter mile of major transit stops and for affordable housing (ESHB 1110, Sec. 3(1)(c)).

The Clark County Countywide Planning Policies provide helpful guidance on the Comprehensive Plan update. Clark County is currently in the process of updating its Comprehensive Plan and its Countywide Planning Policies. The existing 20-year growth plan spans 2015-2035 and includes a Housing Element with relevant policies for jurisdictions within the County. Please see Appendix X for a summary of the existing relevant Clark County Countywide Planning Policies.

Lastly, the City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and

[1] The GMA includes other optional Elements for economic development, parks and recreation, conservation, energy, sub areas, and ports.

interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings helped to shape the updates to the Camas Housing Element.

Community Engagement

The project team held interactive open houses and interviewed stakeholders to learn about housing challenges, opportunities, and actions. Engagement activities identified the following themes that could contribute to future decision-making related to housing in Camas.

Housing Insights

- **North Shore:** Need infill development.
- **General:** Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Housing Strategies

- Citywide: Maintain the strength, vitality, and stability of all neighborhoods and promote the development of a variety of housing choices that meet the needs of all members of the community. This goal seems very wide and difficult to achieve. More focused on affordability?
- More moderate density in and near Downtown with good connectivity (Safe, lit, easy).
- Be intentional- positive in messaging about adding middle housing and moderate density so community gets accustomed to why it is so important for our community and culture to include all. Show that it's not scary.
- Consider incentivizing housing developers through zoning, taxes and fees, and partnerships.
- Partnerships: Partner with Vancouver Housing Authority and other organizations to develop affordable housing. Partner with habitat for humanity and housing authority. Proud ground for moderate- and low-income housing.
- Attract a large senior housing project.
- More 4-5 story multi-family units, especially Downtown.
- Builder incentives to focus on mixed use/ apartments.
- Don't forget the bike paths.
- Make it easy to build ADUs in backyards.
- Support yes in my backyard policies.

- Incentivize small developers (housing & economic development combined!).

Housing Action Plan

The City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings about community priorities and HAP goals and strategies are summarized below.

HAP Goals

- **Develop Housing to Accommodate Growth.** Thoughtful changes to Camas' zoning and development regulations can allow the City to better accommodate projected growth.
- **Diversify the Mix.** A greater variety of housing types can better serve young families, small households, seniors, people with disabilities, and people with diverse incomes.
- **Increase Housing Affordability.** Young families, seniors, and people who work in Camas may have difficulty finding affordable housing in Camas.
- **Preserve Existing Affordable Housing.** Camas should adopt strategies to preserve its existing affordable housing and prevent the displacement of residents. Community members noted concern for preserving existing affordable housing, particularly smaller single-family properties, in older neighborhoods near Downtown.

STRATEGY	GOALS			
	DEVELOP HOUSING	DIVERSIFY HOUSING MIX	INCREASE HOUSING AFFORDABILITY	PRESERVE AFFORDABLE HOUSING
Strategy 1: Expand housing opportunity in mixed use and downtown commercial districts	♦	♦		
Strategy 2: Consider making targeted rezones during Comprehensive Plan updates	♦			
Strategy 3: Diversify allowed housing types and update related lot and dimensional standards	♦	♦	♦	
Strategy 4: Focus on key areas with residential development or redevelopment potential. Expand more mixed-use areas throughout the city.	♦	♦		
Strategy 5: Continue community conversations around housing and housing for all	♦	♦	♦	♦
Strategy 6: Communicate available affordable housing resources			♦	
Strategy 7: Build partnerships to develop and preserve affordable housing for individuals, families, and seniors. Explore expansion of the MFTE program.			♦	♦
Strategy 8: Explore funding source and cost reduction options for affordable housing	♦	♦	♦	♦

Housing Targets

Planning for future housing demand is critical to ensure that the City can meet demand driven by population growth. This section summarizes projected future housing demand for Camas to provide context for the City's housing policies.

Population and Housing Allocations

Table 2 below demonstrates the City of Camas and Clark County's anticipated population forecast between 2023 and 2045. Since 2000, Camas has grown at a faster rate than the County overall with an Average Annual Growth Rate (AAGR) of 5.2% in the City (including annexations), compared to the County's AAGR of 2.4% (Housing Appendix). However, the County's estimates assume a slower growth scenario for the City in the next 22 years. With this assumption, new population growth in Camas is estimated to comprise 4.05% of growth in Clark County overall.

The population growth forecast indicates that the City of Camas will make up 4.05 percent of new growth population in Clark County between 2023 and 2045 with an AAGR of 1.2% in the City. The County's methodology also acknowledges Washington State Department of Commerce's HAPT estimates for current housing supply in Camas and allocates a number of net new units for the Urban Growth Area(s).

Table 2 Population Growth Forecast, Camas and Clark County, 2023 to 2045

Source: Clark County Interim Population Allocations and Clark County Comprehensive Plan 2025 Update, 2025 Population, Housing, and Employment Allocation – Issue Paper 5.

Jurisdiction	2023 Est. Population	Vacant Buildable Land Model Percent Capacity	2023-2045 Growth	2045 Estimate	Change (percent)	AAGR
City of Camas	**29,352**	**4.26%**	**7,729** ***(4.05% of total growth)***	**37,080**	**26%**	**1.2%**
Clark County	527,400	100%	190,754 *(100% of total growth)*	718,154	36%	1.6%

In May 2024, Clark County adopted housing allocations for jurisdictions located within county boundaries. In total, this shows an estimated 4,226 housing units needed by 2045 in the City of Camas and UGA(s).[2] The City would add about 311 new units to meet the new permanent

[2] The Washington State Department of Commerce Housing for All Planning Tool (HAPT) provides two allocation methods for determining the share of a County's housing supply to be met by jurisdictions. Method A assumes all housing needs will be accommodated through new housing production. Method B assumes all jurisdictions will accommodate equivalent shares of the total countywide housing need at each income level, proportional to their size, in the projection year. Clark County elected to use a hybrid method of 75/25 for Camas.

supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045. Camas currently has 143 units of housing affordable for households at or below 30% of AMI that are not Permanently Supportive Housing (PSH)[3] and 14 emergency units[4] according to the HAPT estimate. With this allocation, the City will need to accommodate 172 new units of temporary emergency housing by 2045.[5]

HOUSING ALLOCATIONS

In 2021, HB 1220 created a new way that communities in the state are required to plan for housing needs. This legislation requires that jurisdictions plan for sufficient land capacity for housing needs, including all economic segments of the population (moderate, low, very low and extremely low income, as well as emergency housing and permanent supportive housing).

- **Since 2000, the City of Camas had an average annual growth rate of 221 new housing units per year.**
- **Comparatively, the City will need to add an average of 195 new housing units per year between 2024 and 2045 to reach its allocation of net new units.**

[3] Permanent Supportive Housing is defined as: "subsidized, leased housing with no limit on length of stay that prioritizes people who need comprehensive support services to retain tenancy and utilizes admissions practices designed to use lower barriers to entry than would be typical for other subsidized or unsubsidized rental housing, especially related to rental history, criminal history, and personal behaviors" Washington RCW 36.70A.030(31).

[4] Temporary emergency housing is defined as: "temporary indoor accommodations for individuals or families who are homeless or at imminent risk of becoming homeless that is intended to address the basic health, food, clothing, and personal hygiene needs of individuals or families. Emergency housing may or may not require occupants to enter into a lease or an occupancy agreement." – Washington RCW 36.70A.030(14).

[5] Clark County's interim allocations do not include designated temporary emergency housing units at the City level. Estimates in this section for the City of Camas are derived directly from the Department of Commerce HAPT tool.

Figure 4 Housing Unit Allocations by Income, Camas and its UGA, 2024-2045

Source: Washington State Department of Commerce HAPT, Clark County Interim Housing Allocations, City of Camas
Note: Current supply includes both the estimate from the HAPT with the addition of 599 additional units since its calibration in 2020.



4,226 new homes will be needed over the next 20 years in the City of Camas

In addition, there will also need to be:
172 Emergency housing beds (temporary housing)

	0-30% AMI		>30-50% AMI	>50-80% AMI	>80-100% AMI	>100-120% AMI	>120% AMI	Total	Emergency housing beds
	Non-PSH	PSH							
2024: Current Housing Supply Estimate	143	0	458	1,874	1,182	1,965	4,201	**9,832**	14
2024-2045: New Housing Unit Needed for the Allocation	**564**	**331**	**811**	**955**	**516**	**249**	**799**	**4,226**	172
2045: Total Target Supply	707	331	1,269	2,811	1,627	2,214	4,499	**13,459**	186

Residential Capacity

Residential capacity is generally defined as the amount of existing housing units plus new housing a city can accommodate based on city zoning regulations (e.g., residential density requirements in the zoning code) and land available for new development. Residential capacity relates to residential growth allocations in a number of ways. Evaluating residential growth capacity is necessary to determine whether the housing growth allocation (determined by the

county) can be accommodated within the City of Camas and its UGA. Sufficient capacity is available if residential growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for residential growth capacity. The Vacant Buildable Lands Model (VBLM) for Clark County provided a basis for the available housing capacity in the City of Camas based on available buildable land (including both vacant and underutilized land) and current zoning. The existing zoning and UGA showed insufficient housing capacity.

The City of Camas is proposing zoning modifications that would allow for more residential capacity. Consequently, another analysis was completed to consider future modifications to select zones. According to the housing capacity estimates, Camas would have capacity for 5,329 housing units which would result in a surplus over the 2045 housing target of 4,226 housing units. Results (summarized below) from the updated capacity analysis show sufficient residential growth capacity to meet the 2045 housing target. The estimates depend on the final preferred alternative which could be refined further.

Summary of Housing Analysis Findings

A summary of key findings from the housing data analysis is provided below to help describe key insights to inform Comprehensive Plan policy updates (Technical Appendix provides the full findings).

Community Demographic Trends

- **Since 2000, Camas has grown at a faster rate than Clark County or Washington State overall, more than doubling in size by 2023 from 12,462 to 27,420 persons.** As population increases, the demand for housing also rises and affects planning.
- **In terms of land, Camas has expanded incrementally over time through annexations.** In the 2000's and early 2010's, the City added large new areas on the north side of Lacamas Lake, with a large portion of this area zoned for multifamily housing alongside employment and commercial areas.
- **Camas is becoming a more diverse community.** The share of people of color increased from 13% in 2012 to 24% in 2022 and is slightly more diverse than the county (21% were people of color in 2022).
- **Camas is seeing a larger share of couples and families with children (39%) and has a higher share of both groups than the County or State (24%, 22%, respectively).** The City also had a larger median household size (almost 3 persons) compared to the county (2.65 persons).
- **Median household income in Camas is higher than both Clark County and the state at $133,000 in 2022.** Adjusting for inflation, median income in the City still increased by 31 percentage

points since 2012 which is primarily due to growth in high-income households earning over $100,000 per year.[6]

- **Four out of five households in Camas owned their homes in 2018-2022, at a higher rate than either Clark County or Washington.** The share of renter households stayed the same in Camas since 2012, showing less than a 1% increase over this time period.
- **County-level trends indicate that homeownership disparities exist for some groups by race and ethnicity in Clark County,** with households who are Black or African American, American Indian or Alaska Native, Native Hawaiian or Pacific Islander, Hispanic or Latino, or mixed/other races having lower rates of homeownership.
- **At the County level, income levels also vary by race and ethnicity.** Households who were Black or African American, Native Hawaiian or Pacific Islander, Hispanic or Latino, two or more races, or another race had lower median household incomes than the overall average.
- **Overall levels of housing cost burden are decreasing, but more renters and low-income households experience higher rates.** Around 24% of all Camas households experienced cost burden (2022) with a higher share of renter households experienced cost burden compared to homeowners and with 100% of households earning less than $20,000 experienced severe cost burden (paying at least half of their monthly income towards housing). Although cost burden is generally lower for homeowners, more people of color in Camas who own their homes experience cost burden compared to white, non-Hispanic homeowners.

Existing Housing Inventory

- **Camas has seen growth in their number of housing units in the past two decades,** with a 108% change between 2000 and 2023 (annually this equates with an average of 221 new homes). The City of Camas' growth in housing units was lower than its population change (120%), indicating that the City has not been keeping pace by adding to its supply to meet the rising demand.
- **Camas has steadily low vacancy rates for all housing units in total** (4% in 2022 with little change over the last decade). This level of vacancy is indicative of a healthy housing market with natural rates of turnover; however, the slight decrease could begin to indicate constrained supply of housing.
- **For two-bedroom multifamily units, Camas has seen spikes in vacancy, but these align with new construction trends** which can temporarily raise vacancy rates for newly delivered units but do not indicate long-term vacancy. In 2023, the City saw over 200 new housing units delivered, likely accounting for the fluctuation in vacancies, as well as deliveries in 2017 and 2020.
- **Since 2015, the City has permitted 2,763 new housing units.** Single detached homes have accounted for the largest share (70%) of new permits in the City of Camas, and another 8 percent

[6] The median income in Camas is above the area median income (AMI) for 2023. HUD determined the AMI to be $114,400 for a family of four in the Portland-Vancouver-Hillsboro, OR-WA MSA (including Camas). This is lower than median income in Camas itself which was $133,000 in 2022 (Exhibit 14) and has been consistently lower than the City over time.

were made up of attached townhomes. While apartments, condos, and units in mixed-use buildings made up 20 percent of new permits between 2015-2024, middle housing types like duplexes, triplexes, quadplexes, and accessory dwelling units (ADUs) were only 2 percent of all permits.

- **Median home sale prices in Camas has increased over the last ten years,** with Camas' average prices generally remaining higher than the County. In 2023, the average home sale price in the City was **$704,000,** increasing by 119% since 2013 which is more expensive than the average home in the City of Portland (by $196,000) or Clark County (by $173,000).
- **Prices are also increasing quickly in Camas and Clark County for the average 2-bedroom multifamily rental.** The average 2-bedroom apartment rent was over $1,800 in the City and over $1,700 in Clark County (2024 year-to-date), indicating a 35% increase since 2010. Average 2-bedroom multifamily rents in Portland tracked closely with Camas in the 2010's, while rents in Vancouver remained lower (generally following countywide trends).
- **Compared with home sale price and rent increases in Camas, only households earning over 150% or more of AMI would be able to afford the average home in the City as of 2023.** However, the average 2-bedroom apartment is still affordable to households between 50 and 80% AMI in Camas.
- **The City of Camas had 98 units of regulated affordable housing in 6 buildings** according to data from Oregon Metro and the City. Approximately half of these units are affordable respectively for residents between 30-50% of AMI and 50-80% of AMI. The City also has several long-term care residential facilities for older adults providing 135 units.

Future Housing Demand

- **Since 2000, Camas has grown at a faster rate than Clark County overall but is expected to slow based on County estimates for 2045.** The County's projections assume that new population growth in Camas is estimated to grow at an annual rate of 1.2% to account for 4.05% of county growth.
- **County allocations show the need for 4,226 new housing units in Camas by 2045, adding around 211 new housing units per year.**
- **The City would add about 331 new units to meet the new permanent supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045.**
- **Camas residents with disabilities may require additional housing features for accessibility.** Around 8% of residents in Camas had at least one disability (2022), with the most common being cognitive difficulties, followed by ambulatory and vision difficulties. These disabilities can require housing accommodations such as zero-step entryways, ramps, lifts, or other accessibility features.

Housing Goals and Policies

Goal H-1 Citywide Housing

Promote safe, attractive, and vibrant neighborhoods with access to housing, jobs, services, schools, amenities, and healthy active living that meet the needs of all members of the community.

Policy H-1.1 Provide a range of housing choices and options to support all ages and income levels. Provide an adequate supply of land to accommodate the City's housing growth target.

Policy H-1.2 Support low impact development (LID) in residential development that minimizes both impervious areas and site grading to retain the natural contours of the land. LID strategies include conserving native vegetation, narrower streets, stormwater gardens, and other landscape practices that store and filter runoff.

Policy H-1.3 Promote the use of flexible development options (e.g., planned residential developments and development agreements) to create a variety of accessible housing types within new developments.

Policy H-1.4 Require new residential developments to demonstrate how proposed lot, street, and utility layouts can accommodate development of single-story dwellings, duplexes, and attached or detached accessory dwelling units.

Policy H-1.5 Ensure housing in mixed-use buildings (or developments) will complement the commercial and retail portion of the development and increase local living-wage jobs. Amend the municipal code to support mixed-use and middle housing development in the Downtown Subarea and near other community hubs.

Policy H-1.6 Support in-fill housing development on vacant or underutilized sites, subject to design review guidelines, that have adequate urban services. Ensure development compatibility with the surrounding neighborhood.

Policy H-1.7 Require all new housing developments to provide a range of housing types and sizes that are evaluated through the land use approval process and stipulated on the final plat.

Policy H-1.8 Support the maintenance, repair, and rehabilitation of Camas' existing housing stock by promoting resources that provide financial and other assistance to community members to maintain or repair health and safety features of their home.

Policy H-1.9 Support investment in existing neighborhoods to enhance livability, safety, and accessibility in a way that preserves unique physical character.

Policy H-1.10 Develop objective design standards to ensure new development is compatible in scale, architectural style, and landscape composition with existing and planned neighborhoods.

Policy H-1.11 Provide ongoing education and community engagement regarding Camas' housing needs, including available programs and incentives. Provide permit process support to affordable housing developers.

Policy H-1.12 Achieve and sustain the housing targets by income group allocation for Camas as adopted by the Clark County Council. Monitor and assess the City's progress in meeting housing needs at least every five years.

Policy H-1.13 Support and encourage housing legislation at the county, state, and federal levels that promotes and supports the City's housing goals and policies.

Goal H-2 Housing Choice and Affordability

Create a diversified housing stock that meets the needs of all lifestyles and economic segments of the community through new developments, preservation, and collaborative partnerships.

Policy H-2.1 Support and encourage a wide variety of housing types throughout the City to provide choice, diversity, and affordability and promote homeownership.

Policy H-2.2 Promote the preservation and rehabilitation of the City's existing affordable housing stock of all types, including low-cost rentals and

affordable owner-occupied single-family homes. Support measures that preserve affordable housing, such as home repair programs with partners to rehabilitate existing housing that serve low to moderate-income households.

Policy H-2.3 Create opportunities for ownership housing in a variety of settings, styles, sizes, and affordability levels throughout Camas.

Policy H-2.4 Provide incentives and bonuses for the development of affordable housing and middle housing. Ensure that any affordable housing built with the support of city incentives or bonuses (including, but not limited to, public funds, through development agreements, incentives, or by regulation) remains affordable for the longest possible term.

Policy H-2.5 Participate in collaborative partnerships with local and regional public and non-profit housing groups to ensure that affordable housing and supportive services are provided throughout the City.

Policy H-2.6 Encourage and support collaborations between for-profit and non-profit developers to expand affordable housing options.

Policy H-2.7 Evaluate the existing Multifamily Tax Exemption (MFTE) program provisions and participation. Consider changes and expansions to program options and associated costs and benefits that support housing production and affordable housing targets.

Policy H-2.8 Review and update the Camas Municipal Code to be consistent with State guidelines for housing and residential use.

Policy H-2.9 Plan for and accommodate Camas' allocated share of countywide future housing needs for moderate-, low-, very low-, and extremely low-income households as well as manufactured housing, multifamily housing, group homes, foster care facilities, emergency housing, emergency shelters, and permanent supportive housing.

Goal H-3 Housing Accessibility and Livability

Encourage and support a variety of housing opportunities for those with special needs, particularly those with challenges relating to age, health, or disability.

Policy H-3.1 Encourage and incentivize special needs and senior housing to be dispersed throughout the community and close to public transportation, shopping, medical clinics, and other essential services.

Policy H-3.2 Encourage, support, and work with partners, such as the Clark County Health District, that support social and health service organizations and offer programs and facilities to help persons with special needs remain in the community.

Policy H-3.3 Treat residential structures occupied by persons with disabilities the same as residential structures occupied by a family or by non-disabled unrelated individuals.

Policy H-3.4 Encourage the creation and retrofitting of senior housing and accessible housing types that allow residents to "age in place" to support aging populations and allow residents to continue living in Camas.

Policy H-3.5 Develop and implement a strategy or action plan to work with partners to secure grants and loans by agencies, private developers, and nonprofit organizations that are tied to the provision of permanent supportive housing, emergency shelter beds, transitional housing, and other housing serving at-risk populations.

Policy H-3.6 Work with other jurisdictions and health and social service organizations to develop a coordinated, regional approach to address the impacts of displacement and people at risk of becoming homeless.

Policy H-3.7 Promote the use of universal design principles for new development or redevelopment housing projects to ensure housing is designed for all people and abilities.

Goal H-4 Streamlining Permitting for Housing

Support the development of quality and sustainable housing in Camas with streamlined regulations and permitting processes.

Policy H-4.1 Periodically review and update the City's residential zoning regulations, design standards, and permitting procedures to promote quality development with timely and predictable outcomes.

Policy H-4.2 Create regulations and procedures that balance clarity and objectivity with flexibility for design innovation.

Policy H-4.3 Study the impacts of land use policy decisions and zoning code amendments and minimize the negative impacts to housing supply and affordability.

Policy H-4.4 Classify the development of middle housing and accessory dwelling units as permitted uses in lower density residential zones, consistent with the Growth Management Act.

Policy H-4.5 Review and update policies, codes, and ordinances to allow for a mix of housing types and variable lot and unit sizes in new subdivisions and development projects to promote housing choice diversity and affordability.

Policy H-4.6 Annually review the number and type of housing units built in Camas and permit timelines associated with new housing developments to inform additional changes to permitting, incentives, and housing programs.

ourCamas 2045



Natural Environment

06

06. Natural Environment

Nature in Camas

Camas has an abundance of natural areas that make it an ideal place to live. This element balances Camas' natural environment with the demands of a growing city.

Vision

Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Natural Setting

Camas is blessed with an abundance of natural areas and physical features, making it a highly attractive place for people to call home. Residents and businesses who seek an exceptional quality of life are buoyed by the natural surroundings of Camas and enjoy such amenities as Lacamas, Round and Fallen Leaf Lakes, Lacamas Creek, and the Washougal River greenway. Residents also enjoy the beauty and quiet of the open space and greenbelt network throughout the community, stitched together by the City through many decades of planning and implementation.

As envisioned decades ago and to be held in perpetuity as natural, legacy lands along Lacamas Lake, Fallen Leaf Lake, and near Green Mountain are treasured for their mature stands of evergreen and deciduous trees and offer a respite for many in the community. When people think of Camas, they think of a place that values the natural environment on par with other facets of the community. Camas is a place where stewardship of greenbelts, natural areas, and open space is an essential fiber in the fabric of the community.

Overview

The natural environment element of the comprehensive plan provides a policy framework for the identification, protection, and improvement of Camas' natural environment. Goals and policies include those for environmental stewardship, the protection of

environmentally sensitive lands (critical areas), natural areas and open space, shorelines, and landscaping and tree enhancement.

Environmental stewardship refers to the City's role as chief steward of the environment for the Camas community. A chief steward in this context means how the City, on behalf of the residents, establishes a responsible relationship between the people and the land they inhabit.

Stewardship has three prongs for the benefit of all community members. The first prong relates to compliance with the Growth Management Act (GMA) and the identification, designation, and protection of certain environmentally sensitive lands, which, in GMA, are known as critical areas. The second prong relates to the community and its steadfast approach to keeping Camas a place that balances growth with preservation of a natural areas and open space network. Camas has longed placed a premium on its open space network of environmentally sensitive lands, with or without GMA requirements. The third prong is an ethic of volunteerism and stewardship from the community's citizenry, which manifests in many ways including active volunteer groups, active boards and committees, and public involvement on issues related to the environment.

The City of Camas has preserved over 700 acres of open space across 31 sites, including forests, wetlands, riparian corridors, and steep slopes, with nearly half of this land concentrated around Lacamas Lake. These natural areas, distinct from developed parks, are managed to protect ecosystem functions, water quality, native vegetation, and wildlife habitats, while allowing for limited public access through trails and modest amenities. The City prioritizes conservation and restoration of high-value landscapes such as waterfronts, forested hillsides, and sensitive wetlands, balancing environmental stewardship with recreational use. Key efforts include protecting watercourses within three major watersheds, regulating development on steep slopes and wetlands, and maintaining resilient forest lands to support biodiversity and ecological health.

Environmental Stewardship

One of the most demanding roles the City of Camas must fulfill is that of chief steward of the community's environment while also accommodating growth. The City has the duty to implement land use policies via development regulations and the responsibility to comply with federal and state statutes related to the environment.

Facing federal and state mandates, the City strives to ensure that its environment is managed in compliance with applicable laws and does so in a wise manner. While simultaneously accommodating growth, the City encourages the preservation, restoration, and improvement of the natural environment in all development.

Goal NE-1 Environmental Stewardship

Preserve Camas' natural environment citywide by developing a sustainable urban environment and protecting natural areas and open space, including critical areas.

Policy NE-1.1 Support a cleanup of the Camas Mill and other contaminated sites to protect natural resources and the city's water supply.

Policy NE-1.2 Support programs and regulations that monitor, maintain, conserve and protect water quality in Camas, including watersheds, Lacamas Lake Basin, Columbia River Basin, and Washougal River Basin.

Policy NE-1.3 Encourage restoration and protection of natural areas through the removal of invasive species.

Policy NE-1.4 Support and implement actions identified in adopted plans, including adaptive management of natural resources that is consistent with best available science and climate guidance to improve climate resiliency.

Policy NE-1.5 Protect and restore natural resources, valuable historic and cultural areas, climate refugia, habitat areas and corridors to provide biological and hydrological connectivity that fosters resilience to climate impacts.

Policy NE-1.6 Create and support natural resource management plans that consider climate change impacts and guide adaptive management.

Policy NE-1.7 Include immediate and long-term environmental impacts in the policy and regulatory decision-making process. Identify and quantify the ecosystem services benefits of natural systems and include these natural capital assets in cost-benefit assessments for community and development planning.

Policy NE-1.8 Promote and incentivize public and private landowners to restore and create local habitats and corridors to increase the availability throughout the city.

Policy NE-1.9 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features of undeveloped properties.

Policy NE-1.10 Promote soil stability and minimize and control soil erosion using best management practices, best available science, ecologically sustainable site design, natural drainage systems and protection of existing native vegetation.

Critical Areas

The natural environment includes specific environmentally sensitive areas that the GMA requires the City to identify, designate, and protect. Referred to in statute (RCW 36.70A) as *critical areas.* Under GMA, critical areas include wetlands, critical aquifer recharge areas, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas. Each of these critical areas is present in the City. The law further requires that the City use best available science (BAS) when developing policies and regulations to designate and protect critical areas. GMA also recognizes that salmonids (salmon and trout) play an important role in the ecosystem and are vital cultural and economic resources, which require jurisdictions to give 'special consideration to conservation and protection measures necessary to preserve or enhance anadromous fisheries'.

Functions of Critical Areas

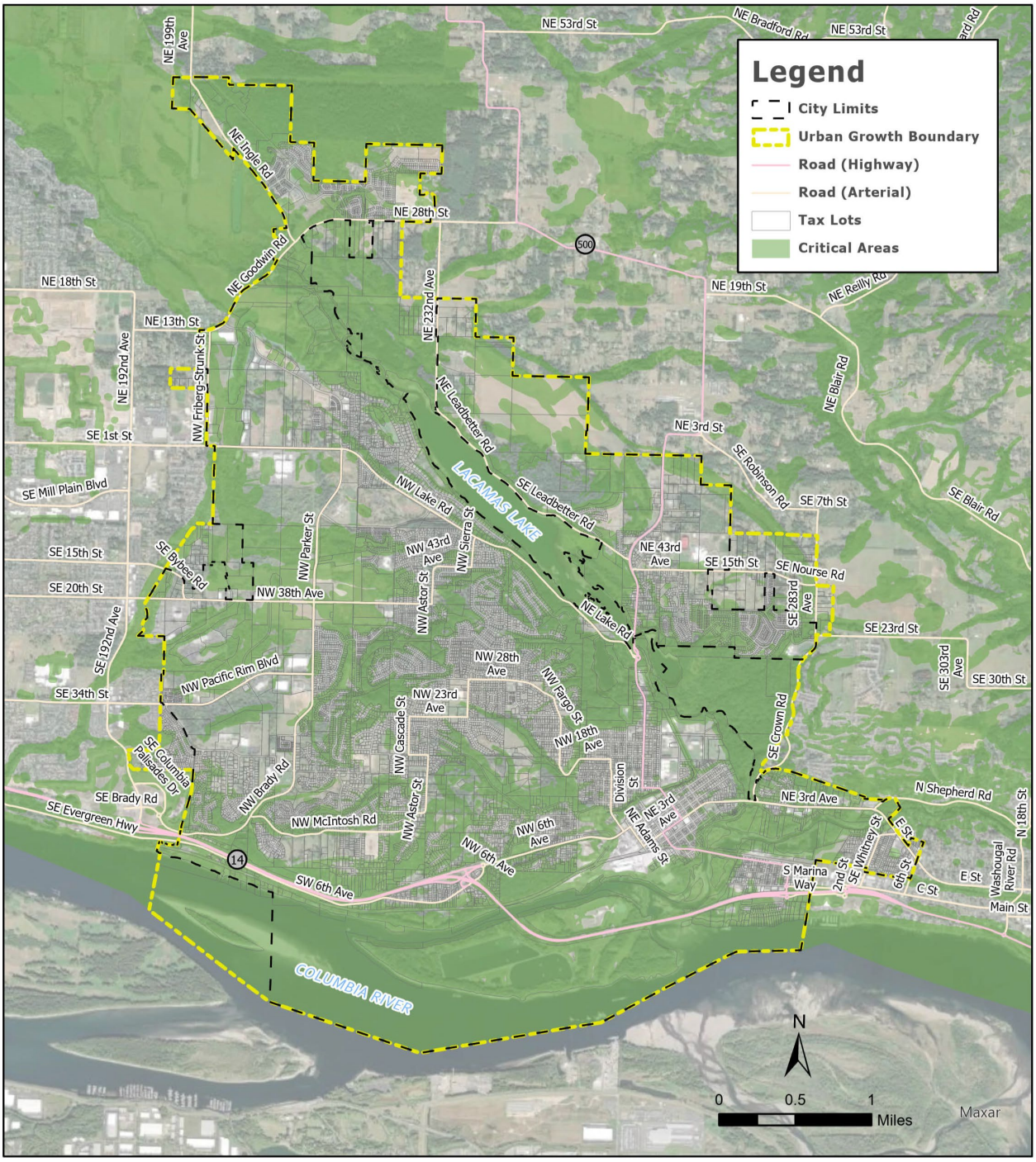
Critical areas perform key functions that enhance the environment and protect us from natural hazards. The beneficial functions and values that critical areas provide include, but are not limited to, water quality protection and enhancement; fish and wildlife habitat; food chain support; flood storage, conveyance, and attenuation of flood waters; groundwater recharge and discharge; drinking water quality and quantity; erosion control; protection from natural hazards; historical, cultural, archaeological, and aesthetic value; and recreation. Identifying the functions and values of local critical areas is essential to defining the purpose of a critical areas protection program.

Each type of critical area performs different functions and each community assesses the values of the critical areas in its environment differently. Therefore, the purpose of protecting critical areas is unique for each community. Critical areas protection is necessary to protect the public's health and safety and is essential to comply with state laws in Washington. It may also provide compliance with federal laws for such things as water quality and endangered species. There are also economic reasons to protect critical areas. For example, protection of drinking water quality and quantity supports sustainable growth, and critical areas support resource industries, such as salmon and other fisheries.

Critical areas are environmentally sensitive and hazardous areas that the State and City have identified for certain development considerations or restrictions to protect their functions and values, while allowing for reasonable use of property. Critical areas protection is regulated through the Camas Municipal Code (CMC) Title 16, which identifies five types of critical areas: wetlands, fish and wildlife habitat conservation areas, geologically hazardous areas (steep

slopes, erosion hazard areas, and seismic hazard areas), critical aquifer recharge areas (CARAs), and frequently flooded areas.

Figure 5 6Critical Areas



Wetlands

Wetlands are defined as those areas, designated in accordance with the approved federal wetland delineation manual and applicable regional supplements, which are inundated or

saturated by surface or ground water at a frequency and duration, and under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands in the community are generally located in and around the Grass Valley area in west Camas, Lacamas Lake, Lacamas Creek, and the Washougal River greenway. The largest mapped wetland is located around the south end of Lacamas Lake, identified as lake habitat. NWI does not identify mapped wetlands in downtown Camas.

Critical Aquifer Recharge Areas

Critical aquifer recharge areas (CARAs) are those areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge. The quality and quantity of groundwater in an aquifer is inextricably linked to its recharge area. To determine the threat to groundwater quality, existing land use activities and their potential to lead to contamination should be evaluated.

The goal of establishing CARAs is to protect the functions and values of the community's drinking water supply by preventing pollution and/or contamination of the supply directly or recharge areas indirectly.

Frequently Flooded Areas

Floodplains and other areas subject to flooding perform important hydrologic functions and may present a risk to persons and property. Classifications of frequently flooded areas should include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP), known as the 'special flood hazard area', which is defined further as having a special flood, mudflow, or flood-related erosion hazards and shown on Flood Insurance Rate Maps (FIRM), which also includes the regulatory floodway.

Geologically Hazardous Areas

In the physical context of Camas, geologically hazardous areas include areas susceptible to erosion hazard, seismic hazard, mine hazard, and other geological events. Geologically hazardous areas in Camas include severe erosion hazard areas adjacent to Lacamas Lake, north of the Columbia River, and to the east along the Washougal River.

Fish and Wildlife Habitat Conservation Areas

Fish and Wildlife Habitat Conservation Areas (FWHCAs) are critical ecological zones that support essential habitats and species necessary for maintaining ecosystem integrity and biodiversity. These areas may include rare ecosystems, high-density wildlife zones, breeding and migration corridors, and habitats for endangered or sensitive species. Their designation plays a key role in guiding land use planning, urban growth boundaries, and conservation strategies. FWHCAs must be identified using the best available science, considering factors such as habitat connectivity, human activity levels, riparian and salmonid protection, and the impact of

surrounding land uses. Buffer zones are also recommended to minimize conflicts between development and habitat preservation.

Aquatic and Riparian Habitat

Fish and wildlife habitat conservation areas in Camas include habitats for state or federally listed endangered, threatened, or sensitive species, as well as areas associated with state priority species identified by the Washington Department of Fish and Wildlife. These areas encompass naturally occurring ponds under twenty acres, classified state waters, and water bodies stocked with game fish by governmental or tribal entities. Key aquatic habitats in Camas include the Columbia and Washougal Rivers, Lacamas Creek, Camas Slough, Lacamas Lake, and various streams, ponds, and wetlands, all often bordered by riparian zones. Lacamas Lake is the largest aquatic habitat in the city aside from the Columbia River system.

Terrestrial Habitat

Terrestrial habitats in Camas, like aquatic ones, include areas supporting state or federally listed endangered, threatened, or sensitive species, as well as state priority species identified by the Washington Department of Fish and Wildlife (WDFW), State Natural Area Preserves, and locally important habitats. Locally designated habitats include Oregon white oak trees and stands, and Camas lily fields of specific sizes. While much of the city is mapped as "cave rich" by WDFW, actual cave presence is limited, though caves are considered a priority habitat feature. The Camas biodiversity corridor, which includes mature timber and sightings of Vaux swifts, runs through parts of the city. Oak woodland habitat is primarily found near Lacamas Lake, and the northern part of Camas including the Lacamas Prairie Natural Area Preserve, which protects rare Willamette Valley wet prairie habitat and several endangered plant species, including Bradshaw's lomatium.

Critical Areas Goals & Policies

Preserve, maintain, and restore the City's critical areas to protect their function and value.

Policy NE-2.1 Use best management practices and best available science to preserve, protect, and restore the biological health and diversity of Camas' critical areas.

Policy NE-2.2 Preserve and restore aquatic and riparian habitats consistent with applicable regulations.

Policy NE-2.3 Preserve and avoid development of areas with endangered, threatened, and sensitive species and species of local importance as required by local, state, and federal laws.

Policy NE-2.4 Ensure that development throughout the City meets or exceeds standards and practices for long-term wetland protection and mitigation.

Shorelines

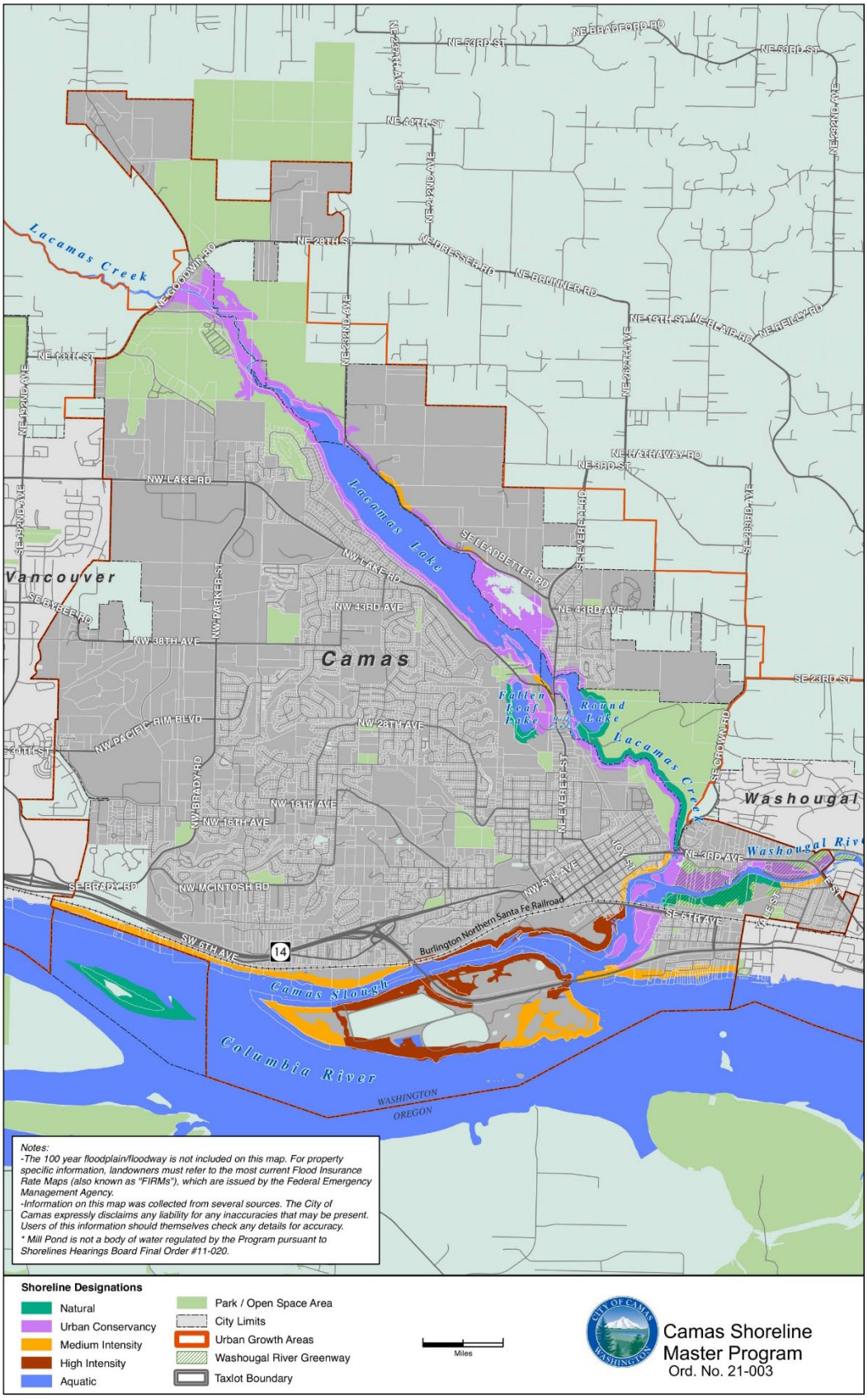
Overview

The Shoreline Management Act, enacted in 1972, created a collaborative framework between Washington State and local governments to manage and protect shorelines. Under this law, local jurisdictions are required to develop Shoreline Master Programs (SMPs) tailored to their specific needs.

Camas encompasses 946 acres of shoreline across 26 miles, including areas along Lacamas Creek, several lakes, and the Columbia and Washougal Rivers. The SMP outlines strategies to minimize flood risks, enhance recreational opportunities, and ensure sustainable shoreline use through voluntary programs and regulatory measures.

To guide development and conservation, Camas assigns specific shoreline designations based on land use, ecological characteristics, and community vision. These designations—Aquatic, Natural, Urban Conservancy, Medium Intensity, and High Intensity—are aligned with state guidelines and the city's comprehensive plan. Each designation comes with tailored policies and development regulations, such as height and setback limits. For example, High Intensity areas support industrial use, while Natural areas prioritize ecological preservation. These designations help ensure that shoreline development aligns with environmental protection and long-term community goals.

Figure 7 Shoreline Map



Shoreline Goals and Policies

Goal NE-3 Shorelines

Use the full potential of shoreline in accordance with the opportunities presented by their relationship to the surrounding area their natural resource values, and their unique aesthetic qualities offered by water, topography, and views. Develop a physical environment that is both ordered and diversified, and which integrates water and shoreline uses while achieving a net gain of ecological function.

Policy NE-3.1 Adopt the goals and policies as outlined in the current Camas Shoreline Master Program.

Landscape Enhancement and Tree Preservation

The natural landscape and existing tree cover are important aspects of Camas' natural environment. Native, mature landscaping and trees contribute to the City's ecological health, supply valuable animal habitat, and enhance the community's natural beauty.

Goal NE-4 Landscape Enhancement and Tree Preservation

Preserve existing natural landscapes and tree canopy. Support opportunities for increasing native and climate resilient landscaping and tree canopy.

Policy NE-4.1 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.2 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collecting and maintaining data on citywide tree canopy.

Policy NE-4.3 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.4 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

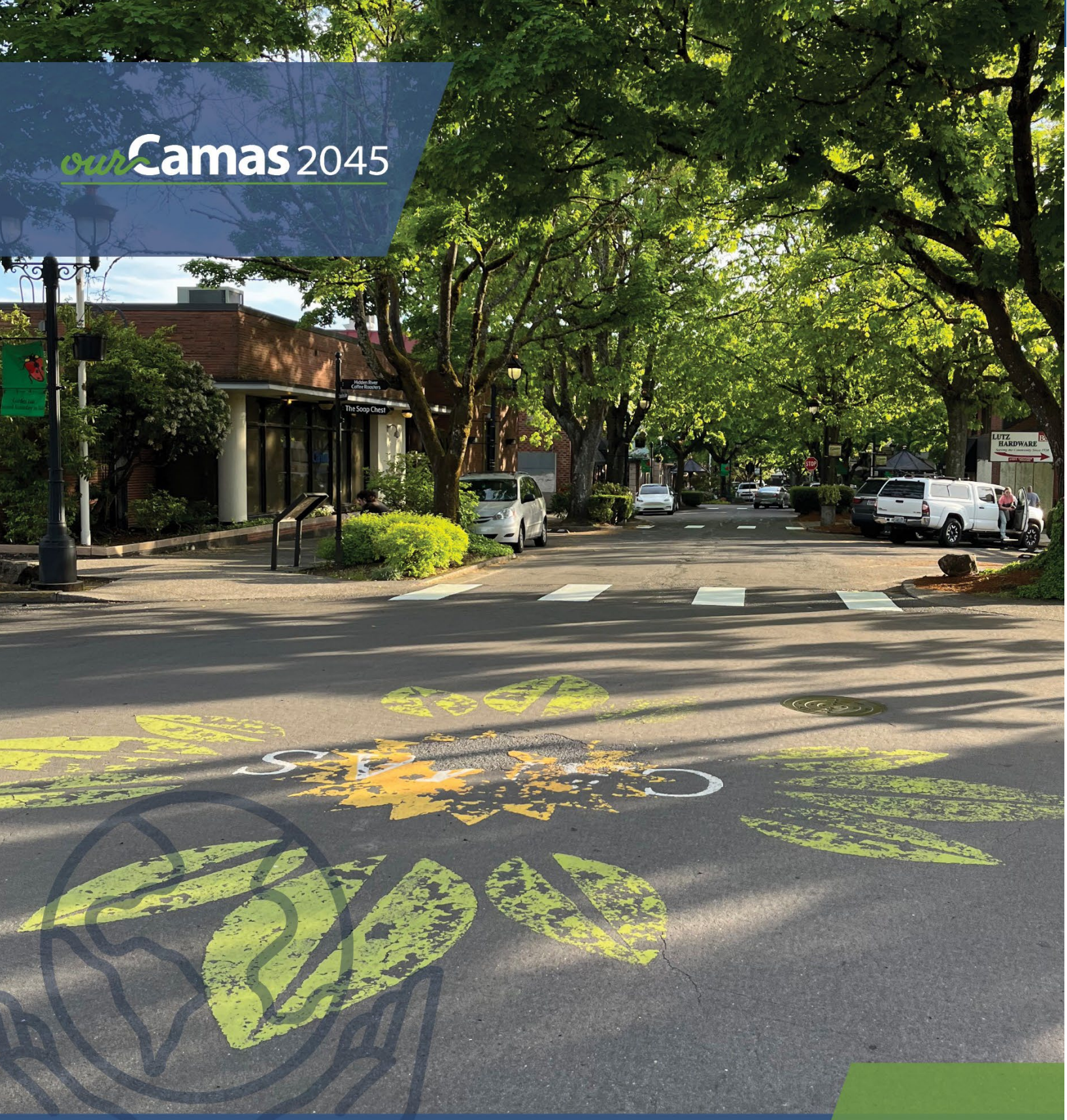
Policy NE-4.5 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.6 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collection and maintaining data on citywide tree canopy.

Policy NE-4.7 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.8 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

ourCamas 2045



Climate Change & Resliency

07

07. Climate Change & Resiliency

Vision

In 2045, Camas has proactive plans to reduce greenhouse gas (GHG) emissions and mitigate the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come. The most vulnerable communities are protected, and climate planning contributes to improvements in community health and well-being.

Introduction

The City developed this climate change and resiliency element consistent with House Bill 1181, signed into law in 2023. This new state law integrates climate planning into Washington's GMA and requires cities and counties to include a climate element in their comprehensive plans.

Climate change refers to long-term shifts in temperatures and weather patterns. The burning of fossil fuels and other human activities are increasing emissions of greenhouse gases (GHGs) that trap heat in the atmosphere and contribute to global and local climate change. Negative effects include impacts on the community caused by natural hazards that are exacerbated by climate change (e.g., the increased frequency and severity of drought conditions). Natural hazards are also referred to as "climate hazards" in this element as climate change is anticipated to affect the frequency and intensity of natural hazards.

The purpose of this climate element is twofold: to reduce contributions to climate change (i.e., GHG emissions) and to build community resilience to climate change.

To support these two overarching goals, the City formed a Climate Policy Advisory Group (CPAT) to advise on the creation of this new element. The 17 CPAT members included community members, City staff, City Council and Planning Commission liaisons, and representatives from the Port of Camas-Washougal, Clark Public Utilities, NW Natural, and the Camas School District. CPAT members held five meetings between early 2024 and early 2025.

The CPAT was instrumental in the identification and development of climate goals and policies.

Community Impacts from Climate Change

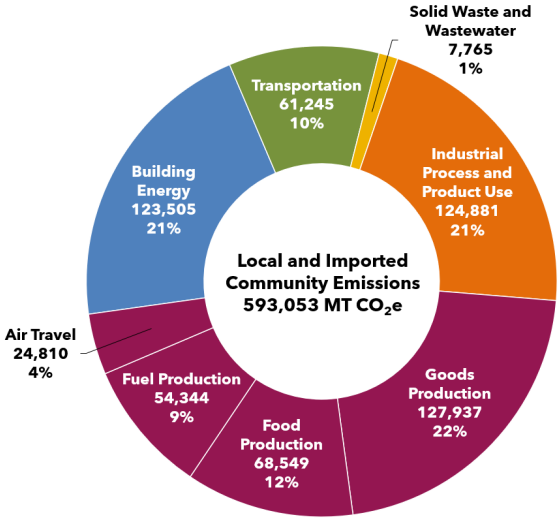
Climate hazards (i.e., natural hazards exacerbated by climate change) of the highest concern and priority are extreme heat and precipitation. Camas can address anticipated impacts by reducing GHG emissions and building community resiliency.

Climate Overview

Greenhouse Gas Emissions

The GHG reduction subelement identifies actions to reduce GHG emissions and decrease per capita vehicle miles traveled (VMT). One of the requirements of the GHG reduction subelement is to meet the GHG reduction requirements in RCW 36.70a.070(9)(d), including reducing per capita VMT within Camas but without increasing GHG emissions elsewhere in the state. To identify actions for VMT reduction, Clark County worked with local cities to prepare a VMT study and travel market assessment to understand baseline travel patterns and strategies for VMT reduction. According to the VMT study, data from the Highway Performance Monitoring System shows that the city's estimated per capita VMT, which represents the average weekday VMT within Camas divided by the city's population, is 11.1. The travel market assessment identified key travel destinations in the city for short trips (i.e., trips 3 miles or less), showing that areas near Lacamas Lake, Camas high school, and Downtown Camas are popular destinations. Both assessments will help inform a regional target for VMT, which will be established outside the climate element/comprehensive plan framework. In addition to VMT reduction, Clark County's Countywide Planning Policies establish requirements for cities to reach net-zero emissions by 2050 (14.1.2) in alignment with statewide GHG emission reductions (RCW 70A.45.020(1)) and set interim (5-year) objectives or targets (14.1.4). A GHG inventory for Camas was also prepared to inform GHG reduction strategies. The inventory provides an estimate of the city's carbon footprint from local emissions (building energy, transportation, solid waste and wastewater, and industrial process and product use) and imported emissions (consumption of goods). Figure 8 Camas Emissions, 2022 shows the combined and per capita emissions for the city.

Figure 8 Camas Emissions, 2022



With a population of 27,250, all 2022 GHG emissions combined (local and imported) for City of Camas totaled

593,035 MT CO_2e

21.8 MT CO_2e Per Capita

Local emissions include sector-based emissions that are generated within Camas. Imported emissions are generated outside of Camas to produce and provide the goods, food, services, air travel, and production of transport of fuels consumed by households. Additionally, wildfires have become one of the largest sources of carbon emissions in Washington state. From 2014 to 2018, wildfires in the state generated 39,200,000 MT CO_2e.

Figure 9 Local and Imported Emissions in Camas

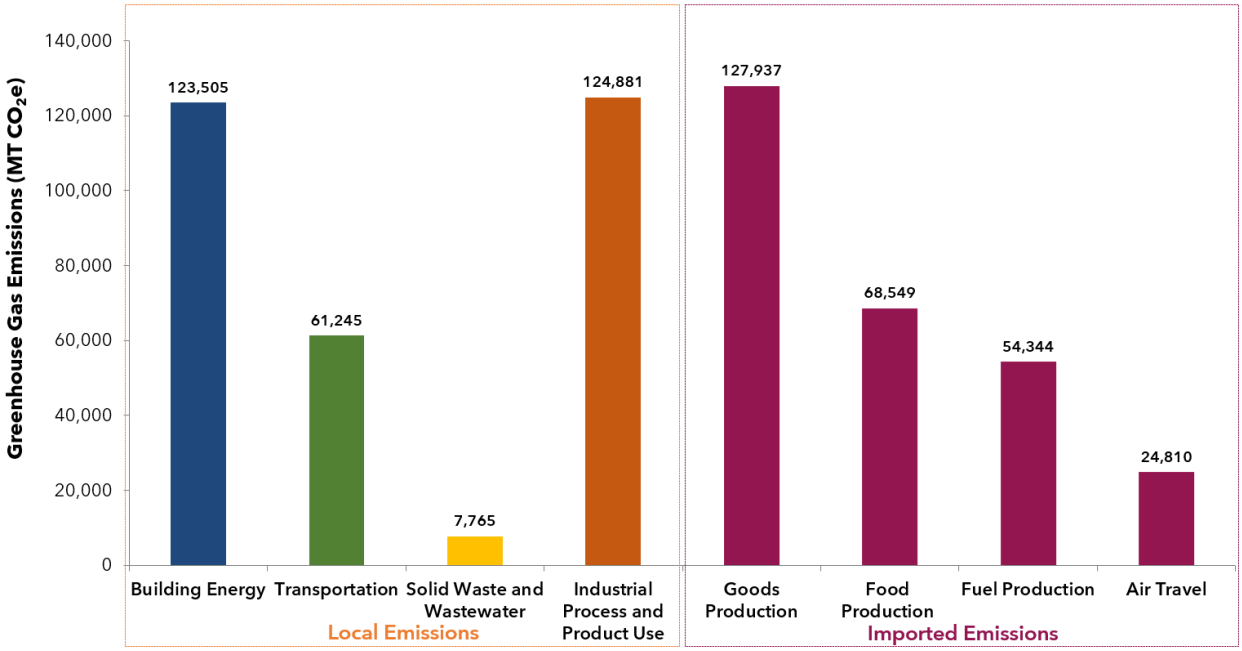


Figure 9 shows a breakdown of the sources of local and imported emissions in Camas. Most sources of local emissions include **industrial process and product use** and **building energy**, which accounts for **78%** of local emissions. Emissions from the industrial process and product use sector generally involve facilities with silicon semiconductor manufacturing. While emissions from these facilities contribute to a large share of local emissions, demand for these goods is global and not specific to Camas. Therefore, goals and policies target reducing local emissions and support existing GHG reduction strategies or targets that are being implemented by businesses and industries in Camas.

Climate Resiliency

Community resiliency is the ongoing process of preparing for, anticipating, and responding to natural hazards created or aggravated by climate change.

Natural hazards relevant to Camas are identified in the 2023 Clark County Natural Hazard Mitigation Plan (NHMP) (CRESA 2023). Table 3 Natural Hazards in Camas lists hazards of concern in order of ranking and their priority, which were evaluated as part of the risk assessment in the NHMP. The risk rating reflects the probability of a hazard weighted against its potential impact on people, property, and the economy. The table also shows the projected climate impacts for each hazard and how hazards have affected the community in the past.

Table 3 Natural Hazards in Camas

Natural Hazard (NHMP Rating[7])	Projected Changes by 2050[8]	Effects on the Community[9]
Extreme Heat (High)	40+ days per year that feel hotter than 90 degrees.	Increased demand for air conditioning, higher utility bills, heat-related illness for sensitive populations and youth at school playgrounds and sports fields, disruption of outdoor activities.
Extreme Precipitation (High)	12% increase in total annual precipitation	Overflowing of streams or rivers, unsafe driving and walking conditions.
Landslide (Medium)	13% increase in heavy rain events	Physical damage to residential and commercial property, energy infrastructure, communication infrastructure, and transportation infrastructure.
Flood (Medium)	17% increase in peak streamflow in Washougal River	Property damage, particularly for older buildings and low-income housing near the floodplain, and temporary or permanent displacement. Temporary closures of businesses and other services.
Wildfire (Medium)	9+ days per year that have high fire danger	Wildfire smoke can impact human health, particularly people with respiratory illnesses or diseases. Increased health risks and property damage for communities near the wildland-urban interface[10].

[7] 2023 CRESA Regional Natural Hazard Mitigation Plan Volume 2 – Planning Partner Annexes
[8] University of Washington's Climate Mapping for a Resilient Washington webtool. Projections are based on a "business as usual" emissions scenario.
[9] Includes effects identified by the Camas community in a 2025 survey.
[10] Clark County Code (15.13.030) defines the wildland-urban interface as areas with elevation in excess of 500 feet and one or more of the following conditions: (a) slope equal to or greater than 25%, (b) forest type vegetation, and (c) outside of an organized fire protection district.

Drought (Low)	14% decrease in summer rains	Impacts to water quality and quantity, decrease in habitat quality and quantity for salmon and other aquatic species.

Vulnerability

Vulnerable Communities

Climate change can impact certain groups of people (vulnerable populations) and areas of the city (overburdened communities) differently. Vulnerable populations are groups of people who are more vulnerable to environmental harms due to socioeconomic factors and other health risk factors (RCW 70A.02.010(14)). Overburdened communities are areas where vulnerable populations experience environmental harms and health impacts (RCW 70A.02.010(11)). Together, vulnerable and overburdened communities are disproportionately impacted by climate change due to the concentration of environmental harms (e.g., air pollution near major roadways) and socioeconomic characteristics (e.g., low income, youth and children). People and communities in Camas who are vulnerable to climate hazards are generally described in the *Our Camas 2045* Equity Framework (see **Introduction** for a description of Equity Communities in Camas).

In addition to communities described in the Equity Framework, CPAT members identified additional communities that could be more vulnerable to climate hazards. These communities include areas that are located near floodplains (such as Lacamas Lake and the Columbia River), near mobile sources of air pollution (such as major roadways), near steep slopes and steep road grades, and/or near the wildland urban interface (e.g., homes adjacent to forested areas).

Vulnerable Assets

In Camas, the impact of climate hazards can depend on the proximity of people and buildings to each hazard. The approximate location of these hazards is shown in Figure 10 Wildfire Hazard Areas and Figure 11 Flood and Landslide Hazard Areas. Climate hazard locations are based on data from publicly available sources such as Clark County's Open Data Hub and include approximate areas of increased risk. While this information provides a visualization of higher risk areas, data may not include all potential risks and data gaps may exist depending on when data was published. Therefore, these figures provide a conceptual understanding of the location of climate hazards and potential effects on the community.

Figure 10 Wildfire Hazard Areas

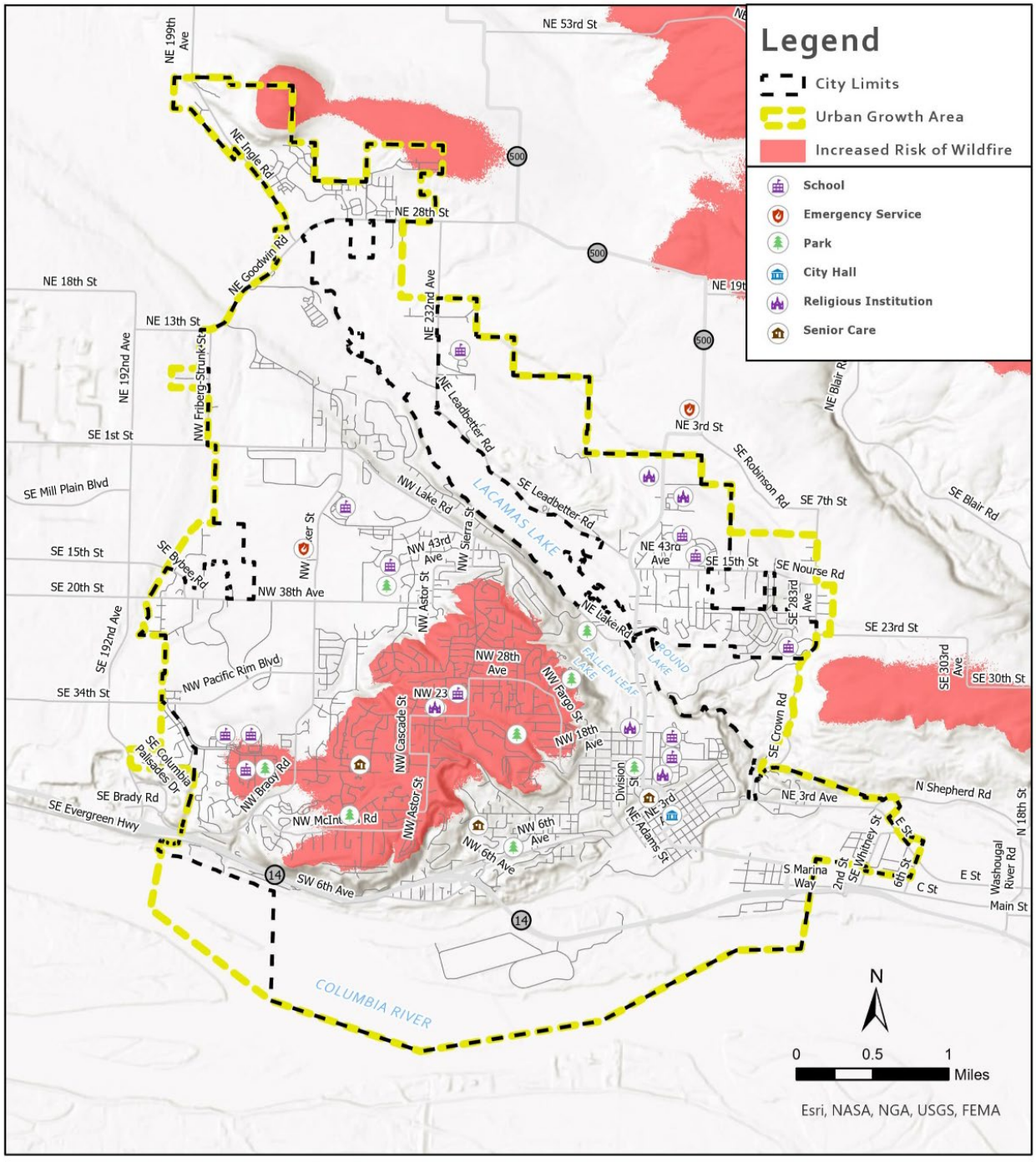
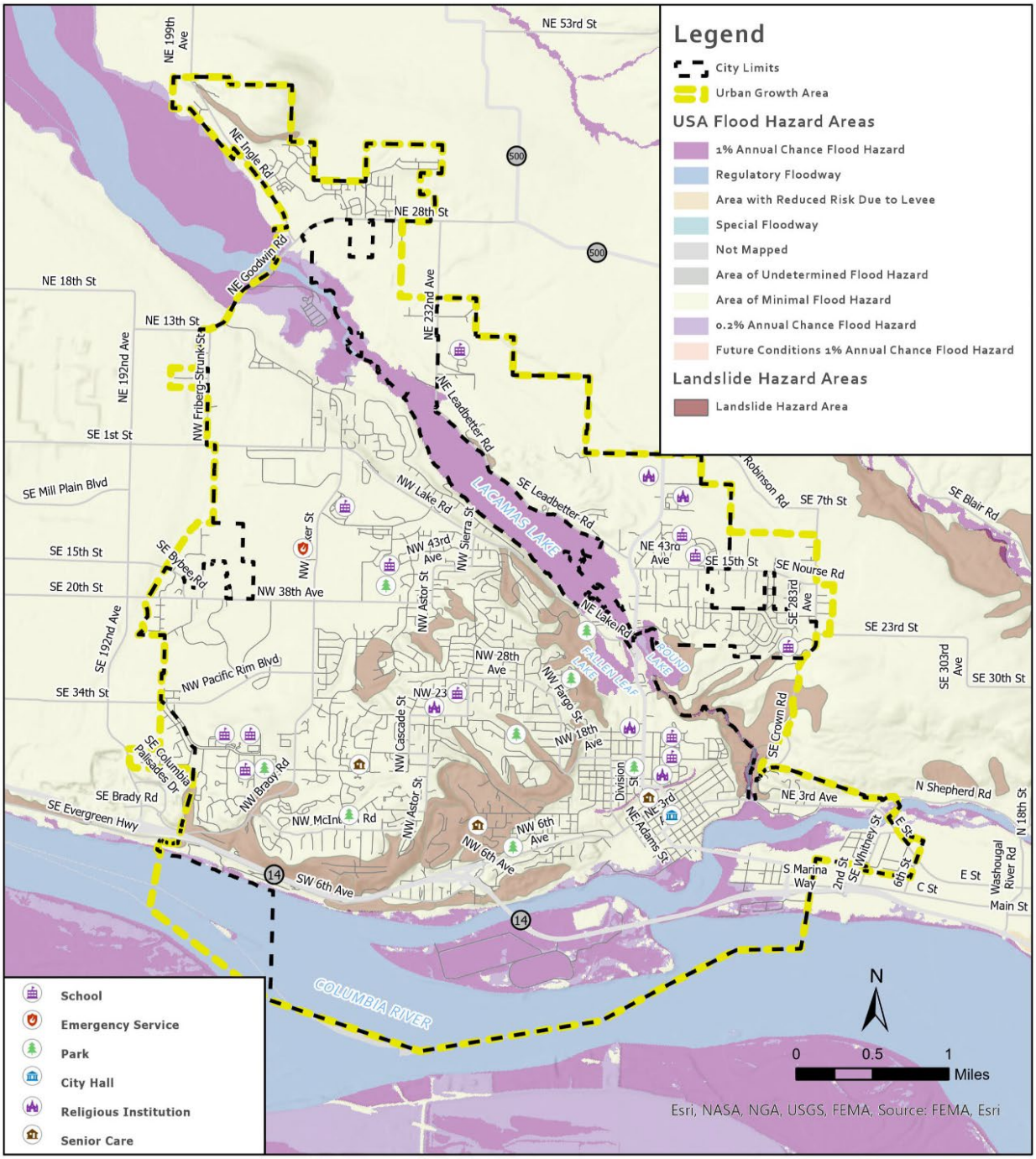


Figure 11 Flood and Landslide Hazard Areas



In Camas, buildings and infrastructure that could be vulnerable to climate hazards include aging water and sewer lines, buildings constructed before adopted seismic codes (e.g., city hall, public works operations center), and high-pressure natural gas lines. High tension power lines may also be vulnerable to severe storms (i.e., wind and ice), homes along the Washougal and Columbia Rivers, including the Georgia Pacific paper mill, may be susceptible to flooding, and the dam at Lacamas Lake could be impacted by an earthquake or flooding.

Extreme heat is one of the highest rated hazards for Camas. Buildings and impervious surfaces such as streets are factors in the urban heat island effect, where urban areas are warmer than surrounding rural or less developed areas. The County's department of public health collected heat data on one day in July 2024 and prepared a heat watch summary report describing how urban heat varies across neighborhoods in the county and how landscape features affect temperature and humidity. Across the county, areas with more buildings and paved surfaces tend to be hotter during the afternoon and evening. In Camas, the hottest areas of the city during the afternoon and evening are near Downtown Camas while cooler areas with more vegetation and shade are in west Camas, northeast of downtown, and near Lacamas Lake.

Vulnerability Assessment

A vulnerability and risk assessment prepared for Camas evaluated the risk of extreme heat on outdoor recreation sites, including (1) Lakes, (2) Parks & Trails, (3) School Playgrounds & Sport Fields, and (4) Downtown Camas. Both vulnerability (sensitivity and adaptive capacity) and risk (probability and magnitude) were evaluated.

The assessment produced composite scores for vulnerability and risk. For the lakes, Lacamas Lake and Round Lake scored high and Fallen Leaf Lake scored low. Under parks and trails, seven scored low, two scored medium, and 11 scored high. School playgrounds and sports fields scored medium (6) and high (6). Lastly, Downtown Camas scored high as it features the hottest area of the city.

To reduce vulnerability and risk, this element includes policies to mitigate the impacts of extreme heat.

Climate Change and Resiliency Goals and Policies

Climate goals and policies are established to meet the State's vision to reduce greenhouse gas emissions, plan for resilience, and support environmental justice. While these goals and policies directly focus on emissions and resiliency, additional policies in other elements of the plan tangentially support these goals. Those policies are noted with a leaf symbol.

Goal CL-1 Energy

Ensure that development and redevelopment projects, including buildings and energy infrastructure (generation, storage, and transmission) are designed to accommodate and use renewable energy, conservation, and efficiency technologies and practices to reduce GHG emissions and increase resiliency to natural hazards.

Policy CL-1.1 Support residents' efforts to improve energy efficiency and resiliency in existing and new residences.

Policy CL-1.2 Encourage renewable energy sources for new and existing buildings.

Policy CL-1.3 Provide commercial buildings, particularly restaurants and food services, with incentives to retrofit buildings for energy efficiency (e.g., grant programs, reduce permit fees, etc.).

Policy CL-1.4 Incentivize and streamline the review process for renewable resource projects.

Goal CL-2 Transportation

Improve the efficiency and resiliency of the transportation system to achieve GHG reduction goals and better withstand natural hazards.

Policy CL-2.1 Promote and complement state and utility incentives to provide electric vehicle charging infrastructure throughout the city, particularly at existing and new multi-family buildings and large employers.

Policy CL-2.2 Provide homeowners and renters information on state and federal tax credits/rebates for electric vehicles, renewable resources and energy efficiency.

Policy CL-2.3 Incorporate projected hydrologic climate impacts into the design and maintenance of water-crossing structures (e.g., climate-smart culverts and bridges).

Goal CL-3 Local Agency Sustainability and Preparedness

Support agencies, districts, and businesses in establishing and achieving their own sustainability goals, initiatives, and programs.

Policy CL-3.1 Support the sustainability initiatives of local agencies, districts, and businesses.

Policy CL-3.2 Support local businesses efforts to bolster climate preparedness and continuity of operations (e.g., develop on-site electricity storage to reduce energy demand during peak hours, incentives to install backup power, building retrofits).

Policy CL-3.3 Support the local economy's resilience to climate disruptions by providing information and resources on how to prepare for extreme heat, flooding, and wildfire.

Policy CL-3.4 Support economic opportunities for green jobs in Camas, including businesses that produce goods or services that benefit the environment and jobs that support business production processes to be more environmentally friendly or use fewer natural resources.

Policy CL-3.5 Develop a sustainable purchasing policy and sustainable construction standards for the City of Camas.

Goal CL-4 Community Health

Protect community health and well-being from the impacts of climate-exacerbated hazards and ensure that the most vulnerable residents do not bear disproportionate health impacts.

Policy CL-4.1 Promote the use of health impact assessments and other tools to identify and address the impacts on health and equity from climate change.

Policy CL-4.2 Develop and implement an urban heat resilience strategy that addresses land use, urban design, urban greening, and waste heat reduction actions.

Goal CL-5 Emergency Preparedness

Enhance emergency preparedness, response, and recovery efforts to mitigate risks and impacts associated with natural hazards.

Policy CL-5.1 Create accessible evacuation plans and outreach materials to help residents plan and practice actions that make evacuation and reunification quicker and safer during a natural hazard event (e.g., notification alerts).

Policy CL-5.2 Develop a comprehensive, communitywide wildfire resilience strategy to improve emergency response capabilities, create fire-resilient landscapes, promote fire-adapted communities, and support the development of community wildfire protection plans.

Policy CL-5.3 Support enhanced data collection for hazard events of all magnitudes to provide a fuller understanding of the community's hazard characteristics.

Policy CL-5.4 Develop resiliency hubs, such as community-serving facilities that support residents, coordinate communication, distribute resources, and enhance quality of life.

Policy CL-5.5 Prepare, plan, and provide ongoing training for those responding to adverse environmental events.

Goal CL-6 Water Resources

Protect and preserve the long-term quality and quantity of Camas' water, and natural and cultural resources from climate change hazards such asdrought and extreme participation.

Policy CL-6.1 Develop and implement a comprehensive drought resilience strategy that factors in projected climate impacts and sets action levels for different drought stages.

Policy CL-6.2 Evaluate the long-term adequacy of water delivery and storage infrastructure to ensure projected changes in hydrological conditions can be anticipated and managed effectively.

Policy CL-6.3 Implement actions recommended by the Lacamas, Round, and Fallen Leaf Lakes Management Plan to reduce the frequency of harmful algae blooms in lakes due to water pollution and projected changes in climate conditions, including higher temperatures.

Policy CL-6.4 Identify funding mechanisms for mitigation measures recommended by the Lake Management Plan to address the impacts of climate hazards on Lacamas, Round, and Fallen Leaf Lakes.

Policy CL-6.5 Introduce adaptive cooling features at local parks and school playgrounds and sports fields to help mitigate the effects of extreme heat on vulnerable park users and young children.

ourCamas 2045



Transportation

08

08. Transportation

GMA Planning Goal

Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.

Vision

In 2045, residents of Camas continue to appreciate their safe transportation infrastructure that equitably serves all users.

Introduction

As part of the comprehensive plan periodic update, the City of Camas reviewed and updated its Transportation System Plan (TSP). The TSP is adopted by reference and included as Appendix X. The TSP is a long-range plan to guide transportation investments for Camas and its UGA for the planning horizon to 2045. The TSP provides the following:

- Inventory of the current transportation system for all modes of travel
- Summary of land use assumptions used for estimating travel demands
- Summary of level of service (LOS) standards
- List of actions to address deficiencies
- Forecast of traffic demand for twenty years
- System needs to meet the current and forecasted demand
- Six-year Transportation Improvement Plan (TIP)

These items are foundational to a comprehensive plan and integral to implementing the Land Use plan.

The transportation element is one of the main parts of the comprehensive plan and is an effective tool for shaping the city's future development patterns. Growth and development patterns have a major influence on the fiscal health of local governments and on the economic performance of the community. The nature of public streets can shape the level of traffic congestion, the use of multiple modes, and the character of neighborhoods. Related requirements, such as parking and loading, will influence the cost to develop in a community and can present both opportunities and barriers to how people can access homes, schools, recreational opportunities, and businesses within the community and in the region.

Ownership, control, development, and the operation and maintenance of streets and public rights-of-way are primary functions of local governments. A transportation system is one of the most expensive facilities a community will construct, operate and maintain. Each new facility adds an asset to the city's portfolio, but it also must be managed, resulting in an incremental increase in operating costs and a new set of maintenance, preservation, and rehabilitation obligations.

Decisions about transportation facilities greatly influence the safety and security of the community. How the streets, roads and other transportation facilities are designed, built and maintained will influence safety in multiple ways for all users.

Federal, state, county and city transportation systems are interrelated, so coordination with other units of government is essential. Responsibility for transportation systems spans all levels of government. The Camas transportation network connects to state highways, neighboring city streets and adjacent county roads and indirectly to federal and interstate highways. It also interacts with transportation facilities operated by other special purpose districts like C-TRAN and for-profit businesses. Moreover, the public does not experience the transportation system as a series of separate systems, but as a single, unified system, and it expects all the parts to function in an integrated fashion.

The GMA requires the transportation element to implement and be consistent with the land use element. Counties and cities should use consistent land use assumptions, population forecasts, and planning periods for both elements. Coordination of the land use and transportation elements must be dynamic and iterative with an ongoing feedback loop coordinating land use and transportation in the plan development and in local implementation. The transportation element is also required to be consistent with state and regional plans. The transportation element is certified by the regional transportation organization, which is the Southwest Washington Regional Transportation Council (RTC), to ensure consistency with the regional transportation plan (RTP).

Performance Standards

Level of Service (LOS)

The TSP includes level of service as a measure of performance standards for motor vehicles. A LOS "D" and a vehicle to capacity (v/c) ratio not higher than 0.85 is the minimum performance standard during the highest one-hour period of the day for signalized, all-way stop and roundabout controlled intersections under City jurisdiction. These standards shall be applied to the intersection as a whole.

A LOS "E" and a v/c ratio not higher than 0.90 is the minimum performance standard during the highest one-hour period of the day for two-way stop and yield controlled intersections under City jurisdiction. These standards shall be applied to all intersection approaches serving more than 20 vehicles. Mobility standards do not apply to approaches at intersections serving 20 vehicles or fewer during the highest one-hour period of the day8. This mobility standard allows

more flexibility in the tension between larger intersection and street designs that are sometimes needed to accommodate peak vehicle demands, and the desire to maintain smaller designs that encourage slower vehicle speeds and tend to be more accommodating to pedestrian and bicycle users.

Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through the Southwest Washington RTC. The Southwest Washington RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities.

As part of the City's TSP update, forecasted 2045 motor vehicle volumes for peak hour conditions were utilized to determine areas on the baseline roadway network that will be congested and may require future investments to accommodate forecasted growth. The corridors recommended to prioritize for improvements include:

- SR 500-NE Everett Street between NE 23rd Avenue and SE Leadbetter Road
- NW 6th Avenue between Norwood Street and Adams Street
- NE 3rd Avenue between NE Dallas Street and SE Lechner Street

Level of Traffic Stress (LTS)

The TSP includes Level of Traffic Stress (LTS) to measure the comfort of those who are walking, biking or rolling on streets shared with vehicles. The best way to make these facilities comfortable to use while walking, biking and rolling is with space, separation, and visibility. The specific application depends on the conditions of each street. LTS is measured on a scale of one to four. A road with an LTS of 1 is best and is suitable for all users. A road with an LTS of 4 has the highest level of stress for a user and is typically used by those with a high level of confidence or those who don't have an alternative option. The TSP indicates LTS 2 is the standard, meaning streets should be comfortable for most adults, including most adults experiencing disabilities. There may be some separation between pedestrians and vehicles, though no physical barrier.

Travel Demands and Characteristics

The number of people who choose to walk, bike, ride transit, or drive alone with the distances they travel is important for assessing how well existing transportation facilities serve the needs of users. Available data on travel demand, travel mode choice, and trip length are used to better understand travel behavior in the community and inform the needs analysis for the transportation system. This data is largely derived from the US Census Bureau on employment-based trips; however, no other travel data is available from this source. The following sections provide a summary of travel demands and characteristics in the City's planning area.

Commuter Trips

Much of the traffic in the Camas planning area, especially during the more congested weekday peak periods, is related to employment. In other words, how do people get to and from work

from their place of residence. People who live in Camas and who are employed overwhelmingly commute to work outside of the planning area (87 percent), while jobs in the planning area are overwhelmingly filled by people who live outside of the planning area (83 percent).[11]

In terms of the predominant travel mode, on average, almost 75 percent of employed residents in the Camas planning area commute to work using single-occupant motor vehicles. About 8 percent of residents carpool to work and the remaining 17 percent work from home, walk, bike, take transit, or use some other means of travel[12].

About 11 percent of employed residents in the Camas planning area worked from home pre-COVID, and that figure likely increased due to COVID-19. It seems likely that a higher percentage of workers will continue a hybrid work schedule that includes teleworking, at least part time. Any increase in the hybrid work week (e.g. 2-3 days in an office with the balance at home or some other remote location) will change the demand on the transportation network, including when and how people travel.

Transportation Demand by Mode

Pedestrian, bicycle, and motor vehicle traffic counts were conducted at key intersections throughout Camas on typical weekdays[13]. This information indicates where and when travel demand is highest for each mode of travel. It also provides a basis for assessing how well existing transportation facilities are able to meet the needs of users during peak demand periods.

- Pedestrian volumes during the PM peak hour are generally highest near downtown Camas, including along NE 3rd Avenue and NE Adams Street (the traffic count summary is included in the appendix). The highest hourly pedestrian activity during the evening peak occurred at the NW Sierra Drive intersection with NW 28th Avenue, near Dorothy Fox Elementary school, with 30 pedestrian crossings in the one-hour period. Other study intersections with more than 15 pedestrian crossings during the one-hour period included many downtown locations such as NE 6th Avenue at NE Adams Street, NE 3rd Avenue at NE Dallas Street, NE 3rd Avenue at NE 4th Street, and Weir Road at NE 3rd Avenue, near the border of Camas and Washougal.
- Bicycle volumes indicate limited biking, with the highest volumes along NW Lake Road, and NW Sierra Street (the traffic count summary is included in the appendix). During the evening peak hour, 20 of the 50 study intersections had no observed bicyclists during the one-hour period. The NE Lake Road at SR 500, NW Lake Road at NW Sierra Street, NW Lake Road at NW Leadbetter Drive, NW Sierra Street at NW 45th Avenue, and NE 6th Avenue at NE Garfield Street intersections had the highest observed bicycle volumes, with 4 or more bicyclists counted during the single hour at each of the intersections.

[11] US Census Bureau, OnTheMap. Home/Work Distance/Direction Analysis, 2015.
[12] US Census Bureau, 2012-2016 American Community Survey
[13] Based on counts conducted in April of 2018.

- Motor vehicle volumes on the roadways in Camas (the traffic count summary is included in the appendix) most commonly peak during weekday evenings between 4:50 and 5:50 p.m. The highest hourly motor vehicle volumes during the evening peak occurred along the NW 6th Avenue corridor between the SR 14 ramps and NE Adams Street, with more than 1,300 trips during the one-hour period. This corridor is the primary entrance into Camas from eastbound travel. The NE Lake Road at NE Everett Street, and NW 6th Avenue at SR 14 Ramps intersections had the highest observed volumes, with more than 1,800 entering vehicle trips during the single hour at each of the intersections.

Active Transportation Networks

Camas is a community with an active citizenry and, therefore, requires a fairly robust active transportation system that includes pedestrian and biking facilities. The TSP inventoried the pedestrian and biking facilities, listed gaps in the systems, and assessed the facilities for how a pedestrian and bicyclist experiences them.

Multimodal Network Design

The design of the streets in the City's planning area is based on the network classifications and area designation. All streets in the planning area are multimodal and include travel lanes and on-street parking for vehicles, sidewalks for pedestrians, and on-street or separated facilities for bicyclists. Accommodating these modes varies by the functional classification and area designations. For a typical street cross-section, the functional classification determines the minimum design requirements for the number of vehicle travel way lanes and on-street parking, and the minimum acceptable bike facility, and the area designation is used to determine the minimum acceptable design for pedestrian facilities, and the minimum travel lane and median/turn lane width. Together, these cross-section standards identify the design characteristics needed to meet the function and demand for each facility type for streets in the City's planning area. Since the actual design of a roadway can vary from segment to segment due to adjacent land uses and demands, this system allows standardization of key characteristics to provide consistency.

The typical designs are intended to be implemented in newly developing or redeveloping areas of the City's planning area, where constrained conditions do not limit the ability to construct the typical cross-section. A variety of physical and natural constraints may prevent adherence to the multimodal network design requirements. A deviation to the street standards may be requested from the City Engineer or City Engineer's designee with justification of constraints to consider a constrained cross-section or other adjustments.

Pedestrian Network

Walking supports healthy lifestyles, is an easy and economical way to travel, and is well-suited for people of all ages and abilities. In this plan, "walking" and "pedestrian" are terms that include people who walk independently or use canes, wheelchairs, or other walking aids, or strollers. Approximately two percent of commuters in the city walk to work, with three percent

utilizing public transportation, which often includes walking at the beginning or end of the trip.[14] In addition to the work commute trips, walking trips are made to and from recreational areas, shopping areas, schools, and other key destinations in the community. Continuous and direct sidewalk connections to all key destinations and along all streets, in addition to safe crossing opportunities along major roadways, are essential to encourage walking and transit use.

A pedestrian network assessment of streets, showing the extent to which the walking network on collector and arterial streets provides a level of comfort and safety for users, was completed throughout the city. About 30 percent of the collector and arterial street miles in Camas were rated "good (i.e., level of traffic stress (LTS) 2)" or "excellent (i.e., LTS 1)" for pedestrians. However, over 35 percent of the collector and arterial street miles rate poorly (i.e., LTS 4). Most of the street miles rated "poor" are located in high growth areas, be that housing or business growth. The pedestrian network in these areas is largely unimproved due to the once rural nature of the surrounding land use. As future urban development occurs, pedestrian facilities will improve in those areas. Overall, the pedestrian network rates relatively high near downtown, and generally poorer towards the edges of the city. See Figure 13 for an inventory of the pedestrian network.

Bicycle Network

Cycling is important for both transportation and recreation in the Camas planning area. This includes people who bike to work and school, bike for recreation or running errands. Approximately one percent of commuters in the city bicycle to work[15]. Riding bicycles also plays a key role in the transportation system's ability to support healthy and active lifestyles and provide a viable alternative to the automobile. Continuous bicycle connections between all activity generators and arterial/collector roadways are desirable to allow for safe and attractive non-motorized travel options.

The bicycle network in the City's planning area, shown in

Figure 12, is composed of bike lanes, roadway shoulders, shared roadways, and shared-use paths.

- Bike lanes are portions of the roadway designated specifically for bicycle travel via a striped lane and pavement stencils. Bike lanes are most appropriate for arterials and collectors, where high traffic volumes and speeds warrant greater separation of the travel modes. Significant segments of continuous bicycle lanes exist along portions of NW Lake Road, NW 38th Avenue, NW Parker Street, NW Friberg-Strunk Street, and SR 500.
- Shoulder bikeways are paved with striped shoulders wide enough for bicycle travel. A six-foot paved shoulder is desired to adequately provide for bicyclists, with a four-foot minimum width in constrained areas. Roadways with shoulders less than four feet are

[14] US Census Bureau, 2012-2016 American Community Survey
[15] US Census Bureau, 2012-2016 American Community Survey

considered shared roadways. Some shoulder bikeways are signed to alert motorists to expect bicycle travel along the roadway

- Shared roadways include those on which bicyclists and motorists share the same travel lane. The most suitable roadways for shared bicycle use are those with low speeds (25 mph or less) and low traffic volumes (3,000 vehicles or fewer per day). Shared roadways, often signed as bicycle routes, serve to provide continuity to other bicycle facilities (e.g., bicycle lanes) or can be designated as a preferred route through the community. Shared roadways can have signs that highlight a special route or provide directional information in bicycling minutes or distance. Most local roadways in the city are considered shared roadways, but do not have signs or pavement markings, although some are planned to be improved in the TSP.
- Shared-use paths provide off-street travel for bicyclists and pedestrians, and are wider than an average sidewalk (e.g., 10 – 14 feet). Shared-use paths are typically paved (asphalt or concrete) but may also consist of an unpaved smooth surface, such as compacted gravel, as long as it meets Americans with Disabilities Act (ADA) standards. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout the residential neighborhoods.

A bicycle network assessment of streets in Camas shows the extent to which the bicycle network on collector and arterial streets provides a level of comfort and safety for users. About 20 percent of the collector and arterial street miles' in Camas rate "good (i.e., LTS 2)" or "excellent (i.e., LTS1)" for bicyclists. However, about 65 percent of the collector and arterial street miles' rate poorly (i.e., LTS 4) for bicyclists.

Overall, the bicycle network rates relatively high on the northwest side of the city and poor on the south and east side. The streets with the lowest ratings are the streets important for local and regional through travel (e.g. portions of NW 6th Avenue, NE 3rd Avenue, and SR 500), where many businesses and services are located. These streets rate low due to the relatively high motor vehicle traffic volumes and speeds and lack of separated bicycle facilities.

Transition Plan for Transportation

Title II of the Americans with Disabilities Act requires cities to establish a transition plan for transportation. The plan shall, at a minimum:

1. Identify physical obstacles in Camas' facilities that limit the accessibility of its programs or activities to individuals with disabilities;
2. Describe in detail the methods that will be used to make the facilities accessible;
3. Specify the schedule for taking the steps necessary to achieve compliance and, if the time period of the transition plan is longer than one year, identify steps that will be taken during each year of the transition period; and
4. Indicate the official responsible for implementation of the plan.

Camas has a relatively well-developed pedestrian network that is also potentially suitable for those who use mobility devices. The network is composed of sidewalks, shared-use paths and pedestrian trails, and other accessways. A large part of downtown Camas was developed prior to 1950, a time in which sidewalks were incorporated into the design of neighborhoods and streets. Although most areas incorporated into Camas over the following decades have sidewalk coverage, a few areas have noticeable gaps that do not make for a complete sidewalk network. These gaps are most significant in southwest, southeast, and northeast Camas, and on roadway segments outside city limits. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout residential neighborhoods. Unpaved pedestrian only trails are scattered throughout the city.

Many intersections in older parts of the city lack ADA-compliant ramps, which provide important connections between sidewalks, making it easier to cross streets and handle the vertical drop at curbs. Knowing these conditions, the city has been recently installing new curb ramps in many of these locations. The presence of curb ramps is fairly consistent along streets in downtown Camas, and in the newer neighborhoods in the city. Additional work is required by the City to ensure all existing and future sidewalks have curb ramps.

About 38 percent of street miles (including City arterial, collector and local streets) lack sidewalk coverage along one or both sides (see Figure 13). These gaps are more common along arterial streets than collector streets, at 40 and 23 percent, respectively, of the street miles with no sidewalk on either side. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways. Any future streets constructed in association with development projects will be required to construct sidewalks with curb ramps, increasing the overall sidewalk supply.

Transportation Projects and Priorities

This section describes the transportation system improvement projects- multimodal street improvement, intersection improvement, pedestrian/bike improvement, transit enhancement, and demand/system management – to address the system needs identified in earlier text.

The list of projects was developed through three main sources including stakeholders, relying on previous plans (such as the North Shore Subarea Plan), and independent project team evaluation.

The full list of projects is identified to improve the transportation network along major streets in the City's planning area, regardless of their priority or their likelihood of being funded. The TSP focuses on streets in the planning area with a functional classification of Collector or higher. Additional improvements will occur with private development in the planning area, including the build-out of the local street network consistent with the applicable standards.

The planning process from the TSP screens candidate projects to set aside those that may not be feasible due to environmental or existing development limitations. The remaining projects

are a combination of new and previous ideas for the transportation system that seek to address the gaps and deficiencies in the city.

The full project list, included as Appendix X, includes 99 projects totaling over $180 million in total investments. For the purposes of cost estimates, project design elements are identified, however, the actual design elements for any project are subject to change and will ultimately be determined through a preliminary and final design process and are subject to City, WSDOT, Clark County, and/or other partner agency approval. The projects were assigned to one of several categories:

- Multimodal Street Improvement - these projects will improve or construct new multimodal streets throughout the planning area, each with facilities for motorists, pedestrians, and bicyclists. A total of 29 projects have been identified that, as of 2024, will cost an estimated $72 million to complete.
- Intersection Improvement – these projects will improve safety and mobility at intersections throughout the planning area. A total of 19 projects were identified to construct new or improve existing intersections that, as of 2024, will cost an estimated $64 million to complete.
- Pedestrian/Bike Improvement – these projects include stand-alone sidewalk, path and roadway crossing improvements, and an integrated network of bicycle lanes, marked on-street routes and shared-use paths to facilitate safe and convenient travel citywide. A total of 39 pedestrian and bicycle projects were identified that, as of 2024, will cost an estimated $38 million to complete.
- Transit Enhancement – these projects will enhance the quality and convenience for transit passengers. One transit project was identified that, as of 2024, will cost an estimated $1 million.
- Demand/System Management – this will encourage more efficient usage of the transportation system. Two projects were identified that, as of 2024, will cost an estimated $450,000.

Transportation Facility Maps

Figure 12 Bicycle Facilities

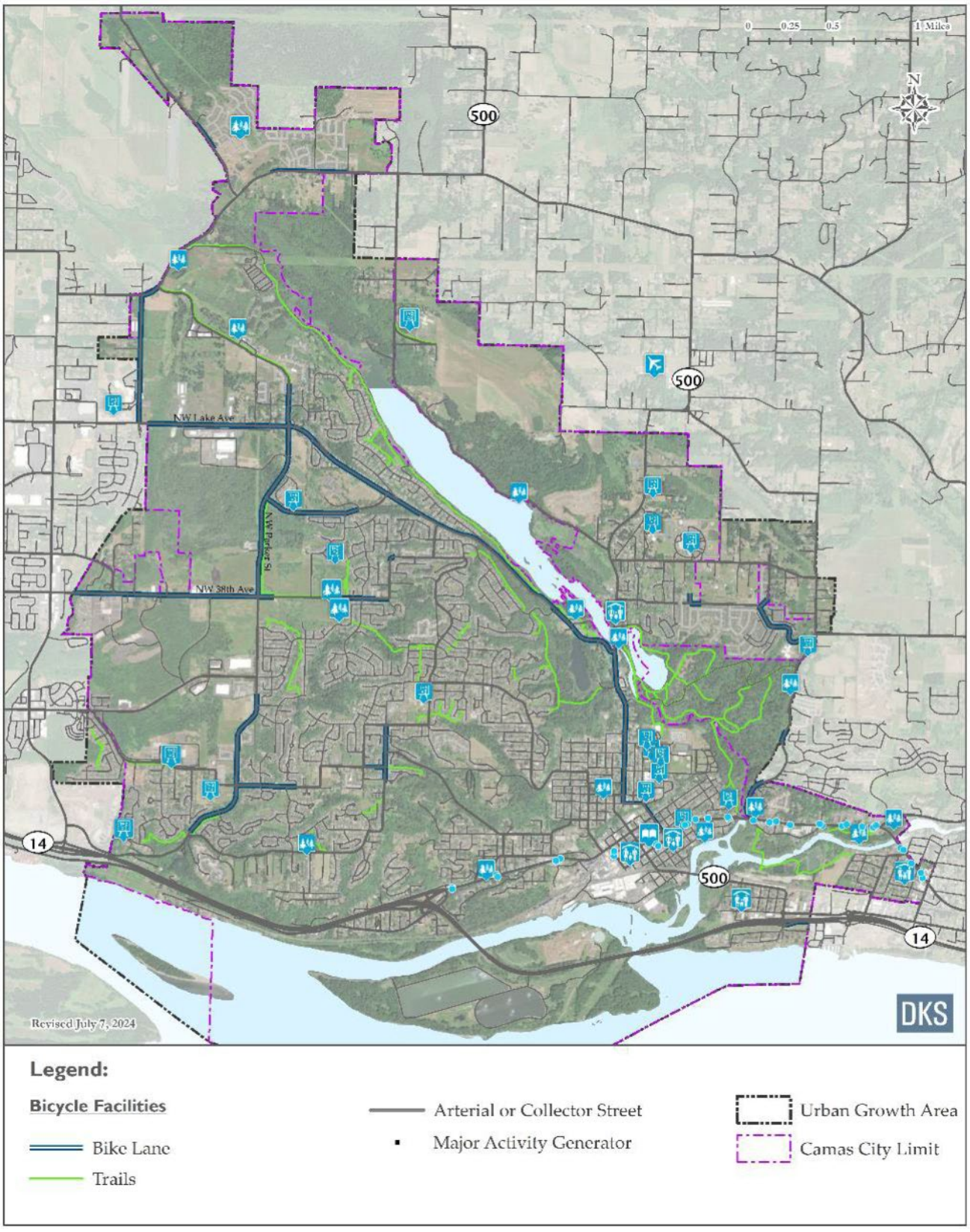


Figure 13 Pedestrian Facilities

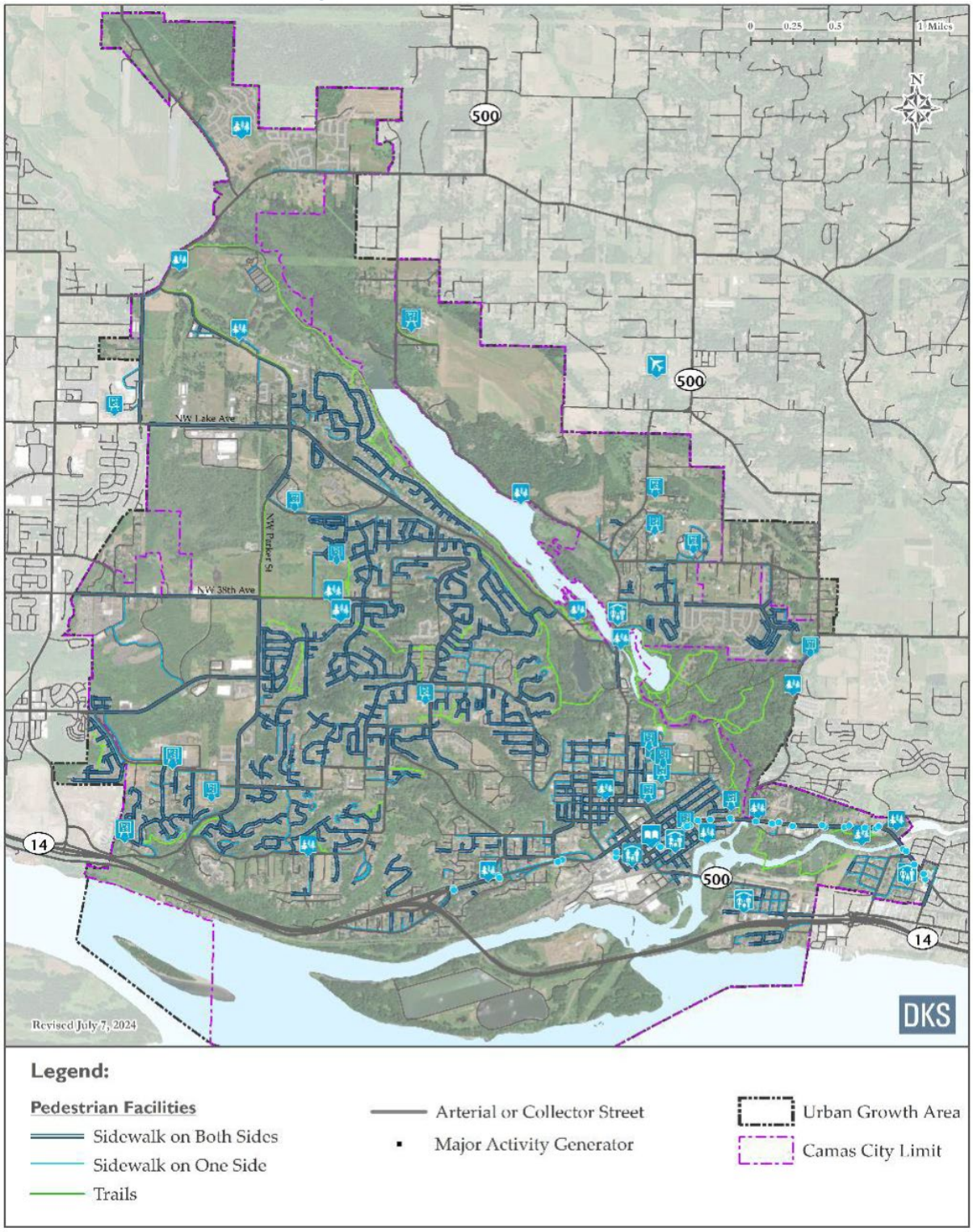


Figure 14 Street Network

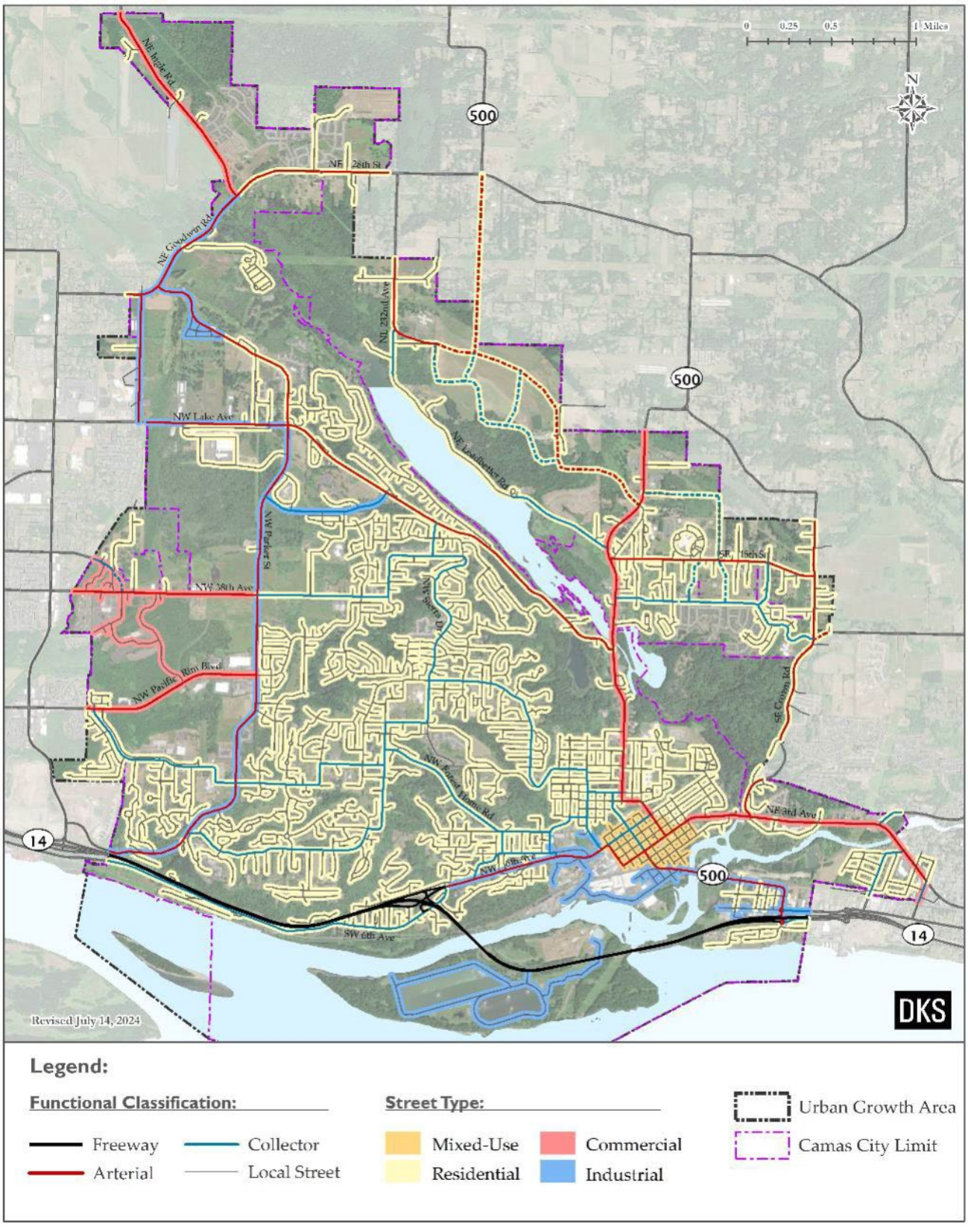
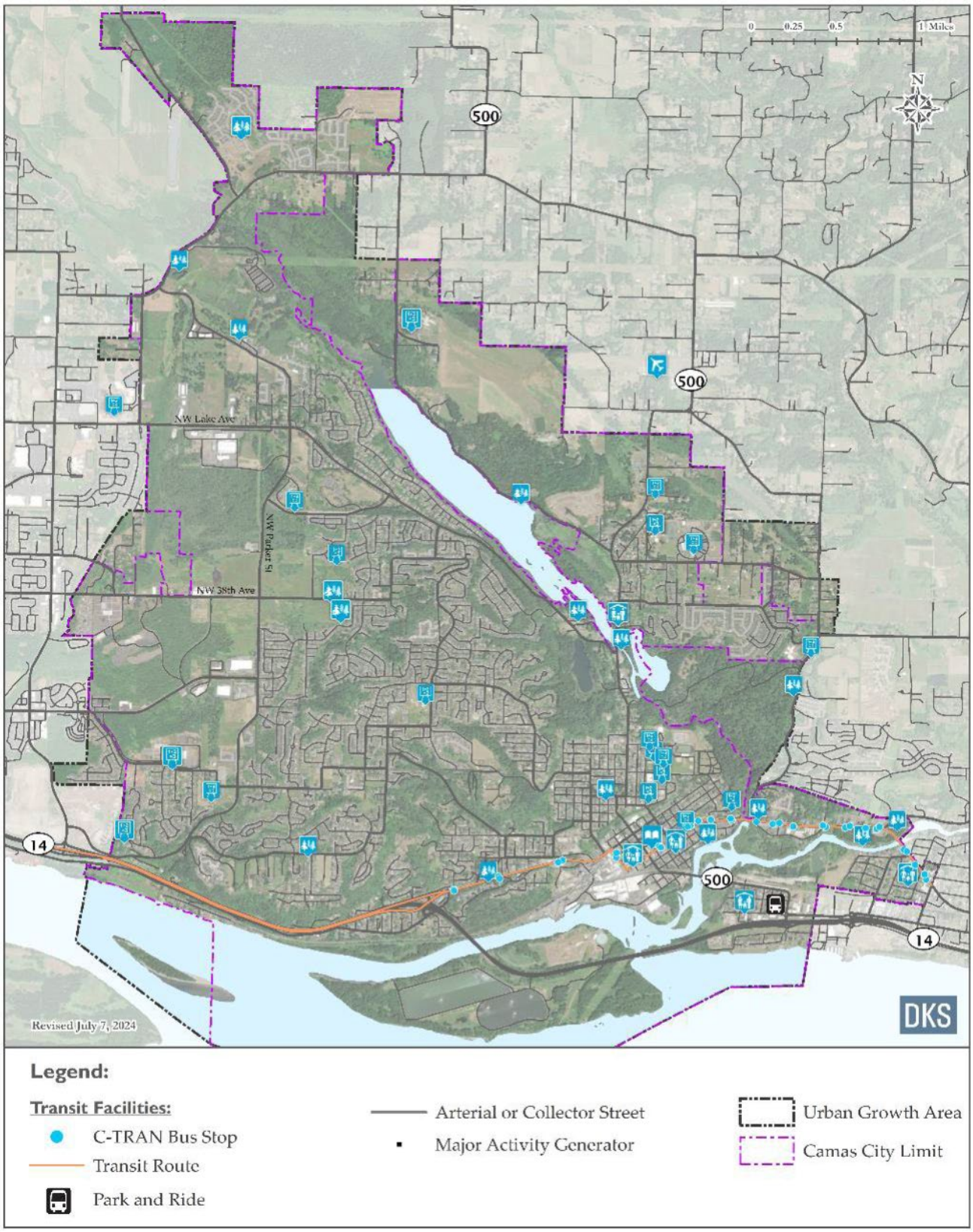


Figure 15 Transit Facilities



Transportation Goals and Policies

Goal TR-1 Complete Streets

Streets will function for all users of all abilities including bicyclists, pedestrians, transit users, and motorists.

Policy TR-1.1 Implement the Transportation System Plan (TSP) to maintain the livability of Camas and guide decision-making for transportation-related projects, policies, and design. Ensure consistency between the TSP, the Parks, Recreation and Open Space Plan and the 6-year street plan.

Policy TR-1.2 Maintain the transportation system to enhance safety and efficiency for all users, facility aesthetics, access management measures and the overall integrity of the system.

Policy TR-1.3 Construct streets that are interconnected and avoid long cul-de-sacs or dead ends. Block lengths should be less than 1,000 feet. Include pedestrian and bicycle linkages in the construction of cul-de-sacs and other forms of dead-end streets. Existing dead-end streets should be retrofitted to provide bicycle and pedestrian linkages as practicable.

Policy TR-1.4 Develop and implement design standards that provide attractive streetscapes, encourage appropriate traffic volumes and speeds, and support multi-modal safety. Include enhanced roadway features such as roundabouts, decorative lighting, and landscaping in gateways and design overlay areas.

Policy TR-1.5 Minimize access to new development and redevelopment along City arterials and consolidate access points when spacing is insufficient.

Policy TR-1.6 Provide routes designed for active transportation to encourage mode shift for short trips. Route planning should seek shortcuts and other opportunities that provide advantages to active transportation users. Public investments should support active transportation routes such as street lighting, safe crosswalks, and protected bike lanes.

Policy TR-1.7 Coordinate with Camas School District to implement a safe routes to school program to encourage the use of alternative and active transportation.

Policy TR-1.8 Develop and implement Complete Streets design in all new and retrofit street projects to support the use of alternative travel modes. Adopt engineering design standards consistent with Complete Streets goals.

Policy TR-1.9 Increase wayfinding signage for outdoor destinations throughout the City.

Policy TR-1.10 Inventory current bicycle and pedestrian networks to identify gaps in route coverage. Support filling in network gaps as new development and redevelopment occurs to create a bicycle and pedestrian network that is safe, comfortable, and accessible to people of all ages and abilities.

Policy TR-1.11 Minimize cut and fill roadway design and, where feasible, minimize restructuring the natural contours of the land.

Policy TR-1.12 Encourage the inclusion of low impact development (LID) design features (e.g. rain gardens, grass pavers, pervious pavement) in the design of road surfaces.

Policy TR-1.13 Require LED lights in new development and replace existing inventory that lack LED features.

Goal TR-2 Local and Regional Transit

Regional transit will provide safe, efficient, and dependable service to the Camas community for a variety of trips within and outside of the city.

Policy TR-2.1 Coordinate with local municipalities, Washington Department of Transportation, adjacent counties, and C-TRAN to ensure that minimum roadway and multi-modal design standards are consistent.

Policy TR-2.2 Partner with C-Tran to advocate for and develop transit options that are safe, convenient, frequent, and accessible for Camas residents.

Goal TR-3 Traffic Safety

Design and construct safe transportation facilities that meet applicable requirements.

Policy TR-3.1 Encourage traffic safety through education, enforcement, and engineering. Use traffic calming, traffic diversion, and other available tools such as landscaping, trees, and art to ensure a comfortable and safe environment for all users.

Policy TR-3.2 Provide adequate access for emergency vehicles throughout the city.

Policy TR-3.3 Develop safe pedestrian and bicycle routes between residential areas, schools, and public facilities.

Policy TR-3.4 Require new development to implement designs standards using the Neighborhood Traffic Management Plan.

Policy TR-3.5 Identify high accident areas and implement specific measures to reduce accident occurrences.

Goal TR-4 Transportation Demand Management

Transportation planning will achieve the efficient use of transportation infrastructure, increase its person carrying capacity, and accommodate and facilitate future growth consistent with land use objectives.

Policy TR-4.1 Require large employers to implement a commute trip reduction program for employees, as mandated by state law.

Policy TR-4.2 Support intergovernmental development review.

Policy TR-4.3 Support the Regional Transportation Council (RTC) with funding and staff participation to the extent possible.

Goal TR-5 Concurrency and Level of Service

The City will maintain the adopted LOS standards for all arterial streets and transit routes.

Policy TR-5.1 Encourage growth in areas with existing or planned infrastructure capacity.

Policy TR-5.2 Require new development to demonstrate that adequate person trips are available, or that multi-modal improvements to the transportation system will be made to accommodate the impacts concurrent with the development.

Policy TR-5.3 Utilize traffic impact fee studies, development traffic impact analyses, and corridor studies to identify deficiencies and plan improvements to maintain or improve LOS standards.

Policy TR-5.4 Take the following actions (in no priority order) if the probable funding falls short of meeting identified needs: 1) delay development until programs, facilities, or services can be funded; 2) obtain the revenue needed or revise the transportation plan to reflect known financial resources; or 3) change the transportation LOS standard, which is a last resort measure.

Goal TR-6 Transportation Revenue

Maximize the use of state and federal funds for transportation capital, operating, service, and demand improvements.

Policy TR-6.1 Maintain a capital improvement plan (CIP) that identifies construction and improvement priorities and funding.

Policy TR-6.2 Ensure that the transportation impact fee program responds to land use changes, supports connectivity, and requires new development to pay its proportionate share of needed capacity.

Policy TR-6.3 Support the Pavement Asset Management System and other maintenance programs to ensure cost-effective maintenance of transportation facilities and efficient use of public funds.

Policy TR-6.4 Develop equitable transportation impact fees to assess developers a fair-share contributions for any transportation improvements.

Policy TR-6.5 Prioritize transportation funding for multi-modal improvements that will enhance safety and access between infill areas, schools, and employment centers.

Policy TR-6.6 Focus transportation projects in economic development areas to act as catalysts for job growth.

ourCamas 2045



Public Facilities & Services

09

09. Public Facilities & Services

Purpose

Plan for adequate facilities that are consistent with the other elements, goals and policies of Our Camas 2045, can accommodate the projected population and employment growth and land use plan, and based on sound fiscal policies for the City.

Vision

In 2045, Camas residents enjoy the city's parks, trails, community centers, and other recreational opportunities. The school district draws families to the community and the library continues its vital role as a place of learning. Residents value accessible police, fire, and emergency response services. Proficient government agencies maintain existing City assets and coordinate future development.

Introduction

The City of Camas is a full-service community that offers a breadth of public facilities, services, and utilities. Public facilities include such things as City Hall, the Camas Public Library, the Public Works Operation Center, Lacamas Lodge, the Community Center, the Camas Police Department headquarters, and Fire Stations 41 and 42. The majority of the City's functions and services are carried out from these facilities.

General government services include such departments as Administration and Human Resources, Community Development, Finance, Information Technology, and the Camas Public Library. General services include but are not limited to utility billing, human resources, city clerk functions, building and engineering permits and inspection, and activities of the City Council and city boards and commissions.

Other city services include Fire and Emergency Medical Services (EMS), Police, and Parks and Recreation. Fire and EMS services are provided in Camas and, via intergovernmental agreements, beyond Camas city limits. The Camas Police Station dispatches law enforcement services throughout the community. Parks and Recreation services are housed in several facilities including Lacamas Lodge, the Community Center, and through a myriad of parks, trails, open spaces, and special use buildings.

Public utilities, administered by the Public Works Department, includes the city's sewer system, water system, and municipal stormwater system. These systems have a variety of assets that support them and are scattered throughout the city.

Public Works also operates solid waste service. Garbage trucks are dispatched from the Operations Center, the hub of Public Works' activities, and the solid waste is transported to an off-site transfer station and then to a landfill in eastern Washington. The City budgets money for capital equipment, however, the solid waste system does not require the same kinds of investments that the sewer, water, and stormwater systems require.

The public facilities and services element is divided into four sections:

- Public Facilities and Services including fire, emergency medical and police services, parks and open space, and City owned facilities
- Public and Franchise Utilities including water, sewer, stormwater, solid waste, electricity, natural gas, and telecommunications
- Capital Improvement Plan
- School Districts

Related to this element is the City's Capital Facilities Plan (CFP) (Appendix X), which provides a comprehensive project list and schedule guiding the investment of city resources in facilities and infrastructure. These resources are made up of local revenues as well as State, Federal and other sources. The CFP identifies those projects which have secured funding as well as a list of projects which have not yet been funded. The projects included in the overall CFP have largely been identified through other planning documents and efforts which are all incorporated into the City's comprehensive plan.

Level of Service (LOS) Standards

Under the GMA, adequate provisions for urban governmental services must be provided in the UGA. The goals and policies in this element are provided to address anticipated growth and maintain adopted LOS standards.

Public Facilities and Services

Many of the public facilities and services listed in this element have strategic plans and actions that guide maintenance and service improvements. The identified goals and policies were given consideration based on a framework of budgetary and operational guidelines as well as these strategic plans.

Fire Protection, Emergency Medical Services, and Police Protection

The city is served by the Camas-Washougal Fire Department (CWFD), which covers 20 square miles and 33,000 residents for fire protection and 80 square miles and 65,000 residents for emergency medical services. The Camas and Washougal fire departments consolidated in 2011 through a joint contract for service to improve efficiency and lower costs. CWFD averages approximately 5,000 fire and medical calls annually. The CWFD is the only fire department in

Clark County to provide ambulance transport services, which requires additional training for the firefighters in addition to fire suppression techniques.

Camas Fire and EMS operates out of two stations – Station 41 located in City Hall on NE Fourth Avenue and Station 42 located off NW Parker Street. Station 42 is relatively new, while Station 41 is many decades old.

Voters approved a capital construction bond in August of 2024 for a new downtown station and headquarters to replace Station 41. It will be located on the property occupied by the City Hall Annex building just west of City Hall on NE Fourth Avenue. When the new Station 41 is completed, there will be vacated space in the City Hall building. Future uses for the vacated space have not been determined.

A Facility Conditions Assessment (Appendix X) was completed in 2021 and lists some deficiencies in Station 42 in the form of HVAC, plumbing, electrical, and interior finishes that will be addressed with funding from a general obligation bond.

The Camas Police Department operates a full-service police department from one location near the downtown core. This 15,000 square-foot facility was built in 1998 and includes a 1,500 square-foot community/training room. Services include police response, community engagement, school resource officers, investigative follow-up, parking enforcement, code enforcement, and records services.

The City is currently investing over $400,000 in upgrades to the Camas Police Station by replacing end-of-life mechanical equipment. This investment will make it more cost-effective and environmentally resilient.

Parks, Trails, and Open Space

Camas' Comprehensive Parks, Recreation, and Open Space (PROS) plan , updated in March 2022, outlines a community vision for Camas that includes a high-quality park and recreation system, with a comprehensive open space and trail system linking all recreational sites to the regional trail network. The PROS plan is adopted by reference and included as Appendix X.

Parks and recreational opportunities in Camas include neighborhood parks that serve individual neighborhoods, natural open space areas that preserve resources throughout the community, and special use areas for specific recreation needs. Supplementing these are public and private sites and facilities, such as school sites, regional parks, and privately-owned recreation facilities.

In response to the community's feedback on the PROS plan, the City is currently working on a Parks and Open Space Management Plan (POSMP). The purpose of the POSMP is to maintain the existing facilities, fill gaps and improve trail connections, and develop and improve existing parks. The POSMP will outline a strategic vision for the thoughtful management of parks and open spaces within the city, ensuring that they continue to serve as resources for all users. The City will need to coordinate the POSMP with the comprehensive plan to ensure consistency.

During the City's review of land use designations, the PROS plan was reviewed to ensure that sufficient land is designated as Park, Open Space/Green Space, and NS-Parks/Open Space. Because the North Shore Subarea Plan was adopted after the last comprehensive plan update, this update includes revisions that incorporate the new NS-Parks/Open Space designation.

Camas receives impact fees paid by new development for park, trail, and open space improvements that increase the capacity of the system. The expenditure of the collected fees will be applied to the total costs of implementing projects that are identified in the PROS Plan project list, and as further refined by the City's Capital Improvements Plan.

City Facilities

The comprehensive FCA reviewed 17 publicly owned buildings located at 11 different sites. The total square footage of the surveyed buildings is just under 276,000 square feet.

The FCA report notes the total replacement value of all facilities at $61 million in 2022 dollars. The reported deficiencies for the years 2022-2027 total $17 million with the priority needs (life safety and code issue deficiencies) at $6.3 million. Long-term needs would require $18 million for major maintenance projects.

Recently, the City appropriated funding, through limited general obligation bonds, to pay for many of the items listed as priority needs in the FCA. This approximately $7 million has allowed the City to attend to some of the high priority deficiencies.

Noteworthy on the list is Station 41 and the City Hall Annex. With passage of a voter approved bond in 2024 specifically to replace Station 41, the City Hall Annex building will be demolished, and the site will house the new Station 41, which will also serve as the Fire Department's headquarters.

The Camas Public Library, located across the street from City Hall on NE Fourth Avenue, provides library services to the community at-large. According to the FCA, the library is in need of priority improvements to address immediate deficiencies. Since the date of the report, the City is funding a number of deficiencies through a general obligation bond.

City and Franchise Utilities

Water

The City owns and operates a multi-source municipal water system which includes supply, treatment, storage, and distribution of potable water to residential and commercial customers. The City currently obtains its water from ten groundwater wells and two surface water sources that are treated to provide high quality water to customers. The City owns over 143 miles of pipelines in its water transmission and distribution system. Service is provided to customers across five major pressure zones and 18 subzones. Eight booster pumping stations are used to move water between pressure zones. Seven storage facilities, with a combined total of 8.45 million gallons (MG), provide storage for normal and emergency conditions, such as fire

suppression. Additionally, distribution system includes numerous meters, isolation valves, and hydrants. Additional information regarding Camas Water Service, including capacity analysis, is available in Appendix X, Water System Plan (2019).

Sewer

The majority of the 7,700-acre UGA and the sewage collecting infrastructure inside the city limits is owned and operated by the City of Camas. The collecting system consists of traditional gravity sewers, pump stations, force mains, and septic tank effluent systems. The system includes 38,260 linear feet of force main, 29 lift stations, and 236,200 linear feet of gravity mains. Approximately half of the city is served by septic tank effluent systems and the other half by a traditional collection system. The City gathers, treats, and discharges wastewater into the Columbia River at the Camas Wastewater Treatment Plant (WWTP).

The City of Camas Sewer Division serves residences and commercial buildings, with approximately 8,500 customers, comprised of industrial, commercial, and residential users.

A collection system flow metering and projection was conducted in 2018/2019 to evaluate the collection system using the City's hydraulic model. The results of this analysis are available in Appendix X, General Sewer Plan (2022), which develops a management plan for the system over the next 20 years.

Stormwater

The stormwater runoff generated from approximately 7,500 acres across the city of Camas is managed through 75 miles of stormwater conveyance pipe and 1,800 stormwater inlets and catch basins. The stormwater conveyance system is owned and maintained by the City. The City also owns and maintains stormwater facilities, including underground treatment vaults, detention ponds, biofiltration swales, wet ponds, drainage ditches, and culverts. These have been geolocated on the City's Stormwater Management Action Plan (SMAP) Public Input Map. The SMAP identifies actions to protect and improve receiving waters' water quality. Commercial and residential stormwater facilities are privately owned and maintained per stormwater code CMC 14.02.200 Ownership and Maintenance. These privately owned facilities within the city are geolocated on the SMAP Public Input Map. Additional details on stormwater management in Camas can be found in Appendix X, Stormwater Management Program (2024).

Solid Waste

The City owns and operates its own solid waste utility which provides for the collection and transfer of solid waste refuse to the Clark County-owned Washougal Transfer Station. The City is responsible for managing garbage collection within the Camas boundaries. The City has established universal compulsory solid waste collection, requiring all residents and businesses to maintain solid waste service. The City contracts with Waste Connections of Washington to provide recycling and yard debris management, collection, and disposal. The City also contracts with Waste Connections to provide large container service (larger than 2 cubic yards) to those with greater solid waste handling needs.

All cities and towns in Clark County have delegated responsibility for solid waste transfer and disposal planning to the County, including Camas. The currently adopted Clark County Solid Waste Management Plan (CSWMP) of 2015 is undergoing updates and anticipated to be adopted by the end of 2025. Agreements between Clark County and its cities commit each to the plan and to the plan's waste disposal system.

Franchise Utilities

There are several other utilities, some of which are provided by public entities and others by private entities, that contribute to the functionality and prosperity of the community. The main utilities include electricity, natural gas, and telecommunications. Electricity is provided by Clark Public Utilities (CPU), a customer-owned public utility; natural gas is provided by Northwest Natural; and telecommunications, including high-speed internet, are provided by a variety of companies (e.g. Comcast, Verizon, Frontier, etc.). No detailed inventory regarding the capacity of these utilities is available.

Electrical

Clark Public Utilities (CPU) (https://www.clarkpublicutilities.com/) provides electricity to Camas and throughout Clark County. CPU balances strategic planning for the future with present rate and service stability in compliance with changing requirements at the local, state, and federal levels. CPU is led by an elected board to plan for integration of new technologies and has indicated there is ample capacity to meet existing demand for areas within both the incorporated City limits and the UGA. Power supplies are provided through a combination of power supply contracts and purchases from the generating system.

Natural Gas

Delivery of natural gas to Camas and its UGA is provided by Northwest Natural (https://www.nwnatural.com/). The delivery of natural gas is governed by the Federal Energy Regulatory Commission, the National Office of Pipeline Safety, and the Washington Utilities and Transportation Commission (WUTC). The City's regulations include safety and emergency provisions, LOS standards, and rate limitations. Northwest Natural provides natural gas service to all of Clark County. The alignment of the main pipeline crosses the Columbia River at the area of the Port of Camas-Washougal. Additionally, Northwest Natural is improving its backbone through the City with the installation of a large-diameter high-pressure gas main connecting Lake Road and Pacific Rim Boulevard.

Telecommunications

Verizon provides local telephone service to the City and its UGA. Many of the telecommunication facilities, including aerial and underground, are co-located with those of the electrical power provider. Frontier Communications also provides telecommunications to a large number of customers in the Camas area. Contact information for telecommunication utility providers is available on the City of Camas website (https://www.cityofcamas.us/utilities/page/new-resident-information).

Capital Improvement Plan

The 6-year Capital Improvement Plan (CIP) is a significant component of the financing plan and is adopted as part of the biennial budget. It includes a list of projects, project start dates, estimated cost, and funding. The CIP is a shorter term funding plan that directs available resources to specific projects including street preservation and improvements, fire and EMS, parks and recreation, stormwater, water, and sewer projects. The 2025-2026 CIP is included as Appendix X.

The first two years of the capital facilities plan are typically consistent with the adopted City budget. However, since capital expenditures often impact multiple years after funding has been committed, it is prudent to plan ahead for the expenditure of funds for at least four years or longer. Additionally, some of the City's adopted plans include longer term expenditure plans in which resources are actively being pursued when opportunities arise.

School Districts

Public schools are recognized as one of the largest public services within the community. Education serves one of the most important roles in community health as the quality of education today impacts the skill levels, employment rates, labor supply, and wages of tomorrow.

The Camas School District has the most, and some of largest, public facilities in the Camas Urban Growth Area. The UGA spans two school districts. Camas and Evergreen School Districts are responsible for facility planning and service levels of the districts and coordination with the city's overall development. Both school districts are currently evaluating school facilities and overall needs to serve the community.

The Camas School District has prepared a 2022 Capital Facilities Plan (CFP) to provide the County and the Cities with a schedule and financing program for capital improvement needs over a six year period (2022-2028) to ensure that adequate facilities are available to serve new growth and development.

The collection of school impact fees generates partial funding for construction of public facilities needed to accommodate new development. School impact fees are collected by the cities and County on behalf of the District at the time plats are approved or building permits are issued. Impact fees are calculated based on a formula, which includes the portion of District construction resulting in increased capacity in schools. The districts submit their capital facilities plans every other year, accompanied by impact fee calculations. The plans describe the existing and planned school facilities and services.

Anticipated property acquisition and new construction is based on the enrollment forecast, capacity, the District's educational standards and the community's support of finance tools to fund improvements.

Public Facilities and Services Goals and Policies

Goal PFS-1 Fire Protection, Emergency Medical Services, Police Protection

Provide fire protection, emergency medical services, and police protection to Camas and accommodate growth in the community.

Policy PFS-1.1 Plan for fire and emergency medical services to include adequate land, building, and equipment to effectively serve the geographic area of the city north of Lacamas Lake (North Shore).

Policy PFS-1.2 Assess the level of service needs and provide fire, advanced life support emergency medical, and police services that meet the community demand. Maintain service levels as growth occurs.Ensure

Policy PFS-1.3 Ensure the installation of commercial fire sprinklers where required by code and strongly encourage their use when installation is optional.Require

Policy PFS-1.4 Pursue funding to maintain fire facilities, including all fire apparatus at levels that best serve the community. Fire apparatus includes fire suppression equipment such as engine, water tenders, brush trucks and command officer vehicles.

Policy PFS-1.5 Require all new residences to install fire sprinkler systems.

Policy PFS-1.6 Plan police annex facilities at strategic locations throughout the City.

Goal PFS-2 Parks, Trails and Open Space

A network of parks, trails, and open space will connect neighborhoods, wildlife corridors, and natural resources and enhance the quality of life for residents and visitors. Refer to the Camas PROS plan for additional goals and policies.

Policy PFS-2.1 Provide and maintain an active transportation network to increase connectivity to natural areas, wildlife corridors, and other natural resources in Camas.

Policy PFS-2.2 Ensure every neighborhood has access to a park within a 15-minute walk or roll.

Policy PFS-2.3 Provide safe and maintained parks, natural areas, and other recreational spaces that are accessible for all ages and abilities.

Policy PFS-2.4 Provide a continuous trail network around Lacamas Lake with ample access points, prioritizing active transportation users. Consider new public access points through dedications, easements, and acquisitions. Partner with transit agencies to plan and implement transit service to Lacamas and Round Lake.X

Policy PFS-2.5 Explore the development of dog parks within special use park areas to balance the needs of pet owners and other park users.

Policy PFS-2.6 Encourage the development of parks and playgrounds that have ample facilities for all users.

Policy PFS-2.7 Work with the Camas Parks & Recreation Department to acquire land for parks, trails, recreational uses, and habitat conservation.

Policy PFS-2.8 Enhance water conservation methods and technologies in development of irrigation infrastructure within parks and recreation areas.

Goal PFS-3 City Facilities and Services

Provide facilities and services to support the functions of City government and the community, including cemetery, animal control, and the public library.

Policy PFS-3.1 Develop an expansion plan (e.g., new municipal facility, meeting space) to accommodate additional personnel.

Policy PFS-3.2 Ensure that the municipal building and primary services remain downtown.

Policy PFS-3.3 Incorporate sustainable and low climate impact design into city buildings. Promote LEED certification (or similar) for all publicly owned facilities.

Policy PFS-3.4 Utilize the City's capital improvement program to develop alternative transportation facilities and electric vehicle charging infrastructure for public facilities.

Policy PFS-3.5 Maximize the developed and undeveloped property for cemetery use to meet future burial needs and trends and meet residents' service expectations.

Policy PFS-3.6 Provide economic stability to the cemetery fund by reducing dependency on the general fund.

Policy PFS-3.7 Develop a strong volunteer and donation program for the cemetery.

Policy PFS-3.8 Continue animal control partnership with the City of Washougal.

Policy PFS-3.9 Maintain funding and support for library services that meet the demands of current and future residents.

Policy PFS-3.10 Assess need and solutions for additional library services throughout the growing City.

Goal PFS-4 City and Franchise Utilities

Provide utility services, including energy and communication facilities and their services, to all businesses, residents, and properties in the City limits.

General Utilities Policy

Policy PFS-4.1 Maintain and improve City utility systems through preventative maintenance and regular assessments and improvements to meet regulatory standards.

Policy PFS-4.2 Where service is available, require connection to public water for domestic and irrigation needs and connection to sewer systems. Promote connection to sewer and water before system failure of private well or septic.

Policy PFS-4.3 The City should be the sole provider of urban services, including water and sewer, within the UGA for sewer service and the Water Service Area for water. Require all new construction connect to city systems. Prohibit construction of new private wells and subsurface sewage disposal systems in new developments.

Policy PFS-4.4 Do not extend utilities without annexation or commitments for annexation. Exceptions may be made in cases where human

health is threatened. In areas where utilities presently extend beyond City limits, but are within UGAs, plan development jointly with the County. A joint development must be consistent with City standards.

Policy PFS-4.5 Coordinate plans for providing public utility services in UGAs and rural areas with plans for transitioning undeveloped land to urban uses.

Policy PFS-4.6 Plan public utility services so that service provision maximizes efficiency and cost effectiveness and ensures concurrency. Coordinate with other entities to provide services within the urban area.

Water Service Policy

Policy PFS-4.7 Extend adequate public water service throughout the City's urban areas that meets state requirements and provides minimum fire flow as required by the Fire Marshal.

Policy PFS-4.8 Conserve and protect groundwater resources to provide safe, clean, high quality drinking water to residents.

Policy PFS-4.9 Ensure water infrastructure is designed to City standards and is in place prior to land development.

Policy PFS-4.10 Coordinate with Clark County and other purveyors to eliminate private systems in accordance with the Clark County Coordinated Water System Plan.

Policy PFS-4.11 Coordinate with the County and the cities of Vancouver and Washougal to protect groundwater from contamination.

Policy PFS-4.12 Expand municipal reclaimed water systems and allow onsite non-potable water systems to reduce water demand in private-sector commercial and residential buildings.

Policy PFS-4.13 Eliminate the introduction of groundwater and surface water into the sewer system.

Sewer Services Policy

Policy PFS-4.14 Extend public sanitary sewer service, as required, throughout urban areas. Service may be provided outside urban areas to serve areas where imminent health hazards exist.

Policy PFS-4.15 Use traditional gravity sewer systems (in lieu of STEP systems) to serve future customers and reduce maintenance and power costs.

Policy PFS-4.16 Coordinate with Clark County to eliminate septic systems.

Stormwater Policy

Policy PFS-4.17 Provide a stable funding source to meet National Pollutant Discharge Elimination Systems (NPDES) Phase II requirements to manage and control stormwater runoff.

Policy PFS-4.18 Inspect homeowner association and other private facilities and provide directions and standards for repair.

Policy PFS-4.19 Meet water quality standards by providing best management practices for development activities.

Policy PFS-4.20 Establish baseline flows on each drainage basin or sub-basin for the analysis of deficiencies.

Policy PFS-4.21 Consider stormwater impacts during land use review processes and develop standards that would reduce the amount of impervious surface on existing and new development, including the creation and adoption of low-impact development standards and the use of green infrastructure, to address increased storm intensities and stormwater runoff.

Policy PFS-4.22 Require new development or redevelopment to comply with the Camas Stormwater Design Standards Manual and design criteria.

Policy PFS-4.23 Protect natural stream courses for water quality.

Policy PFS-4.24 Manage stormwater to safely pass surface water and maintain water quality of lakes, streams, and rivers.

Solid Waste Policy

Policy PFS-4.25 Provide for solid waste service throughout the City through continuance of self-collection of solid waste and contracting with private waste management companies to provide recycling and yard debris collection options.

Policy PFS-4.26 Continue a system of universal compulsory solid waste collection.

Policy PFS-4.27 Coordinate with the County to implement the Clark County Solid Waste Management Plan (CSWMP). Reduce the total production of waste, increase the recycling rate of waste that is produced, and properly manage and dispose of waste that is not recycled. Provide education and outreach to businesses and the public on benefits and opportunities for waste reduction and recycling. Focus on residential recycling rates to improve participation rates similar to the rest of the County.

Policy PFS-4.28 Work with solid waste utility companies to determine if household food waste/compost can be accommodated in yard waste bins.

Franchise Utility Policy

Policy PFS-4.29 Minimize the effects on adjacent properties, the environment, and the visual quality of the community of siting, developing, operating, and maintaining facilities.

Policy PFS-4.30 Coordinate to provide reliable service through partnerships and agreements with utility companies.

Policy PFS-4.31 Promote the conservation of energy resources through the adoption of appropriate energy codes and efficient land use and transportation systems.

Policy PFS-4.32 Work with energy utilities to improve the safety and reliability of infrastructure vulnerable to climate change (e.g., undergrounding transmission lines).

Goal PFS-5 Capital Improvement Plan

Maintain and implement the Capital Improvement Plan in coordination with the biennial budget.

Policy PFS-5.1 Update the capital improvement plan biannually and include a statement of projected costs and sources of revenue.

Policy PFS-5.2 Ensure capital improvements enhance the community and add physical value to the City.

Policy PFS-5.3 Apply earnings from bond proceeds toward the debt service fund reserved for the future repayment of debt directly for enhancement of the project.

Policy PFS-5.4 Dedicate all or a portion of the first year of property taxes generated from newly incorporated areas to the Capital Fund.

Policy PFS-5.5 Dedicated funds and bonds may be used to fund essential capital improvement projects such as police, fire, and general municipal structures.

Policy PFS-5.6 Use voted, general obligation debt for discretionary projects such as recreation and library facilities.

Policy PFS-5.7 Prioritize projects that support the core services provided by the City.

Policy PFS-5.8 Ensure consistency of capital improvement plans with the adopted comprehensive plan map and evaluate if funding is adequate to provide necessary public facilities and services to implement the plan.

Goal PFS-6 School Districts

Support access to quality education and public schools through partnerships and investments.

Policy PFS-6.1 Encourage the Camas School District, Clark County, and the City of Camas to invest in mutual use facilities that support intergenerational and intercultural use.

Policy PFS-6.2 Coordinate planning between the Camas School District and the City of Camas to reflect school facility needs in response to growth forecasts.

Policy PFS-6.3 Ensure equitable access to schools and educational programs, specifically considering those in underserved areas, where needs and abilities may differ.

ourCamas 2045



Economic Development

10

10. Economic Development

Boosting the Local Economy

The economic health and well-being of the City of Camas is supported by providing a wide range of employment opportunities throughout the community and a setting and quality of life that is attractive to businesses and residents.

Vision

In 2045, Camas has cultivated a diverse and thriving economy with stable employment opportunities and living-wage jobs across various sectors, including technology, healthcare, manufacturing, retail, recreation, and professional services. Camas residents have access to a wide range of services and amenities in their community, while benefiting from excellent regional connectivity and the city's proximity to Portland International Airport. Camas is a gateway to nature and recreational opportunities, supporting regional tourism in the area. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity. Professional office, medical, and industrial uses typify western Camas, with retail businesses supporting these firms and nearby residents. The North Shore area will fulfill the employment and retail needs of the growing population on the northeast side, and reduce trips outside the city. Downtown Camas anchors the community with a dynamic economic landscape and retains its historic atmosphere as a walkable, attractive place to shop, dine, and gather. Inclusive housing options within the city's core contributes to a town center that supports local businesses.

Approach for Updating this Element

The approach for updating the economic development element for the 2025 to 2045 planning horizon was informed by community input (outlined below), state legislation requirements, priorities, and a comprehensive economic profile. This profile integrated the best available information from public and private data sources to assess the city's economic trajectory, opportunities, challenges, and economic conditions and competitiveness. These insights help build a factual basis for the updates.

Community Engagement Insights

Interactive open houses and interviews with stakeholders provided information about economic development strengths,

challenges, opportunities, and actions in Downtown Camas and other areas in the City. Engagement activities identified the following themes that could contribute to future decision-making related to economic development in Camas.

Economic Development

- **North Shore:** Need infill development.
- **Grass Valley:** Needs mixed/light industrial park with athlete fields/parks. Why no Grass Valley Subarea Plan? Be clear on what kinds of businesses would be most beneficial to Camas in Grass Valley to build awareness when talking with prospective businesses.
- **General:** Need more commercial space, more manufacturing jobs, and a dedicated economic development director or staff person (apply for grant), and plan. Focus on tourism and bring in money. Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.

Downtown Strengths

- **Strong sense of place:** Downtown stakeholders feel supported by Camas community. They discussed the quaint, small-town character, with unique features attracting visitors and services and how the mix of new and old/established businesses contributes to vitality of Downtown.
- **Positive support for businesses**: Good interactions with the DCA, overall good experience working with the City and business owners cultivate a collaborative environment.
- **Increases in housing density seen as a positive direction:** New housing is opportunity for more amenities to support the growth and expansion of amenities can make Downtown more walkable.

Downtown Opportunities

- **Improvements to public realm** to increase / improve street lighting, address issues with street trees (some interfere with sidewalks, other infrastructure), improve the civic area of Fire Dept. plan, add connectivity to adjacent residential neighborhoods, and open spaces, and provide outdoor dining spilling out onto sidewalk.
- **Community gathering spaces**: Need more meeting places indoor/outdoor and outdoor spaces for children/families, should expand Downtown Core beyond 4th Ave, support redevelopment of underutilized land on 3rd and 5th Ave, and should create more spaces for retail that extends walkability of Downtown, cohesiveness.
- **Development potential:** Explore more ways to activate ground floors and embrace walkability / modern parking standards.

Downtown Challenges

- **Parking is a concern for some:** Two-hour duration (especially difficult for employees) and Mill property / parking lot.
- **Pace of development:** Concern over what new development will mean for current businesses and need for balance between new development and preserving historic structures in Downtown.
- **Growth opportunities are limited:** Need to expand the definition of Downtown (beyond just 4th Ave) to expand and provide more amenities. There is limited space on 4th Ave where businesses would like to locate.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Strategies

- **Need more responsive permitting and ongoing maintenance to the public realm** since this supports the success of Downtown.
- **More partnerships between City and Downtown businesses:** City can increase interaction and build relationships with business / property owners.
- **Identify ways to keep local presence and restore historic structures:** Some expressed concern over losing historic structures and asked for ways to balance preservation with new development. The City could provide incentives for existing business owners who would like to expand or stay in Downtown Camas as new development continues.
- **Explore ways to address underutilized property**: For example, opportunities at GP parking lot.
- **Pedestrian Safety and Connectivity:** Address 3rd and 5th Avenue pedestrian safety and improve connections to and from Downtown. Focus on pedestrian activation through plazas and public spaces. Address accessibility needs both with ADA and beyond.
- **Improvements:** Expand character of Downtown to the broader boundary defined in the plan. Accommodate a flexibility of spaces and variety of uses through use of public space (sidewalks, parking, etc.). Define the historic character of 4th Avenue through specific streetscape elements.

City of Camas Competitive Position

The city's competitive position can be summarized in terms of strengths, weaknesses, opportunities, and threats. These represent internal and external factors that can have positive or negative impacts on economic outcomes in Camas. Several ideas added to the summary below are based on feedback received through community engagement activities. Table 4 below outlines key findings associated with economic growth and development.

Table 4 Strengths, Weaknesses, Opportunities, and Threats Summary Analysis

STRENGTHS	WEAKNESSES
• High quality of life amenities like parks and recreation opportunities including new City investments in capital projects. • Downtown experiencing high visitation and high demand for retail spaces (increasing rents, low vacancy). • Responsive permitting, ongoing maintenance of the public realm. • No Washington State income tax. • Proximity to Portland International Airport. • Well regarded public schools. • The Downtown Camas Association is completing a comprehensive Downtown lighting plan with a state grant to support safety.	• Rising housing costs, purchasing a home is unaffordable for those under 120% AMI. • High industrial rents and very low industrial real estate vacancies. • Development standards related to height was cited as a barrier by stakeholders. • Need Downtown development to be feasible to build (pencil). • Highly constrained lands may be difficult to develop for commercial or industrial land uses (such as in Washougal).
OPPORTUNITIES	**THREATS**
• Attract highly skilled workers with locational flexibility. • Develop pathways for youth to gain skills and seek jobs in Camas. • Identify target industries for managing land capacity and expected growth. • Incentives for existing business owners, wishing to expand their operations. • Opportunities for Downtown redevelopment and partnerships with Downtown businesses and nonprofits (such as Downtown Camas Association, the Port, Chamber, Farmers Market, and more). • Develop mill ditch into a compelling, easy, and beautiful trail system that is clear to connect with from Downtown and improve the trails to encourage local resident activity and to attract visitors. • Need more hotels and conference space. • City should partner more with the Downtown Camas Association on incentive programs. • Improve pedestrian safety throughout downtown.	• Unequal rates of homeownership by race and ethnicity indicating unequal economic opportunities. • Disparities between remote and non-remote workers. • Anchor employer changes. • Safety threats that could be supported by better lighting, street tree improvements, safer crossings for pedestrians in the Downtown. • Need to balance preserving historic features with new development in Downtown.

Broad Planning Context

Comprehensive planning in Washington is guided by the Growth Management Act (GMA), a series of statutes first adopted in 1990 which requires cities and towns within the state's most populous counties to fully plan for future growth (RCW 36.70A) and develop mandatory comprehensive plan elements. State provisions set limits on what actions cities and counties can take to support economic development. Article 8, Section 7 of the state constitution specifies that "No county, city, town or other municipal corporation shall hereafter give any money, property, or loan its money, or credit to or in aid of any individual, association, company or corporation, except for the necessary support of the poor and infirm."[16] Given this limitation, cities generally cannot directly use public funds to attract private development and instead target policies that facilitate economic growth through land use, infrastructure, tourism, marketing, and partnerships with nonprofit community-based organizations.

Cities in Washington also coordinate with county-level Associate Development Organizations (ADOs) that represent each of Washington's counties, funded in part by the state Department of Commerce. The Columbia River Economic Development Council (CREDC) represents Clark County and presents a baseline of goals and objectives for the region. Their former 2018-2023 Comprehensive Economic Development Plan outlined goals and actions based on a vision and set of values and guiding principles identified through extensive engagement with local partners, which have carried through and expanded with the more recent 2024 Comprehensive Economic Development Plan with new supplemental actions to encourage economic development for communities within Clark County.

New objectives in CREDC's regional economic development plan expand on support for entrepreneurship, placemaking investments, fostering development and redevelopment projects, and expanding equitable employment opportunities. The Plan also recognizes the growing role of smaller cities like Camas outside of Vancouver which are seeing fast population growth and opportunities to develop their own employment bases.

[16] RCW 35.21.703 does allow cities to contract with nonprofit corporations to advance economic development.

Table 5 Goals and Objectives from 2018-2023 CREDC Comprehensive Economic Development Plan

Source: CREDC

	2018 Plan Objectives	2024 Update Objectives
Expand the Existing Base	• Become Industry Experts • Strategically Market Industry Clusters • Build a Start-Up Ecosystem	• Reduce Site Infrastructure Hurdles • Grow Start-Up Ecosystem • Support Permitting Consistency • Explore Commercial Code Flexibility • Foster Small Business Networking
Support People	• Foster Skills Development • Prepare Youth for Economic Opportunity • Launch a Brain Gain Initiative	• Align Workforce with Employer Needs • Enhance Access to Career Pathways • Support Talent Retention
Create Place	• Each Community Creates a Placemaking Strategy • Embrace Economic Opportunity in Urban Center • CREDC Tells the Story of Place • Make Areas Desired by Industry Clusters Shovel-Ready • Determine All Transportation Needs on a Regional Level	• Leverage Placemaking Investments • Encourage Infrastructure Investments That Cross Municipal Boundaries

The Clark Countywide Planning Policies provide guidance on economic development across incorporated and unincorporated areas of the County (the County also distinguishes policies specifically for unincorporated areas, but not for jurisdictions and their UGAs). These policies (adopted in 2015) are currently being updated. The updated version will be reviewed as a part of the policy and goal development stage of the Comprehensive Plan update.

Buildable Land Capacity and Employment Capacity

Cities fully planning for adequate land capacity to meet the needs of the community must understand their current employment base, development trends, workforce housing availability, income segments of the population, and future projections. To fully plan for growth and meet community needs in compliance with state provisions, more suburban cities like Camas that are

growing in terms of employment must understand the dynamics of the local and regional economy, consider where employment is concentrated and how residents and workers access employment opportunities, what industries are growing or declining, and whether there is sufficient space to fulfill anticipated employment land needs alongside other uses.

Washington's Review and Evaluation Program (the Buildable Lands Program, RCW 36.70A.215) requires certain counties, including Clark County, to establish their own buildable lands programs and review past development and density patterns to see if local policies are effective and prepare to plan for the next 20 years of growth, through a "Buildable Lands Report" released before a Comprehensive Plan update.

Clark County has updated its Vacant Buildable Lands Model (VBLM) as a part of their 2025 periodic update of their Comprehensive Plan. This VBLM provides a basis for the available employment capacity in the City of Camas based on available buildable land (including both vacant and underutilized land), current zoning, and market and employment density assumptions. Table 6 below shows the County's current allocation of jobs for the City of Camas and the Camas Urban Growth Area (UGA) and the 2023 Vacant Buildable Lands Model (VBLM) capacity and yield calculations.[17]

This analysis shows that the City of Camas has a job target of 13,658 jobs, with a preliminary estimated capacity showing availability for 11,363 jobs, as well as additional assumptions for work from home, construction, and government jobs which have specific land need considerations documented in Clark County's 2025 Population, Housing and Employment Allocation memorandum.[18]

Evaluating employment capacity is necessary to determine whether the job growth allocation (determined by the county) can be accommodated within the City of Camas and Camas UGA(s). Sufficient capacity is available if employment growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for employment growth capacity. To help provide geographic context for this analysis, a map of the City of Camas and its existing and proposed Urban Growth Areas was created see Figure 16.

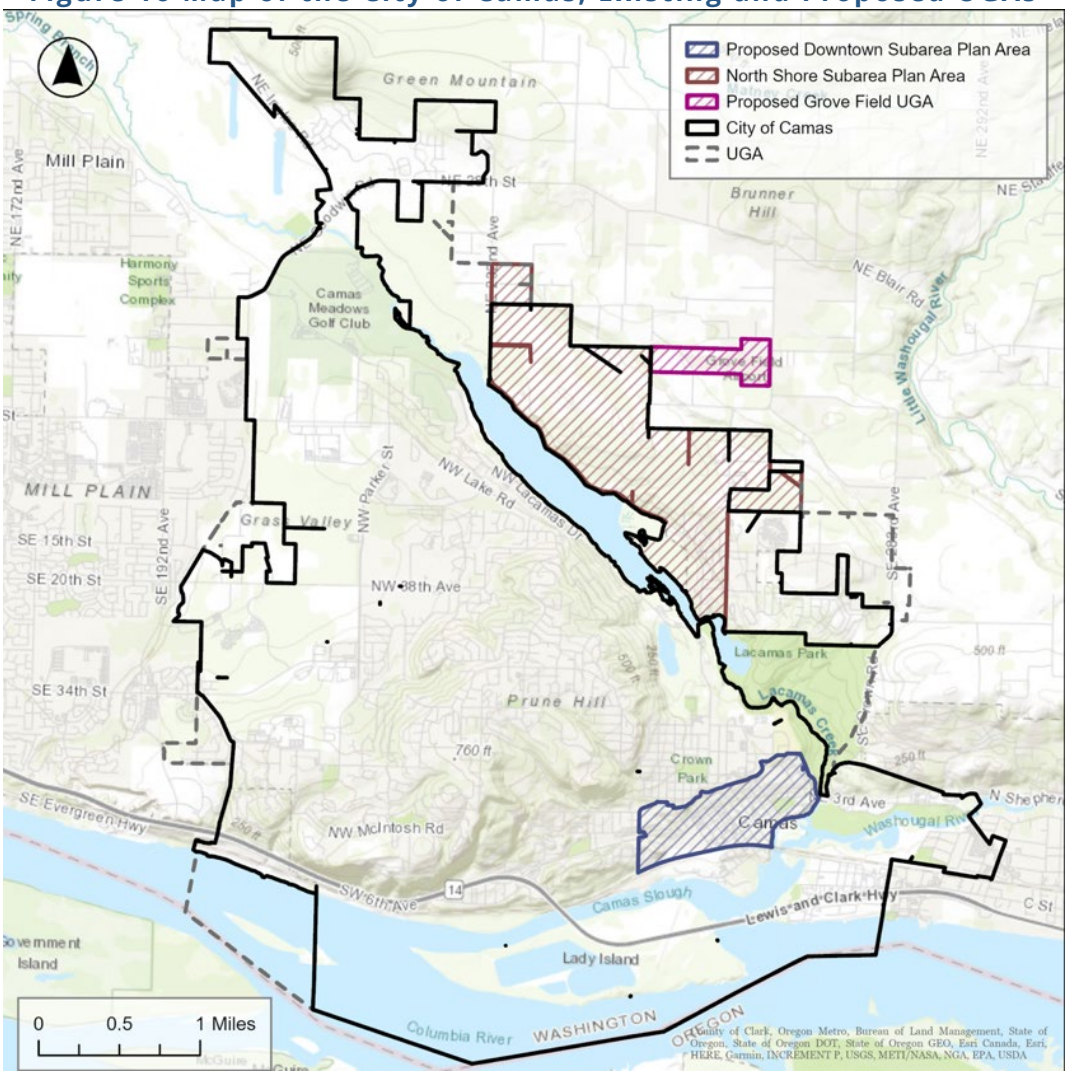
[17] This has been modified since the County's 2020 Buildable Lands Report, which identified 963 net buildable acres (296 on commercial land, 667 on industrial land) in the Camas UGA (Clark County Buildable Lands Report, 2023).
[18] Clark County Community Planning, 'Clark County Comprehensive Plan 2025 Update 2025 Population, Housing and Employment Allocation – Issue Paper 5,' April 2024, https://clark.wa.gov/sites/default/files/media/document/2024-04/issue_paper_5_pop-emp_alloc_4_17_24.pdf.

Table 6 Employment Capacity and Allocation by UGA, Clark County

Source: VBLM 2023, Capacity and Yield by Jurisdiction. Note: The County total estimate is 88,100 jobs accounting for government, construction, rural, and work from home jobs.

Jurisdiction	2023-2045 Employment Allocation	2023 VBLM Capacity	Assumptions		
			Work from Home	Construction	Government
City of Camas and Camas UGA	**13,658 jobs**	**11,363 jobs**	615 jobs	879 jobs	549 jobs
Total Clark County UGAs and Cities	**83,695 jobs**	65,091 jobs	3,524 jobs	5,038 jobs	8,600 jobs

Figure 16 Map of the City of Camas, Existing and Proposed UGAs



Additional analysis refining the employment capacity is underway that is based on key City of Camas zoning and UGA modifications. The City of Camas is proposing zoning modifications and the addition of a new UGA that would allow for additional employment capacity. According to these refined employment capacity estimates, Camas would have capacity for 12,273 jobs which would almost meet the 2045 employment target of 13,658 jobs. The finalized estimates will depend on the final preferred alternative.

CLARK COUNTY'S BUILDABLE LANDS REPORT, 2023, KEY FINDINGS

Clark County's Buildable Lands Report was adopted in June 2022 to update the methodology and Vacant Buildable Lands Model (VBLM) and updated with 2023 data.

- The Clark County Buildable Lands Report and employment allocations and City of Camas estimates indicate that there is sufficient employment capacity for employment growth in the county through 2045.
- Camas has the second largest share of total projected jobs in Clark County (17.5%) after the City of Vancouver and the Vancouver Unincorporated Urban Area (U). The City of Camas is expected to have capacity to accommodate 11,363 jobs, with about half (55%) of new employment on commercial land and half on industrial (45%).

City of Camas Profile

More than 10,000 years ago, Native Americans occupied the Columbia River Valley in the area where Camas is now situated. Before Camas was incorporated, a paper mill owned by the LaCamas Colony Company was established in 1883 to help supply newsprint for The Oregonian. Shortly thereafter, the City of Camas became an incorporated city in 1906. The City is named after the camas lily, a deep blue flowered plant with edible onion-like bulbs valued by various Columbia river Native American Tribes.[19] The paper mill expanded in the early 20th Century playing an important role in the local economy and grew to become Clark County's largest manufacturing company with 2,700 employees by 1971.[20] Located in the western edge of Downtown Camas along the Columbia River, the mill then experienced a downturn beginning in the 1980s that continued into the 21st Century, resulting in a reduced workforce. More recently, in 2018, the mill now owned by Georgia-Pacific, shut down several facilities and all but one of its paper machines and downsized its workforce to roughly 150 workers. In 2024, the mill continues to operate with a reduced workforce.

[19] City of Camas history: https://www.cityofcamas.us/community/page/camas-history
[20] Source: https://www.camaspostrecord.com/news/2023/sep/07/camas-mill-celebrates-its-140th-birthday/#:~:text=An%20entire%20wall%20of%20photos,built%20the%20mill%20to%20produce

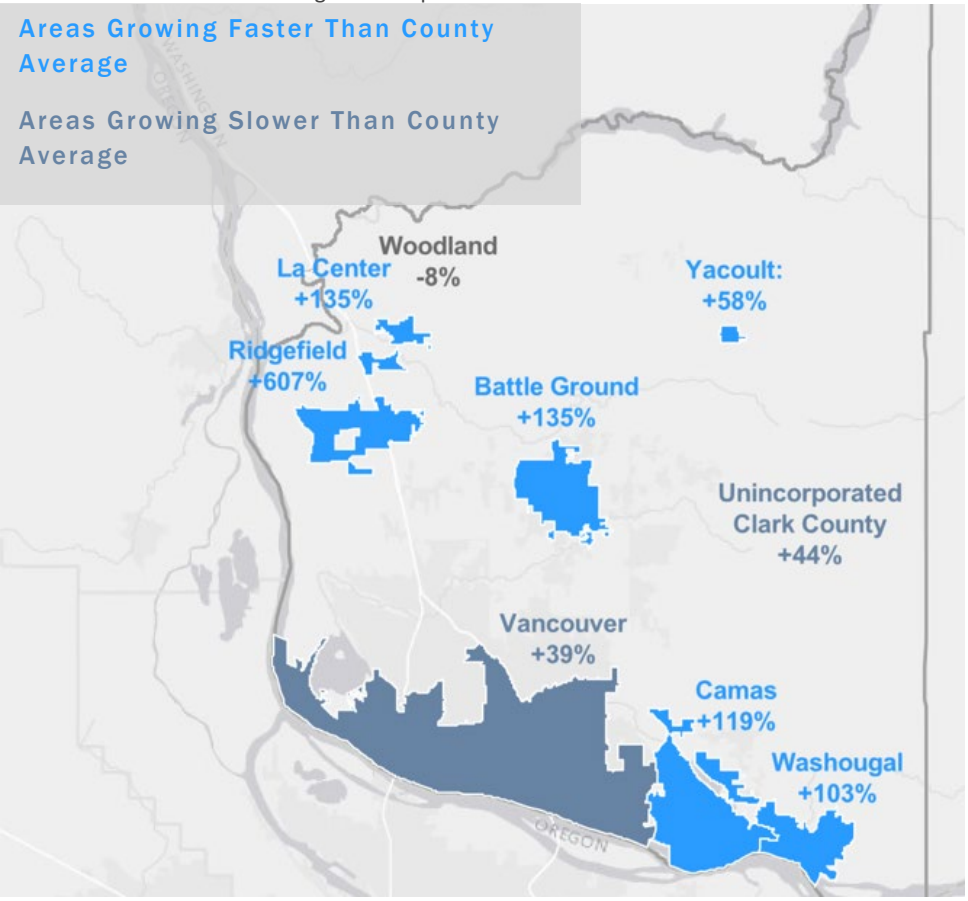
The early economy in Camas was at first dominated by manufacturing but has shifted and diversified over time. The 2015 Comp Plan describes a transition where the City's past economic health was closely tied to the paper mill and then shifted to become more diversified supporting many technology and manufacturing firms, as well as a growing school system and professional offices. In the last four decades, the family-friendly City with close ties to the Portland Metropolitan Region has continued to attract more residents especially from 1990 to 2000 by almost doubling in size to almost 13,000 people, increasing to a little over 19,000 people in 2010, and then reaching 27,420 people by 2023. Similar to the City of Vancouver, Camas has experienced high population growth over the last two decades, with an average annual growth rate of 5.2% which is double the rate in Clark County and Washington State.

Today, the City of Camas is a highly desirable place to live, offering a prime location nearby the growing cities and employment centers of Vancouver and Portland, and the smaller cities of Washougal and Battle Ground in south Clark County. The City of Camas is sandwiched between the City of Vancouver (sharing a border on the west side of Camas) to the west and the City of Washougal to the east. At a regional level, the City is interconnected to the Portland Metropolitan region, located northeast of Portland (see map below).

Camas has been working to advance its economic development goals in recent years while investing in quality-of-life amenities that make it as competitive location for attracting workers and residents. Recently, the City adopted a North Shore subarea plan (2022) to support community vibrancy and economic development strategies and the City is working to adopt a new Downtown subarea plan as a part of the 2025 Comprehensive Plan periodic update project. The City has also been expanding its inventory of parks space by leveraging the County's Legacy Lands program to expand its offerings of natural areas and recreation facilities. As larger economic trends increase locational flexibility (especially for professional services and traditionally office-based jobs), these types of investments will be critical for cities in the region to continue drawing in and retaining a residential base and workforce. The Port of Camas-Washougal manages an airport that is outside City limits, but most of the developable land in the North Shore area is within the airport influence area.

Figure 17 Camas Compared to Clark County Cities

Source: Office of Financial Management Population Estimates



Economic Development Overview

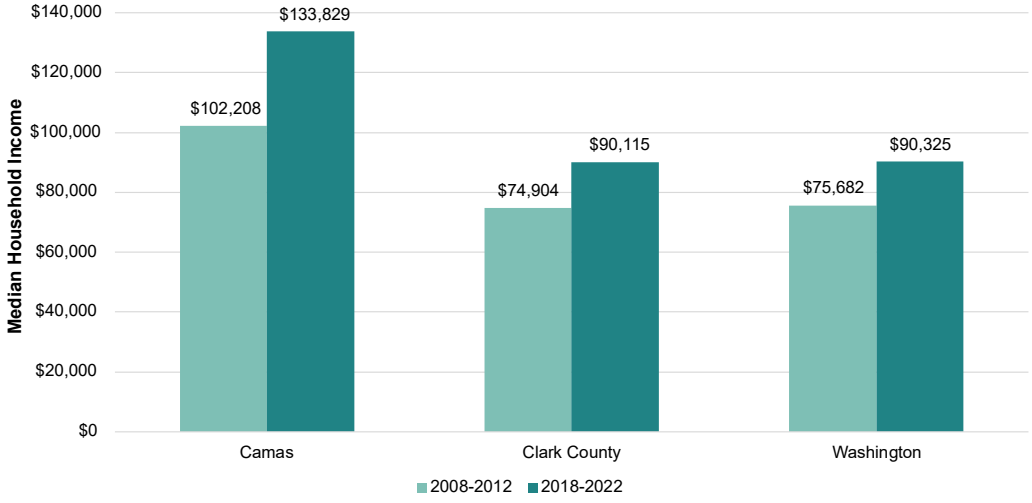
Economic development for the City of Camas is the creation and sustenance of a diverse array of employment opportunities, ensuring the tax base currently enjoyed by the City endures and is strengthened. The economic health and well-being of the City are tied to commitments to promote a wide range of employment opportunities for the citizens of the community and to provide a setting and quality of life that attract businesses and residents.

Planning a diverse and vibrant economy must start by understanding current economic conditions in the City and Clark County. While the City's past economic health was closely tied to the paper mill, in more recent years, the City's economy has diversified and now supports many technology and manufacturing firms, as well as a growing school system and professional offices. The figures below compare the median household income for Camas, Clark County, and Washington as well as employment and related trends over time.

As illustrated in Figure 18 when compared with Clark County, wages in Camas are higher and have grown over the last decade. Higher wages can have positive impacts on other aspects of the economy, and community members have expressed their desire to support living-wage jobs, particularly in healthcare and high technology.

Figure 18 Median Household Income, Camas, Clark County, and Washington

Source: U.S. Census Bureau, 2008-2012 and 2018-2022 ACS 5-Year Estimates
Note: 2008-2012 values are adjusted for inflation. Median household incomes are shown in 2022 $.



Growth in employment, population, and housing are interconnected. In general, communities with a high ratio of population to jobs can be characterized as "bedroom" or commuter communities, where there are fewer jobs than residents in the city. In Camas, there are roughly three residents for every one employee, indicating a continued trend from the past decade.

The ratio of jobs to housing has slightly increased from 0.9 to 1.0, indicating a healthy balance of housing units in comparison with employment and meeting the jobs-to-housing ratio of 1:1 adopted by Clark County (Resolution 2016-03-01). As the City grows, maintaining this trend can help to ensure there is adequate housing for those who work in Camas.

Table 7 Population, Employment, and Jobs Comparison Ratios, Camas, 2010-2021

Source: OFM, LEHD-LODES. Note: Employment data is currently only available at the City level through 2021.

	Trends			Ratios	
	Population	Employment	Housing Units	Population : Jobs	Jobs : Housing
2010	19,355	6,508	7,072	3.0	0.9
2021	26,870	9,558	9,586	2.8	**1.0**

Overall, Clark County has seen fluctuations in employment since 2000, with the most notable decline in employment in the wake of the 2008 recession and at the onset of the COVID-19 in 2020. However, the County has also seen a rapid rebound from pandemic trends, with sharp employment growth after 2020. The City has generally seen positive growth in employment over the last two decades. The City saw less of a decrease during 2020 compared to Clark County overall, which may reflect Camas' growth in remote workers during this period (Figure 19).

Figure 19 Total Covered Employment Change YOY, Clark County (2001-2022)

Source: Washington Employment Security Department

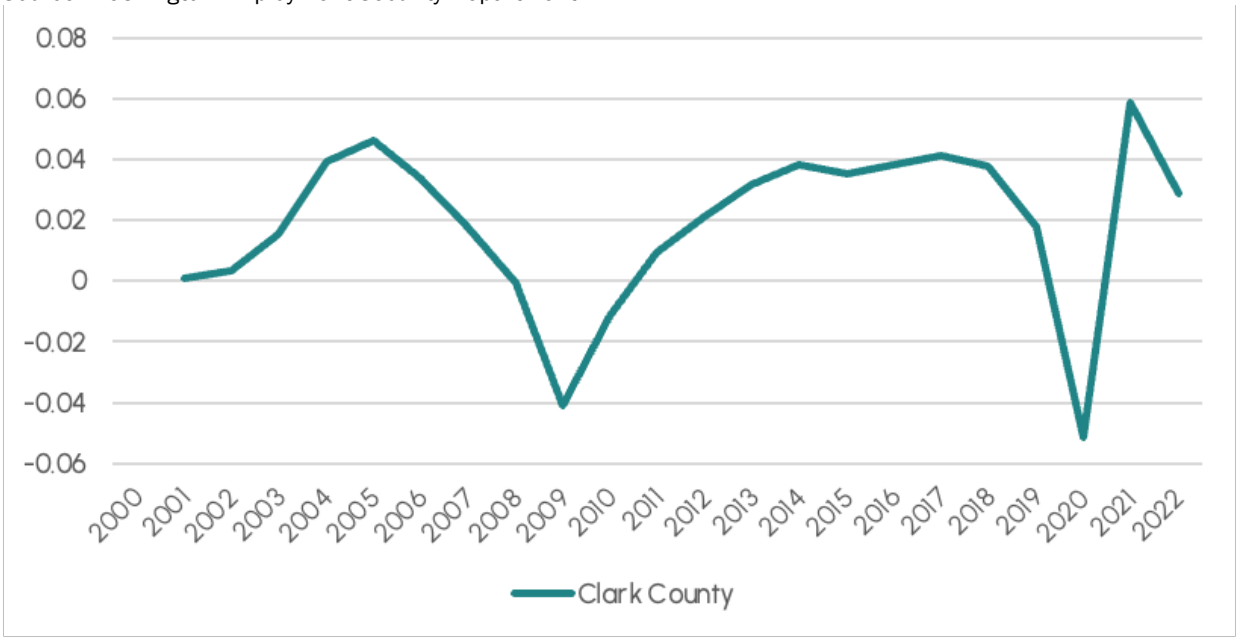
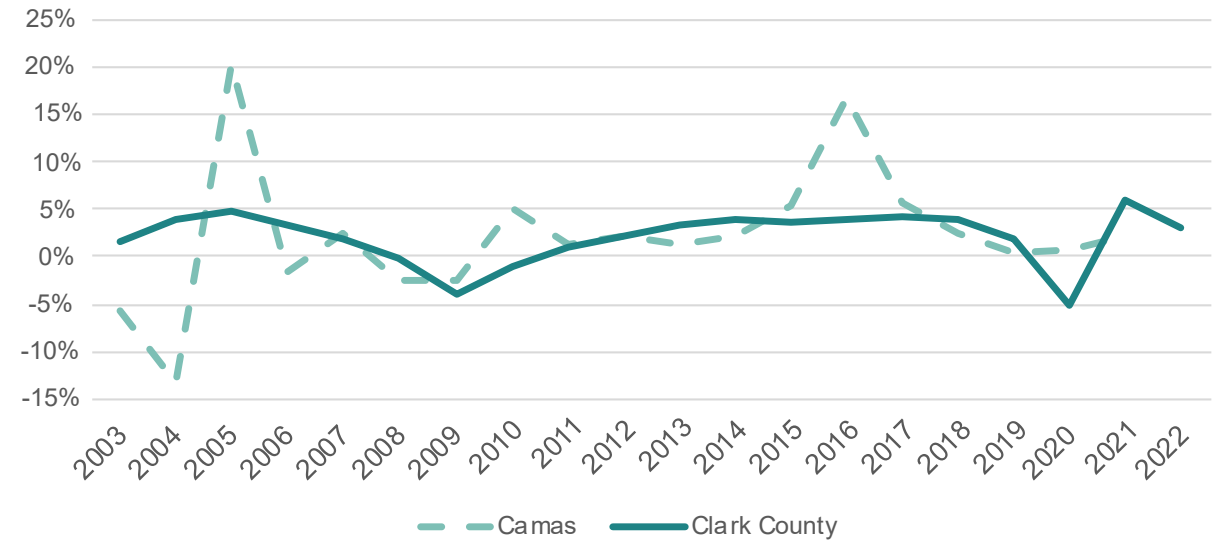


Figure 20 Total Employment Change YOY (Primary Jobs), Camas and Clark County

Source: Washington Employment Security Department, LEHD-LODES. Note: LEHD-LODES data for the City of Camas only available through 2021



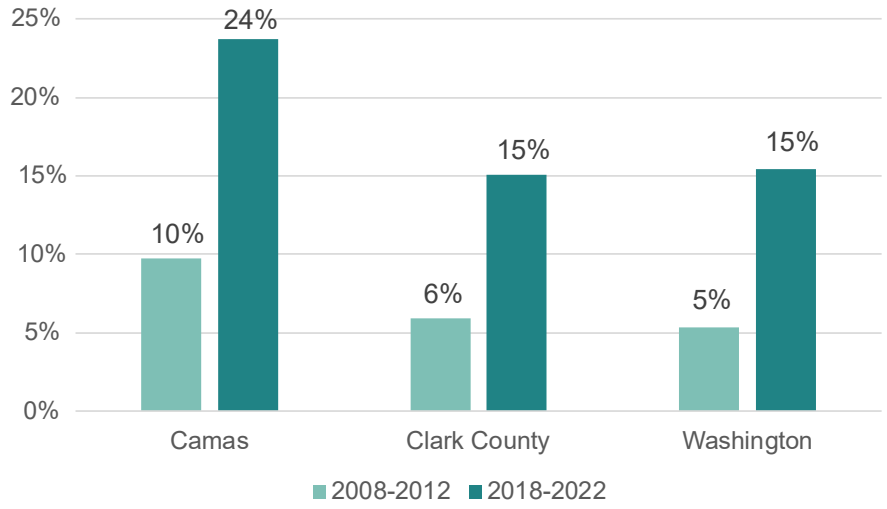
The Economic Development Element establishes goals and policies that seek to maintain the diversification of employment opportunities and support the continued growth of the Camas economy and attainment of the jobs target by 2045.

The City is targeting businesses that provide a greater proportion of living-wage jobs. Increasing retail services in support of residential, industrial, and professional business growth

is highly desirable. Camas is also seeing an increasing share of remote workers at a higher rate than the County or State, with nearly a quarter of workers falling into this category in 2022.

Figure 21 Share of Remote Workers, Camas, Clark County, and Washington, 2012-2022

Source: ACS, 2008-2012, 2018-2022



Summary of Demographic and Economic Trends

A summary of key findings from this Economic Development Element analysis is provided below to help describe key insights regarding the economic context, economic opportunities and challenges informing plan updates (Technical Appendix provides the full findings).

- **Camas has an aging population with a median age of 40 years in 2022 and a growing share of residents aged 60 years and over.** This group typically represents late-career workers or retirees. Median age in Camas is higher than Clark County overall and quickly growing since 2012, likely indicating a combination of natural growth and in-migration of older adults.
- **Camas has a higher share of residents 25 or older with at least a college level bachelor degree compared to Clark County or Washington State**, with 79% of residents holding these degrees in 2022. This share of residents rose quickly from only 37% in 2012.
- **Median household income for all households in Camas was nearly $134,000 in 2022, higher than Clark County or Washington State.** Since 2012, median income for residents of Camas increased by about 30% (in nominal dollars, not adjusted for inflation), more than either the County or State.
- **The City of Camas has seen generally positive trends in employment growth over the last two decades,** with notable increases in the number of workers in 2005, 2010, and 2016. The City of Camas employment grew from approximately 6,584 to 9,558 between 2011 and 2021.

- **The current employment to housing ratio in Camas was 1.0 in 2021, meaning that there is about one employee working in the City for every housing unit.** This ratio indicates that Camas has a well-balanced housing stock to accommodate workers in the City.
- **In 2021, the top five industries by employment in Camas were Finance and Insurance; Manufacturing; Educational Services; Professional, Scientific, and Technical Services; and Wholesale Trade.** Four of these five top industries paid above average wages (all except Educational Services paid below average wages). Finance and Insurance was the City's fastest growing industry (with an average annual growth rate of about 33%).
- **Top employers also reflect many of the County's largest industries, including professional services like finance and insurance, technology, manufacturing, and health care. Four of the City's top ten employers were in the manufacturing industry as of 2020.** Within Camas, employment has concentrated at two nodes, including the Downtown area to the southeast and corporate campuses in the Grass Valley near the border with the City of Vancouver.
- **Camas is part of an interconnected region, with more residents commuting out of Camas for work (8,159) than employees commuting in (6,982) as of 2021. Approximately 9,102 people are employed in Camas and among this total nearly 90% live in Camas (8,159) but work outside of the city and the remaining 10% live and work in Camas (943 people).** Top commuting destinations for Camas residents are primarily nearby, larger cities with employment hubs like Vancouver and Portland, while only 10% remained in the City. Nearly 59% commute less than 10 miles. The fourth most common destination for residents was Seattle, likely indicating remote workers at companies based in the Puget Sound area. Workers commuting to Camas originated from similar destinations, with one quarter coming from Vancouver.
- **Washington State Employment Security Department projections for future employment growth estimated that the Southwest Washington region will grow by about 19% overall by 2031.** The sectors expected to see the greatest increase in their share of employment are Professional/ Business Services, Leisure/ Hospitality, Education/ Health Services, Information, and Other Services.
- **Camas has a larger share of remote workers compared with Clark County and Washington State.** In 2022 one in four workers in Camas was a remote employee, compared to 15% in both the County and State overall. The share of remote workers in Camas has grown since 2012.
- **Since 2020, the City has issued 8,652 new business permits, with the largest volume of new permits in 2020 and a decreasing amount annually after 2020.** General business establishments accounted for the largest portion of these permits (74%), followed by home occupations (25%), and nonprofits (1%).
- **Camas' taxable retail sales were higher than those in most comparable jurisdictions in Clark County over the past decade**, competing primarily with the City of Battle

Ground for the highest annual sales. In 2022, total taxable retail sales reached an all-time high of over $600 million.

- **Retail rents in Camas had slight upward growth since 2014 while vacancies trended downward, indicating increasing demand for retail. Industrial real estate in the City of Camas is also performing well compared to Clark County in 2024.** The City is home to only about 3.9% of Clark County's industrial real estate in square footage but saw a sharp increase of industrial rents PSF in 2022, growing by over 200% year-over-year (YOY) to $23. Vacancy rates for industrial real estate were also extremely low in Camas in 2024 YTD at 1.7%, indicating high demand in the industrial market.

Implementation Tools and Strategies

Realizing the City of Camas economic development goals requires building on the City's potential while overcoming existing constraints. The following implementation strategies will generate positive momentum toward creating a more balanced and healthy economy.

Programmatic Strategies

- **Economic Development Committee:** Establish a mayor-appointed committee to help refine and implement Camas' economic development goals and strategies. The committee will:
  - Convene government, private sector, and nonprofit partners to leverage resources or secure financial support for economic development initiatives that benefit Camas and the broader region. In addition, this committee would help provide input on the Economic Development Strategy.
- **Economic Development Strategy**: Create an Economic Development Strategic Plan involving the Economic Development Committee, local businesses, community groups, school districts, and city leadership that further identifies priorities for job creation in targeted industries, infrastructure needs, reducing regulatory barriers, and incentives to attract needed and desired businesses.
  - Promote the development of an economic development strategy that will capitalize on the creation and retention of industries that provide living-wage jobs.
  - Future economic development strategy planning should capitalize on existing facilities and infrastructure and include a mix of uses that are trail- and transit-oriented and designed with high-quality streetscape appeal.
  - Lead an economic development strategy update every 1 to 3 years.

Financial Strategies

- **Leverage Grant Dollars**: Utilize federal, state, and county grants to support the establishment and expansion of small local businesses and infrastructure improvements benefiting economic development areas.
- **Incentives**: Explore incentives to encourage mixed-use development and provide affordable housing options (such as TIF, LID, MFTE changes).

- **Partnership**: Coordinate with the Columbia River Economic Development Council (CREDC) or other relevant organizations, to explore collaborative opportunities in promoting regional workforce development.
- **Opportunity Site Inventory**: Identify sites where the city can participate in cost-sharing mechanisms for infrastructure development.
    - Establish a policy that prioritizes capital investments to or on opportunities sites or other capital projects that better connect commercial nodes. This could include sidewalks, trails, bike paths, etc.

Regulatory Strategies

- **Code Audit**: Ensure the zoning code supports/incentivizes a broad range of needed and desired businesses in various zones.
    - **Study Allowed Uses:** Ensure needed and desired businesses are allowed in certain zones, including accessory uses which can support home-based businesses.
    - **Design standards**: Consider revisiting existing design standards to ensure they adequately support efforts to maintain and enhance existing character without compromising development feasibility.
    - **Flexible parking standards:** Develop flexible parking standards that can respond to site conditions.
    - **Revised Gateway Corridor Design Standards:** Update the design standards and allowed uses for gateway corridors to enhance its natural beauty but deemphasize its auto-oriented environment.

Procedural Strategies

- **Capacity Building**: Leverage increased tax revenue from population growth to support Camas' economic development strategy.
- **Clear and Objective Development Standards**: Establish clear and objective development standards for all development types, reducing the need for conditional use processes or other discretionary review processes.
- **Monitoring**: Monitor the performance of economic development such as with business retention and attrition, changes in tax revenues, and permitting of employment facilities. Monitor the financial impact of new programs, policies, and regulatory requirements on development feasibility by providing a report update every 1-3 years describing key metrics such as development changes and infrastructure projects.

Economic Development Goals and Policies

Goal ED-1 Citywide Economic Development

Maintain a diverse range of employment opportunities to support all residents, provide sufficient land supporting employment needs, and provide a setting and quality of life that attract and retain living-wage jobs[21] throughout the community.

Policy ED-1.1 Work with partners to identify strategies to proactively recruit businesses and ensure that tools and incentives are in place to attract sustainable and innovative industries to expand and provide stable living-wage employment.

Policy ED-1.2 Work with partners (such as the Chamber of Commerce, education programs, Workforce SW WA, CREDC) to provide apprenticeships, internships, vocational training schools, entrepreneurship programs, equitable opportunities, and on-the-job training in targeted industry sectors.

Policy ED-1.3 Encourage appropriate reuse, environmental cleanup, and redevelopment of older and deteriorating commercial areas and industrial brownfield sites. Identify opportunities to support place-based economic development, provide connections to the waterfront, diversify the economy, and support mixed-use development.

Policy ED-1.4 Foster and expand year-round recreational services, lodging, conference spaces, dining, and retail options to support tourism, benefit residents and employers, leverage Camas' strong parks and open space assets, and connect to the waterfront.

Policy ED-1.5 Participate in regional recruitment organizations to ensure the availability of an adequate supply of commercial and industrial employment land to support the City's economic development goals. Evaluate city resources to support economic development

[21] A living-wage job is one that pays an income sufficient to cover basic living expenses without financial hardship, allowing an individual or family to afford essential needs such as housing, food, healthcare, transportation, childcare, and other necessities without relying on public assistance. MIT Living wage calculation (2024): https://livingwage.mit.edu/counties/53053.

planning and implementation by designating a point-of-contact for economic development programs and serving as a liaison to the business community.

Policy ED-1.6 Support and encourage employees to use the Commute Trip Reduction Program. Encourage businesses to support remote work to reduce trips and implement a trip reduction program with incentives for carpooling, transit ridership, and other options beyond single-occupancy vehicles.

Policy ED-1.7 Encourage mixed-use development and complementary businesses throughout the City to support industry clusters and leverage resources.

Policy ED-1.8 Review regulatory design standards and planning procedures for industrial and commercial facilities and provide economic incentives to promote private investment in start-ups, incubator businesses, and businesses relocating to Camas.

Policy ED-1.9 Coordinate with Clark County and evaluate adding a Grove Field Urban Growth Area (UGA) for employment purposes to support employment targets.

Policy ED-1.10 Explore ways to support remote workers such as community hubs and third places and code revisions for co-working spaces.

Policy ED-1.11 Implement the Downtown Camas subarea plan and the associated goals and actions (see downtown subarea element).

Policy ED-1.12 Promote the growth of residential development in the North Shore as described in the Camas North Shore Subarea Plan.

Goal ED-2 Local Business Development

Promote business creation, expansion, retention, and diversification throughout the community to create a consistent and reliable tax base and a healthy, diversified local economy.

Policy ED-2.1 Identify and plan for infrastructure (such as the capital facilities plan) to nurture and incubate new businesses. Explore financing tools such as tax increment financing to fund infrastructure to support development and investment in targeted areas.

Policy ED-2.2 Support retention, expansion, and recruitment of local businesses in Camas.

Policy ED-2.3 Support development standards that promote high-quality building and site design, encourage businesses to operate in a sustainable and environmentally responsible manner and integrate energy efficient design features.

Policy ED-2.4 Collaborate with partners and agencies (such as CREDC and the Port of Camas Washougal) to develop economic strategies that promote diversification of business and industry in the city and facilitate opportunities for entrepreneurship.

Policy ED-2.5 Work with partners to proactively recruit and promote the growth of businesses and industries that provide, at a minimum, cost-of-living wages and economic diversity in alignment with the CREDC regional economic development plan.

Policy ED-2.6 Explore the creation of an economic development grant program for local businesses in connection with local partners.

Policy ED-2.7 Facilitate an environment for the success and growth of small businesses to maintain a strong, diverse, and resilient local economy.

Policy ED-2.8 Encourage investments and programs that provide resources and support to minority-owned and woman-owned businesses.

Policy ED-2.9 Increase the number of neighborhood business districts to expand local access to goods and services. Consider expanding mixed-use zoning options with ground floor commercial uses that allow residents to walk or roll from home.

Policy ED-2.10 Encourage shopping local to support Camas businesses.

Goal ED-3 Mixed Use and Commercial Areas

Encourage efficient and innovative development that thoughtfully mixes commercial and residential land uses that are pedestrian-friendly and consider the context of the surrounding area.

Policy ED-3.1 Develop commercial and mixed-use areas that are safe, comfortable, and attractive to pedestrians.

Policy ED-3.2 Encourage efficient land use in the mixed-use land use designation by facilitating compact, high-density development and minimizing the amount of land that is needed for surface parking.

Policy ED-3.3 Promote the growth of businesses such as grocery stores, medical offices, and restaurants that meet the retail and service needs of the community.

Policy ED-3.4 Encourage new developments to provide neighborhood parks and shared use paths to encourage greater physical activity and connect residential areas to commercial centers, public transit, and community facilities.

Goal ED-4 Mixed Employment and Industrial Areas

Providing a mix of traditional industrial and non-industrial land uses to maximize opportunities and partnerships and facilitate employers to remain, expand, or locate in Camas.

Policy ED-4.1 Evaluate the costs and benefits associated with adding the Grove Field Urban Growth Area to the North Shore Subarea Plan.

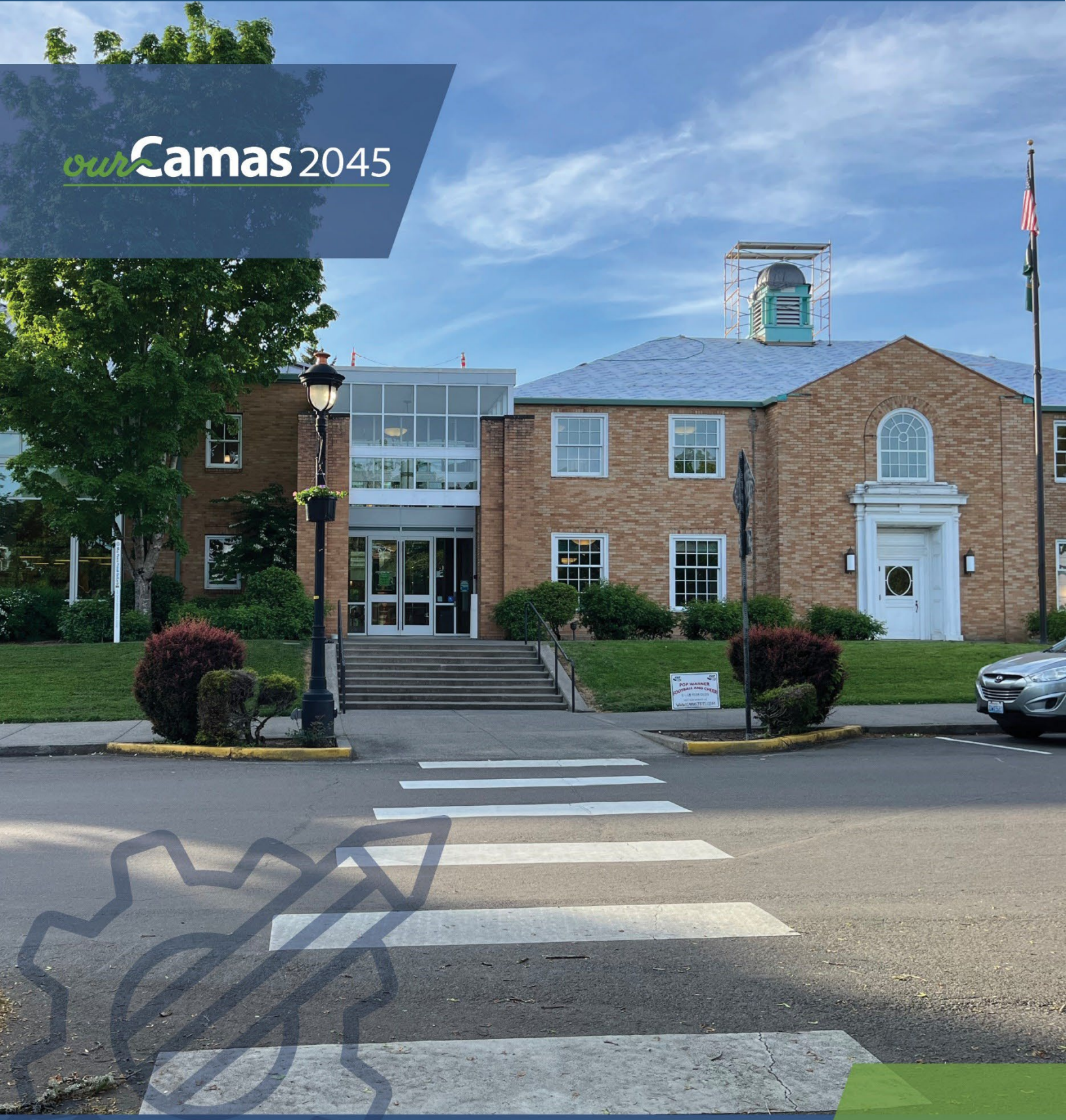
Policy ED-4.2 Preserve large tracts of land for large industry and master-planned commercial development within mixed employment land use areas.

Policy ED-4.3 Support a mix of light industrial, research and development, manufacturing, and office spaces through flexible zoning that allows for evolving business needs.

Policy ED-4.4 Support the development of business parks, incubators, and innovation hubs that integrate industrial and high-tech employment uses.

Policy ED-4.5 Ensure zoning and development regulations support both large-scale employers and small businesses, including start-ups and maker spaces.

ourCamas 2045



Technical Appendices

11

11. Technical Appendices

[Appendices to be included in future draft]

2025-2026 Capital Improvement Project List

6-Year Street Plan

Camas General Sewer Plan (2022)

Camas School District Capital Facilities Plan (2022)

Camas Stormwater Management Plan (2024)

Camas Water System Plan (2019)

Capital Facilities Plan

Clark County Comprehensive Plan (2025)

Economic Opportunity Analysis (2024)

Engagement Summary

Facility Conditions Assessment, Volumes 1 and 2

Housing Action Plan (2021)

Housing Needs Assessment (2024)

Parks and Open Space Management Plan (POSMP) (2025)

Parks, Recreation & Open Space Plan (2022)

Transportation System Plan (2025)

APPENDIX D

CAMAS FLOW MONITORING REPORT 2025

Camas Flow Monitoring 2025

Final Report Submitted to **Carollo Engineers** May 28, 2025



ADS ENVIRONMENTAL SERVICES

846 Industry Dr.
Tukwila, WA 98188

800-633-7246
www.adsenv.com

May 28, 2025

Max Mozer

Carollo Engineers

1200 5th Avenue Suite 900

Seattle, WA 98101

SUBJECT: Camas Flow Monitoring 2025

Dear Mr. Mozer,

ADS is pleased to submit the report for the project referenced above completed on behalf of Carollo Engineers. The metering was conducted at four (4) flow monitoring locations and one (1) rain monitoring location. The study was conducted during the period of Wednesday, 15 January 2025 to Tuesday, 29 April 2025.

The report contains depth, velocity, and quantity hydrographs as well as daily long tables for the metering period. An Excel file containing depth, quantity, and velocity entities for the monitoring location in 15-minute format was provided previously.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Cody Mahaffey at (425) 620-6412.

It has been our pleasure to be of service to you in the performance of this project. Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,
ADS ENVIRONMENTAL SERVICES

Justin Hatch
Hydraulic Data Analyst

Camas Flow Monitoring 2025

Prepared For:

Max Mozer
Carollo Engineers
1200 5th Avenue Suite 900
Seattle, WA 98101

Prepared By:

ADS, LLC
846 Industry Dr.
Tukwila, WA 98188

Scope and Methodology

Introduction

Carollo Engineers entered into an agreement with ADS Environmental Services to conduct flow monitoring at (4) four flow locations and (1) one rainfall gauging location in Camas, Washington. The study was scheduled for a period of (105) one-hundred and five days. Once in place, the flow monitoring equipment was to be used to measure depth, velocity, and to quantify flows. Data obtained from the study will be used for inflow and infiltration analysis.

Project Scope

The scope of this study involved using a flow monitor to quantify wastewater flow at the designated locations for the study period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions
- Flow monitor installation
- Flow monitor confirmations and data collections
- Flow data analysis

Additionally, temporary rain gauge monitors were used to measure and record rainfall at the designated locations. Specifically, the study involved the following key components.

- Investigate the proposed rain gauge sites for sufficient exposure and security
- Rain Gauge installations
- Manually confirming rain gauge tipping bucket operation and date collections
- Rain data analysis

Equipment installation was completed on January 14, 2025. The monitoring period began on January 15, 2025 and was completed on April 29, 2025. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment



The ***ADS Triton+*** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Triton+ monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The Triton+ monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The Triton+ monitor can support two (2) sets of sensors. The sensor option used for this project was:

The Peak Combo Sensor installed at the bottom of the pipe includes three types of data acquisition technologies

The ***up looking ultrasonic depth*** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by sensor to calculate depth.

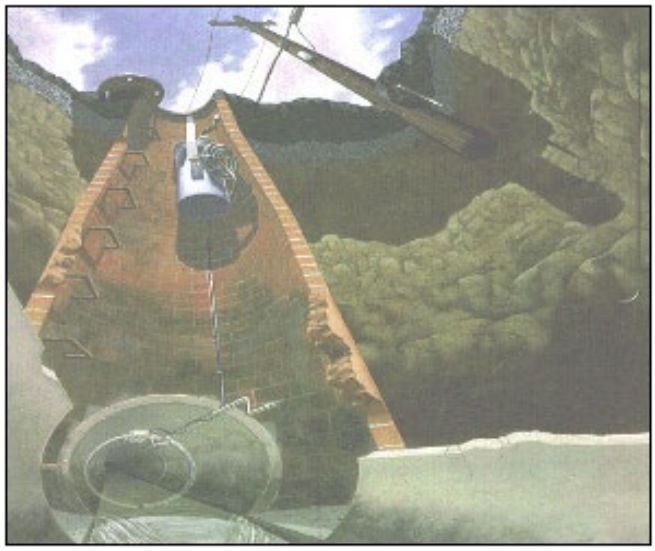
The ***pressure depth*** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain ***peak velocity*****,** the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless-steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.





Data Collection, Confirmation, and Quality Assurance

Data collects were done remotely via wireless connect on a weekly basis. As needed, during the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare the meter readings to confirm that they agreed. The site met the criteria for confirmation for depth and velocity unless noted otherwise in the site commentary section. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Rainfall Logging Equipment



The ***ADS RainAlert III*** monitor was selected for this project. This monitor provides rainfall data acquisition and intelligent alarming to support wastewater capital improvement.

The ADS RainAlert III monitor measures rainfall using a tipping bucket containing a funnel and a small tipping mechanism that can collect a specific amount of rainfall. Once the tipping mechanism is full it empties and records that a tip has occurred. Typically, each tip is equivalent to 0.01 inches (or 0.2mm) of rainfall. The monitor records the number of tips that occur over each 5-minute interval to calculate discrete rainfall amounts for each of those 5-minute intervals.

Installation

Installation of rainfall logging equipment typically proceeds in five steps. First, investigating and selecting the appropriate location to install the tipping bucket and monitor. Second, installing the Sun Shield involves properly placing the sun shield and securing it to an appropriate structure or surface, or mounting it to a pole, as applicable. Third, involves mounting the tipping bucket on the sun shield at the designated rainfall collection location and connecting the wires from the monitor to the tipping bucket. Fourth, involves testing and adjusting the tipping bucket and internal tipping mechanism to ensure it accurately measures rainfall amounts. The final step involves installing the monitor at the appropriate location.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the ***Continuity Equation*** and the ***Manning Equation.*** The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows (~< 1") that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs.
Hydrographs are based on 15-minute data. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the flow data table and hydrograph.

DFINAL - Final calculated depth measurement (in inches)

QFINAL - Final calculated flow rate (in MGD)

VFINAL - Final calculated flow velocity (in feet per second)

RAIN – Final calculated rainfall (in inches)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

CAM_100290

Site Commentary

SITE INFORMATION

Pipe	Elliptical (19 in H x 19.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located upstream of site CAM_51123. A review of flow balancing indicated no problems

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.24	2.00	0.326
Minimum	1.34	1.05	0.049
Maximum	9.57	3.56	1.941
Min Time	04/29/2025 02:10:00	04/23/2025 00:55:00	04/29/2025 02:10:00
Max Time	02/23/2025 16:40:00	01/31/2025 09:25:00	02/23/2025 15:50:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

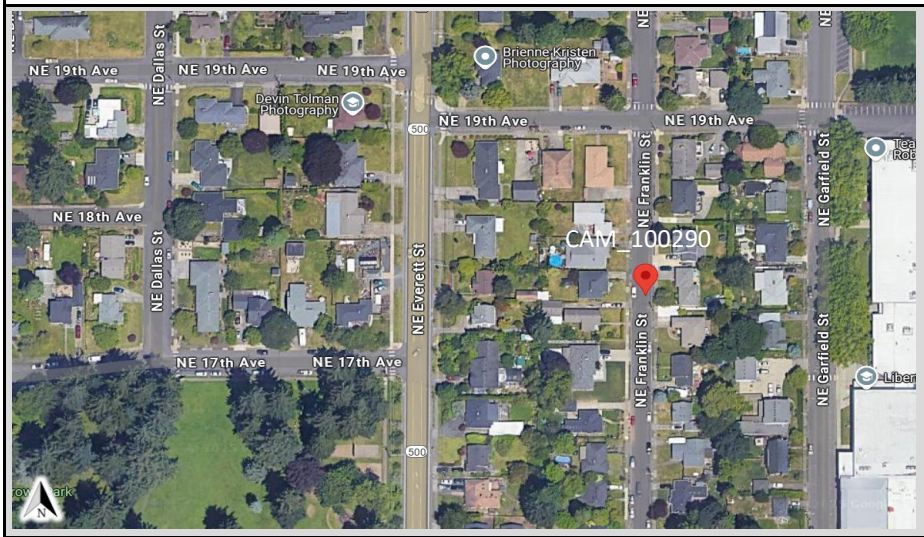
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report		CAM_100290

Site Address /Location:	1724 NE Franklin St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5919803	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4042885	19.00 x 19.50	Circular



Manhole #	System Characteristics
100290	Residential
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Special Installation
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
12:14:00 PM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.23	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

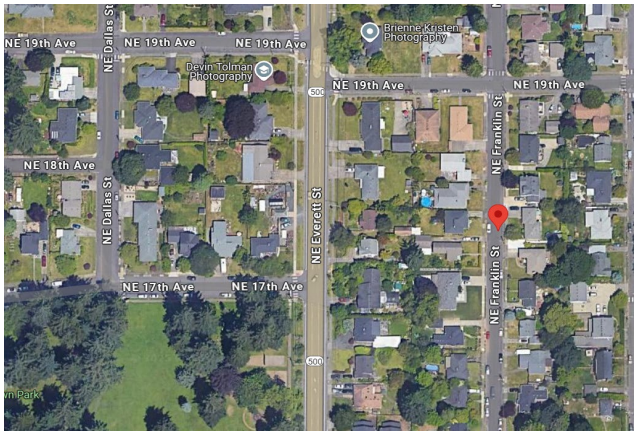
Manhole Depth (Approx. FT):	Manhole Configuration
13'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
PVC	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

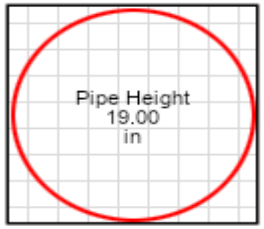
Monitoring Point Inlet	Outlet	
		
Top Down	Location	Map
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_100290

Flow Monitor

CAM_100290



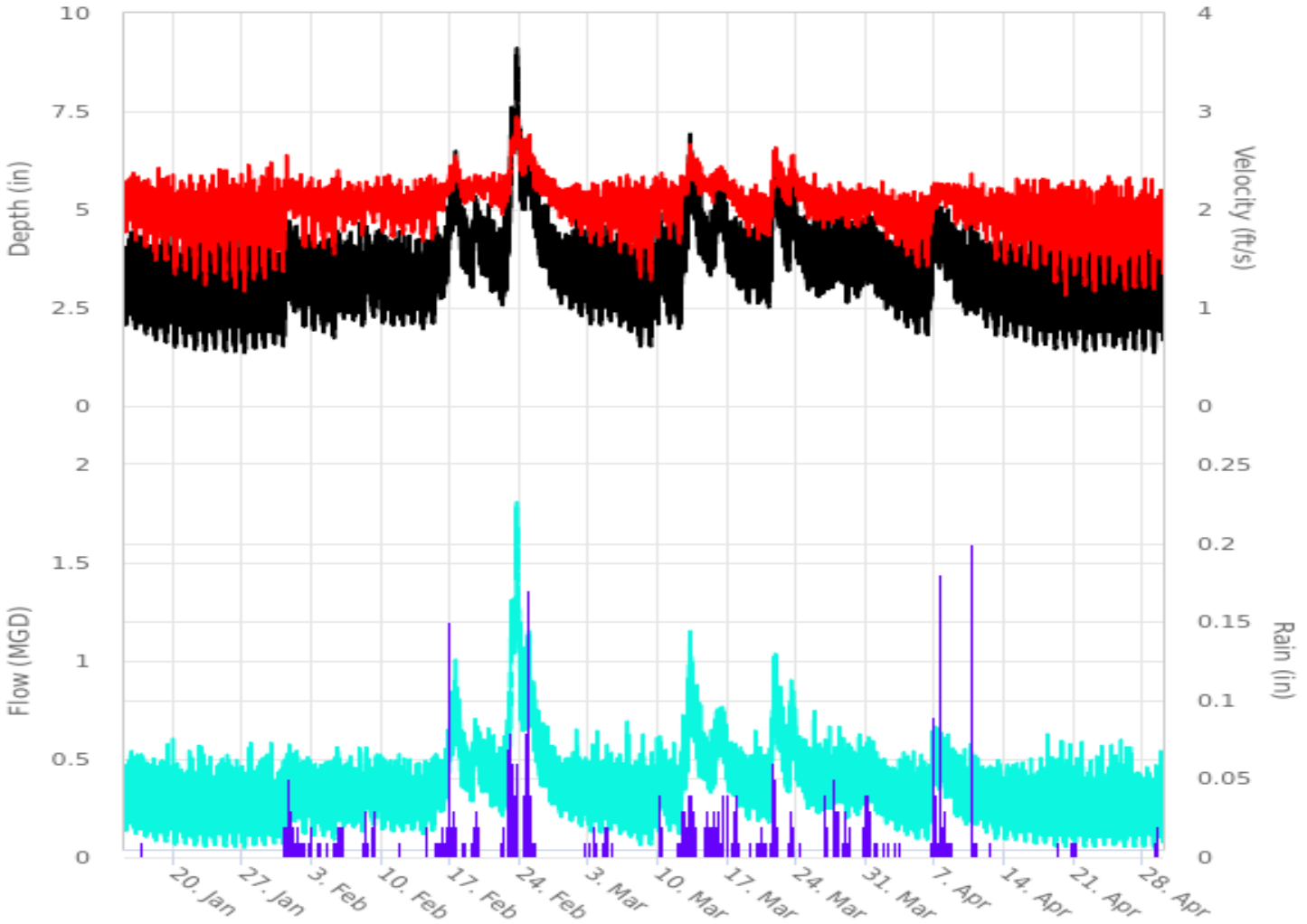
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

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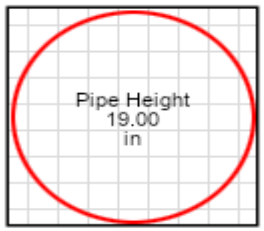
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Scattergraph Report

CAM_100290

Flow Monitor

CAM_100290



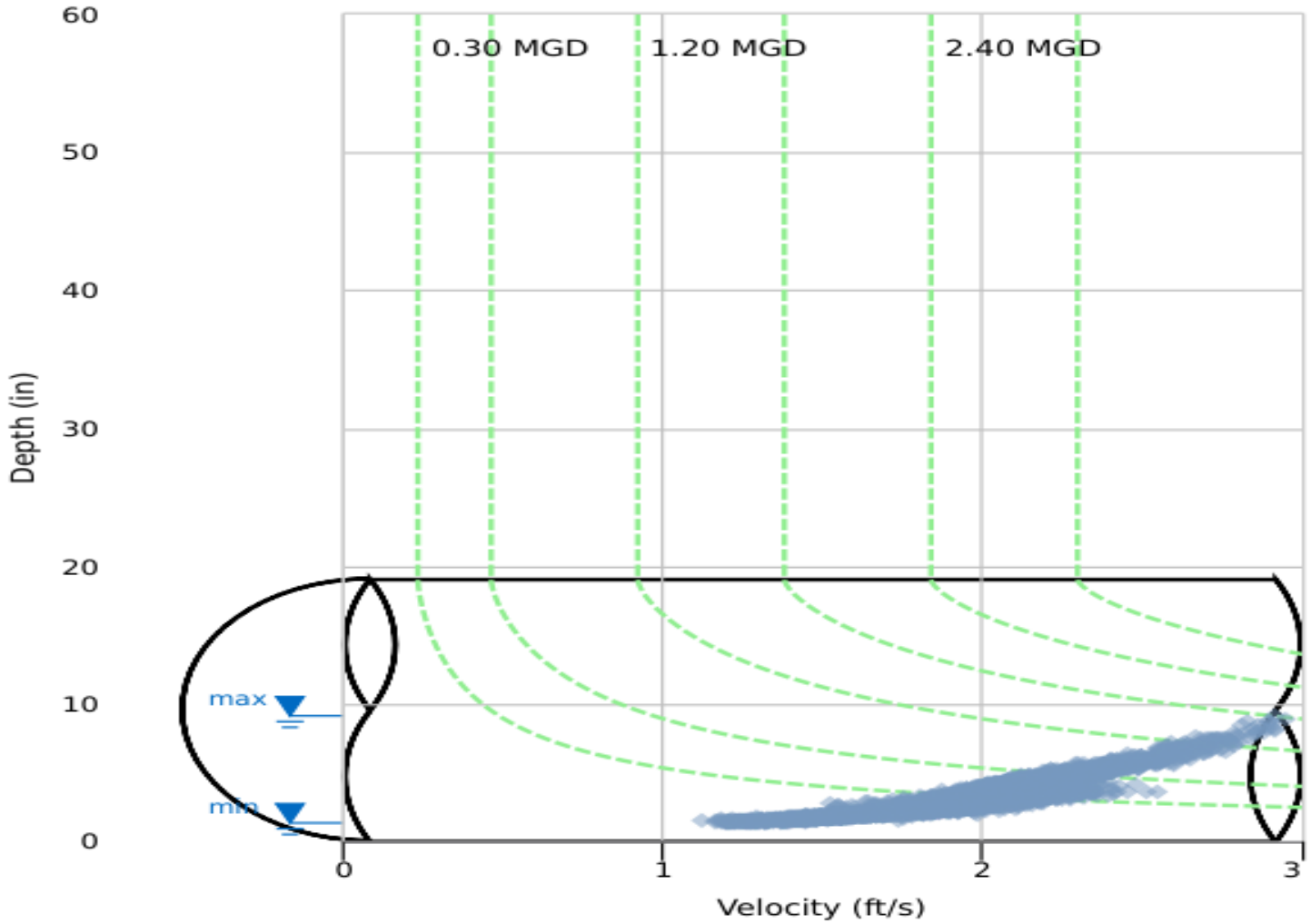
Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth





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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_100290 Pipe: Elliptical (19 in H x 19.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:00	2.05	17:35	5.79	2.91	04:00	1.72	12:50	2.64	2.05	04:00	0.131	17:35	0.777	0.274	0.274	-
01/16/2025	03:45	1.95	17:20	5.64	2.78	03:30	1.67	14:35	2.65	2.01	03:30	0.118	17:20	0.766	0.256	0.256	0.01
01/17/2025	04:50	1.82	08:55	5.72	2.66	03:50	1.60	09:35	2.65	1.94	03:50	0.104	08:55	0.823	0.235	0.235	-
01/18/2025	03:35	1.66	15:10	5.61	2.61	04:05	1.38	21:50	2.67	1.90	04:05	0.078	15:10	0.752	0.228	0.228	-
01/19/2025	05:50	1.61	21:45	5.69	2.60	03:00	1.46	10:10	2.67	1.88	05:50	0.080	21:45	0.792	0.226	0.226	-
01/20/2025	03:10	1.48	08:50	5.26	2.58	03:00	1.32	19:10	2.65	1.87	03:10	0.063	15:55	0.700	0.222	0.222	-
01/21/2025	04:10	1.50	07:40	5.55	2.49	02:40	1.34	14:05	2.65	1.83	04:10	0.067	07:40	0.757	0.208	0.208	-
01/22/2025	03:15	1.42	10:40	5.50	2.46	05:05	1.28	19:00	2.61	1.81	03:30	0.058	17:15	0.705	0.203	0.203	-
01/23/2025	03:10	1.40	11:55	5.55	2.41	03:15	1.20	21:45	2.60	1.80	03:15	0.052	11:55	0.717	0.197	0.197	-
01/24/2025	03:40	1.44	21:35	5.46	2.48	03:05	1.33	13:30	2.67	1.83	03:50	0.062	21:35	0.802	0.207	0.207	-
01/25/2025	05:10	1.37	09:30	5.59	2.47	04:50	1.25	06:30	2.75	1.80	04:50	0.053	09:30	0.746	0.207	0.207	-
01/26/2025	04:05	1.37	18:40	5.56	2.48	04:05	1.18	16:35	2.58	1.79	04:05	0.050	18:40	0.741	0.207	0.207	-
01/27/2025	03:05	1.34	10:10	5.32	2.44	02:35	1.15	10:15	2.88	1.81	03:10	0.049	09:25	0.712	0.203	0.203	-
01/28/2025	05:20	1.45	13:35	5.60	2.48	02:40	1.17	20:45	2.80	1.81	02:40	0.055	20:45	0.790	0.206	0.206	-
01/29/2025	04:05	1.49	08:25	5.63	2.50	03:55	1.25	19:20	2.99	1.82	03:55	0.060	19:20	0.884	0.211	0.211	-
01/30/2025	05:00	1.56	20:55	5.05	2.46	05:15	1.37	10:00	2.95	1.83	05:15	0.070	10:00	0.682	0.202	0.202	-
01/31/2025	02:00	1.50	16:35	5.68	3.25	00:45	1.34	09:25	3.56	2.05	01:50	0.065	09:25	1.079	0.328	0.328	0.60
02/01/2025	06:40	2.37	10:00	5.76	3.09	03:45	1.90	20:15	2.55	2.08	06:40	0.180	10:00	0.736	0.296	0.296	0.12
02/02/2025	03:50	2.02	20:45	5.43	2.96	03:35	1.56	15:20	2.60	1.98	03:35	0.117	15:20	0.791	0.273	0.273	0.07
02/03/2025	03:05	1.91	07:20	5.57	2.82	04:25	1.60	18:10	2.66	1.97	04:25	0.111	07:20	0.704	0.253	0.253	0.02
02/04/2025	03:45	1.86	07:55	5.46	2.75	04:30	1.60	14:20	2.57	1.96	04:30	0.107	07:55	0.718	0.245	0.245	0.01
02/05/2025	04:30	1.71	12:15	5.74	2.93	04:10	1.52	12:10	2.55	1.99	04:10	0.090	12:15	0.824	0.273	0.273	0.19
02/06/2025	04:30	2.21	21:30	5.44	3.02	03:40	1.70	15:20	2.55	2.03	03:40	0.150	20:30	0.679	0.282	0.282	-
02/07/2025	04:55	2.16	07:10	5.58	2.89	04:55	1.80	00:35	2.51	2.01	04:55	0.148	07:10	0.722	0.264	0.264	-
02/08/2025	01:55	2.02	11:05	5.93	3.17	01:45	1.73	11:05	2.33	2.06	01:55	0.129	11:05	0.812	0.309	0.309	0.25
02/09/2025	04:40	2.25	20:30	5.60	3.14	17:30	1.83	14:20	2.45	2.07	04:25	0.162	20:30	0.709	0.303	0.303	0.05
02/10/2025	03:10	2.10	07:40	5.61	2.98	02:50	1.76	07:35	2.71	2.04	04:00	0.141	07:40	0.778	0.279	0.279	-
02/11/2025	05:00	2.04	07:40	5.65	2.90	02:40	1.70	15:20	2.57	2.00	04:35	0.131	07:40	0.738	0.265	0.265	0.01
02/12/2025	03:55	2.05	07:05	5.48	2.90	00:20	1.69	13:50	2.52	2.00	03:30	0.131	07:05	0.690	0.264	0.264	-
02/13/2025	03:50	2.09	06:40	5.37	2.95	03:20	1.74	15:05	2.49	2.02	03:20	0.137	06:40	0.678	0.272	0.272	-
02/14/2025	05:10	1.95	08:55	5.54	2.87	05:00	1.66	08:50	2.56	1.98	05:00	0.117	08:55	0.770	0.261	0.261	0.07
02/15/2025	06:10	2.10	11:30	5.53	3.08	03:35	1.65	00:25	2.58	2.02	03:35	0.130	08:40	0.734	0.291	0.291	0.09
02/16/2025	01:45	2.76	21:35	6.26	3.77	04:55	1.90	20:30	2.43	2.18	04:55	0.229	21:35	0.902	0.412	0.412	0.77
02/17/2025	23:35	3.96	11:45	6.94	5.05	02:20	2.17	12:20	2.65	2.34	23:35	0.429	11:45	1.090	0.657	0.657	0.39
02/18/2025	23:30	3.21	06:40	6.08	4.00	14:05	2.02	20:45	2.42	2.20	23:30	0.309	06:40	0.852	0.445	0.445	0.02
02/19/2025	05:00	3.01	08:55	6.23	4.25	07:05	2.06	08:55	2.43	2.23	05:00	0.281	08:55	0.904	0.495	0.495	0.40
02/20/2025	23:55	3.15	02:50	5.75	3.82	07:55	2.08	18:05	2.40	2.21	23:55	0.307	09:40	0.788	0.420	0.420	-
02/21/2025	23:15	2.78	23:20	5.80	3.45	16:05	2.01	08:05	2.54	2.16	23:15	0.245	08:10	0.793	0.357	0.357	0.04
02/22/2025	05:40	2.55	23:30	6.71	3.69	06:45	1.91	23:00	2.49	2.16	06:45	0.207	23:30	0.988	0.402	0.402	0.84
02/23/2025	00:00	5.10	16:40	9.57	7.24	00:00	2.35	15:55	3.00	2.71	00:00	0.663	15:50	1.941	1.246	1.246	1.07
02/24/2025	10:35	4.91	23:25	7.52	5.85	05:45	2.34	15:35	2.86	2.54	10:35	0.633	19:35	1.324	0.874	0.874	0.87
02/25/2025	23:40	3.80	00:40	6.97	5.08	11:05	2.14	00:00	2.77	2.40	23:40	0.409	00:40	1.145	0.682	0.682	0.03
02/26/2025	23:55	3.25	06:45	6.02	3.98	15:30	2.11	06:45	2.49	2.22	23:55	0.314	06:45	0.886	0.448	0.448	-
02/27/2025	23:55	2.81	19:55	5.67	3.54	16:45	1.97	06:20	2.46	2.14	23:55	0.240	19:55	0.766	0.367	0.367	-
02/28/2025	03:25	2.59	14:55	5.80	3.32	13:50	1.88	14:55	2.37	2.05	03:20	0.202	14:55	0.799	0.323	0.323	-
03/01/2025	03:20	2.45	19:55	5.73	3.23	04:15	1.82	23:00	2.35	2.02	04:15	0.185	14:25	0.770	0.310	0.310	-
03/02/2025	06:20	2.29	14:00	5.53	3.17	04:00	1.73	08:25	2.29	1.97	04:00	0.155	20:10	0.709	0.295	0.295	0.05
03/03/2025	03:55	2.07	19:00	5.90	3.04	04:05	1.66	21:10	2.30	1.93	04:00	0.128	19:00	0.793	0.277	0.277	0.07
03/04/2025	04:20	2.05	16:25	5.79	3.09	03:20	1.62	16:20	2.39	1.97	03:55	0.124	16:25	0.801	0.290	0.290	0.12
03/05/2025	04:10	2.14	20:15	5.47	3.03	03:30	1.65	22:25	2.42	1.97	03:35	0.137	20:50	0.701	0.279	0.279	0.01
03/06/2025	03:20	2.02	22:15	5.72	2.85	02:55	1.55	13:25	2.50	1.90	03:15	0.116	22:15	0.785	0.250	0.250	-
03/07/2025	23:55	1.85	16:35	5.47	2.68	03:40	1.51	21:30	2.45	1.87	03:40	0.101	16:35	0.729	0.230	0.230	-
03/08/2025	04:20	1.50	17:25	5.66	2.60	04:05	1.29	10:35	2.41	1.81	04:05	0.062	17:25	0.767	0.220	0.220	-
03/09/2025	04:20	1.51	07:45	5.47	2.73	05:00	1.27	15:00	2.49	1.85	05:05	0.062	07:45	0.742	0.240	0.240	0.20
03/10/2025	23:05	2.29	06:20	5.91	3.41	00:00	1.81	07:35	2.58	2.11	00:00	0.164	06:20	0.811	0.344	0.344	0.22
03/11/2025	23:30	2.06	06:40	5.64	2.92	01:55	1.62	19:10	2.53	2.01	01:55	0.133	16:25	0.766	0.270	0.270	0.02
03/12/2025	03:25	1.96	23:15	6.33	3.68	02:15	1.64	23:15	2.41	2.10	03:10	0.117	23:15	0.917	0.398	0.398	0.83
03/13/2025	23:50	4.25	03:05	7.64	5.44	22:35	2.20	05:00	2.73	2.40	23:50	0.484	05:00	1.283	0.749	0.749	0.49
03/14/2025	23:40	3.51	01:00	6.11	4.27	04:20	2.15	01:00	2.55	2.26	23:40	0.369	01:00	0.924	0.502	0.502	0.16
03/15/2025	06:25	3.30	20:15	6.13	4.13	13:15	2.04	20:15	2.46	2.25	06:20	0.327	20:15	0.895	0.479	0.479	0.60
03/16/2025	23:35	3.62	04:50	6.35	4.73	21:10	2.11	07:10	2.60	2.28	23:35	0.378	07:10	0.995	0.584	0.584	0.16
03/17/2025	23:40	3.11	02:55	5.79	3.87	14:45	2.01	15:20	2.60	2.18	23:40	0.284	02:55	0.808	0.421	0.421	0.19
03/18/2025	23:05	2.71	06:40	5.83	3.51	23:55	1.77	12:40	2.35	2.04	23:55	0.203	06:40	0.776	0.348	0.348	0.02
03/19/2025	04:25	2.60	20:55	5.97	3.47	04:40	1.68	18:45	2.39	1.97	01:45	0.190	18:45	0.832	0.334	0.334	0.07
03/20/2025	03:25	2.60	06:45	5.86	3.38	01:30	1.67	03:50	2.27	1.93	01:30	0.182	06:45	0.774	0.316	0.316	0.11
03/21/2025	03:20	2.49	15:25	7.29	4.60	02:45	1.73	15:55	2.76	2.19	03:20	0.176	15:25	1.249	0.577	0.577	1.12
03/22/2025	23:00	3.51	05:40	6.54	4.75	23:00	2.07	04:10	2.62	2.28	23:00	0.344	05:40	1.031	0.590	0.590	-
03/23/2025	02:40	3.42	09:50	6.72	4.53	03:15	2.03	09:50	2.74	2.26	04:05	0.329	09:50	1.132	0.551	0.551	0.44
03/24/2025	23:55	3.16	06:10	6.03	3.99	23:10	2.00	15:55	2.44	2.17	23:55	0.288	15:55	0.855	0.439	0.439	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	04:25	2.94	20:10	5.99	3.58	16:25	1.85	18:45	2.42	2.07	02:40	0.241	18:45	0.851	0.363	0.363	-
03/26/2025	04:25	2.76	06:25	5.96	3.53	17:00	1.77	06:25	2.38	2.05	04:20	0.224	06:25	0.834	0.354	0.354	0.20
03/27/2025	03:50	2.95	06:45	5.94	3.62	01:45	1.76	06:45	2.33	2.01	01:45	0.238	06:45	0.812	0.357	0.357	0.24
03/28/2025	23:55	2.79	03:25	6.14	3.78	23:10	1.87	06:30	2.37	2.06	23:55	0.225	06:30	0.862	0.388	0.388	0.17
03/29/2025	01:45	2.62	15:55	5.90	3.59	03:25	1.78	06:05	2.36	2.01	01:30	0.198	06:05	0.797	0.355	0.355	0.12
03/30/2025	02:00	2.74	08:55	5.83	3.57	04:05	1.81	09:30	2.34	2.02	04:05	0.216	09:30	0.793	0.354	0.354	0.23
03/31/2025	23:50	2.91	12:40	6.05	3.74	23:50	1.87	12:40	2.38	2.07	23:50	0.237	12:40	0.852	0.384	0.384	0.10
04/01/2025	23:55	2.49	01:35	5.59	3.34	23:55	1.72	14:00	2.39	1.99	23:55	0.174	01:35	0.751	0.318	0.318	0.03
04/02/2025	23:25	2.33	16:55	5.70	3.15	23:05	1.60	00:25	2.32	1.92	23:25	0.152	16:55	0.749	0.283	0.283	0.05
04/03/2025	23:25	2.18	00:55	5.66	2.98	23:25	1.55	19:15	2.26	1.86	23:25	0.129	19:15	0.726	0.259	0.259	0.02
04/04/2025	02:40	2.00	14:05	5.65	2.85	04:20	1.51	23:25	2.30	1.83	02:10	0.112	14:05	0.741	0.241	0.241	-
04/05/2025	03:15	1.84	14:15	5.67	2.75	05:10	1.40	22:20	2.38	1.80	05:10	0.092	14:15	0.748	0.229	0.229	-
04/06/2025	04:35	1.80	22:35	6.10	3.29	03:10	1.39	12:10	2.36	1.91	04:40	0.091	21:00	0.840	0.319	0.319	0.71
04/07/2025	23:45	3.31	00:40	6.20	4.18	01:25	1.92	23:50	2.32	2.15	10:35	0.314	00:40	0.850	0.464	0.464	0.37
04/08/2025	23:50	2.80	06:45	6.01	3.74	00:20	1.94	07:20	2.39	2.13	23:50	0.233	06:45	0.819	0.394	0.394	0.07
04/09/2025	23:10	2.49	15:20	5.69	3.30	15:10	1.79	07:40	2.46	2.04	23:10	0.187	07:40	0.759	0.319	0.319	-
04/10/2025	02:15	2.32	06:10	5.60	3.18	04:10	1.73	05:05	2.45	2.04	02:25	0.164	06:10	0.699	0.305	0.305	0.27
04/11/2025	23:10	2.28	06:05	5.51	3.07	23:55	1.76	19:15	2.34	2.00	23:55	0.157	06:05	0.732	0.284	0.284	0.01
04/12/2025	23:55	1.94	06:05	5.40	2.95	23:50	1.59	06:05	2.34	1.93	23:50	0.113	06:05	0.716	0.266	0.266	0.01
04/13/2025	03:05	1.78	08:30	5.37	2.89	04:40	1.47	08:30	2.53	1.90	02:50	0.092	08:30	0.769	0.258	0.258	-
04/14/2025	03:15	1.77	06:40	5.62	2.77	02:20	1.40	06:40	2.42	1.87	02:20	0.088	06:40	0.782	0.240	0.240	-
04/15/2025	02:50	1.74	18:50	5.27	2.73	02:30	1.47	05:45	2.43	1.86	02:25	0.088	18:50	0.669	0.233	0.233	-
04/16/2025	23:55	1.63	15:15	5.54	2.60	01:35	1.43	07:00	2.45	1.84	23:55	0.079	15:15	0.719	0.217	0.217	-
04/17/2025	01:40	1.53	06:20	5.34	2.59	01:35	1.33	00:00	2.67	1.83	01:35	0.067	06:20	0.679	0.218	0.218	-
04/18/2025	02:45	1.56	15:10	5.61	2.53	03:00	1.42	00:10	2.45	1.80	02:25	0.073	12:50	0.764	0.209	0.209	-
04/19/2025	02:55	1.43	15:10	5.55	2.51	00:35	1.24	16:10	2.46	1.76	02:55	0.056	13:10	0.726	0.206	0.206	0.01
04/20/2025	03:50	1.46	10:55	5.52	2.59	03:30	1.09	10:50	2.49	1.76	03:30	0.051	10:55	0.765	0.215	0.215	0.05
04/21/2025	03:00	1.54	17:10	5.56	2.56	00:15	1.33	20:30	2.53	1.80	02:25	0.068	10:45	0.718	0.212	0.212	0.02
04/22/2025	02:45	1.38	19:10	5.57	2.49	02:55	1.21	14:35	2.34	1.75	02:55	0.052	19:10	0.740	0.202	0.202	-
04/23/2025	03:35	1.41	07:00	5.56	2.52	00:55	1.05	09:30	2.33	1.76	00:55	0.050	07:00	0.705	0.206	0.206	-
04/24/2025	03:35	1.53	19:30	5.64	2.49	03:00	1.22	12:30	2.62	1.77	03:00	0.063	19:30	0.756	0.201	0.201	-
04/25/2025	01:30	1.46	15:20	5.44	2.49	00:55	1.24	15:20	2.35	1.73	01:30	0.057	15:20	0.724	0.200	0.200	-
04/26/2025	02:30	1.42	14:20	5.51	2.50	05:25	1.17	18:25	2.54	1.75	02:30	0.055	14:20	0.747	0.205	0.205	-
04/27/2025	04:00	1.42	07:20	5.24	2.58	02:55	1.18	20:20	2.47	1.75	04:00	0.053	07:20	0.667	0.212	0.212	-
04/28/2025	01:40	1.41	08:35	5.40	2.51	01:50	1.19	12:40	2.56	1.76	01:40	0.052	08:35	0.688	0.204	0.204	-
04/29/2025	02:10	1.34	10:55	5.61	2.52	02:00	1.19	21:10	2.47	1.74	02:10	0.049	10:55	0.759	0.205	0.205	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			34.250	13.62
Average	3.24	2.00	0.326	

CAM_51123

Site Commentary

SITE INFORMATION

Pipe	Elliptical (20 in H x 20.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located downstream of site CAM_100290. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	7.07	2.37	1.132
Minimum	3.27	1.07	0.162
Maximum	19.05	3.74	5.203
Min Time	04/28/2025 03:45:00	04/28/2025 03:45:00	04/28/2025 03:45:00
Max Time	02/23/2025 16:05:00	02/23/2025 15:45:00	02/23/2025 16:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

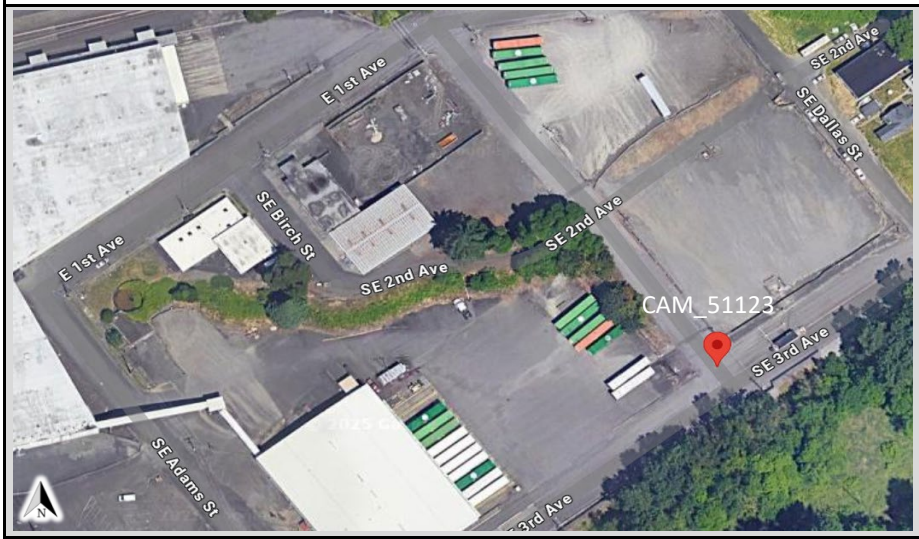
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	99.653
VFINAL (ft/s)	99.653
QFINAL (MGD - Total MG)	99.653

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report		CAM_51123

Site Address /Location:	SE Cedar St and SE 3rd Ave, Camas, WA 98607			Monitor Series: TRITON+	Location Type: Temporary
Site Access Details:	On Road	Latitude:	45.5829094	Pipe Size (H x W): 20.00 X 20.13	Pipe Shape: Circular
		Longitude:	-122.4010296		



Manhole #	System Characteristics
51123	Industrial
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Wednesday, January 15, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
8:23:00 AM	
Depth of Flow (Wet DOF) (in)	
7.75	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.38"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.77	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

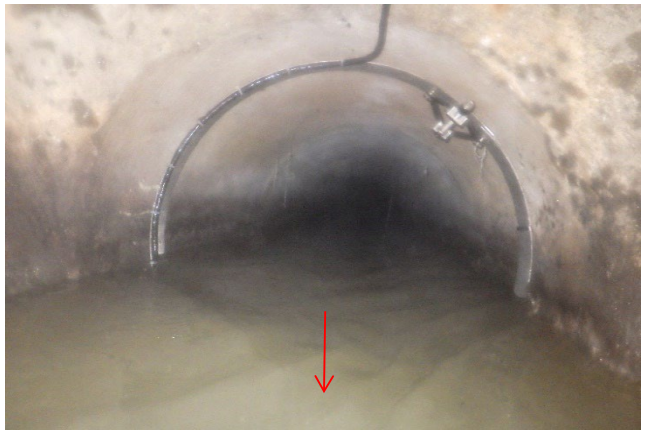
Manhole Depth (Approx. FT):	Manhole Configuration
16'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

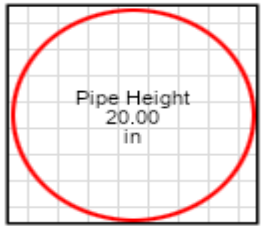
Monitoring Point Inlet	Outlet	
		
Top Down	Location	Map
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_51123

Flow Monitor

CAM_51123



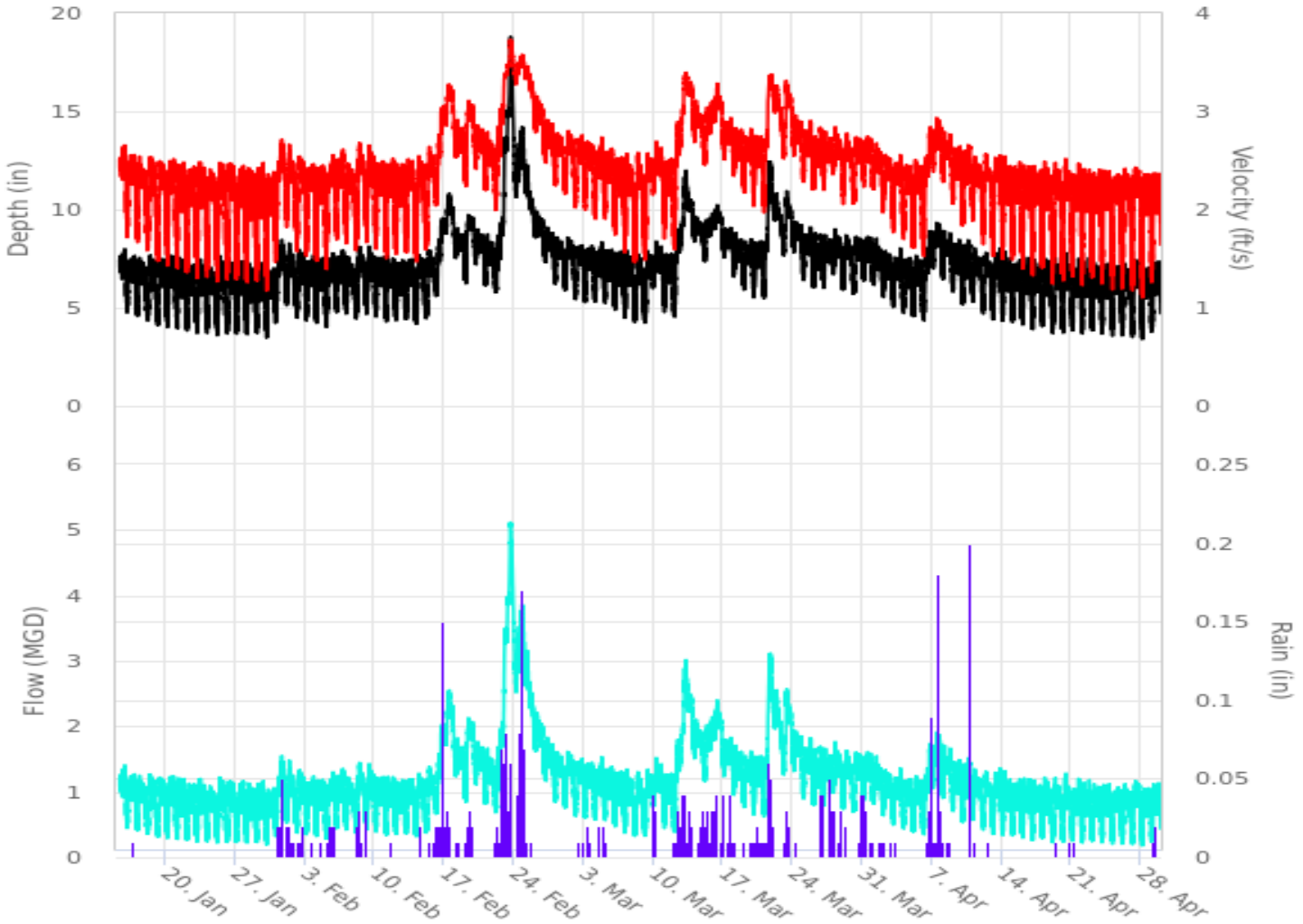
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL





846 Industry Dr.
Tukwila, WA 98188

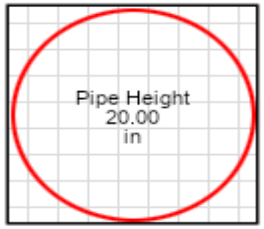
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Scattergraph Report

CAM_51123

Flow Monitor

CAM_51123

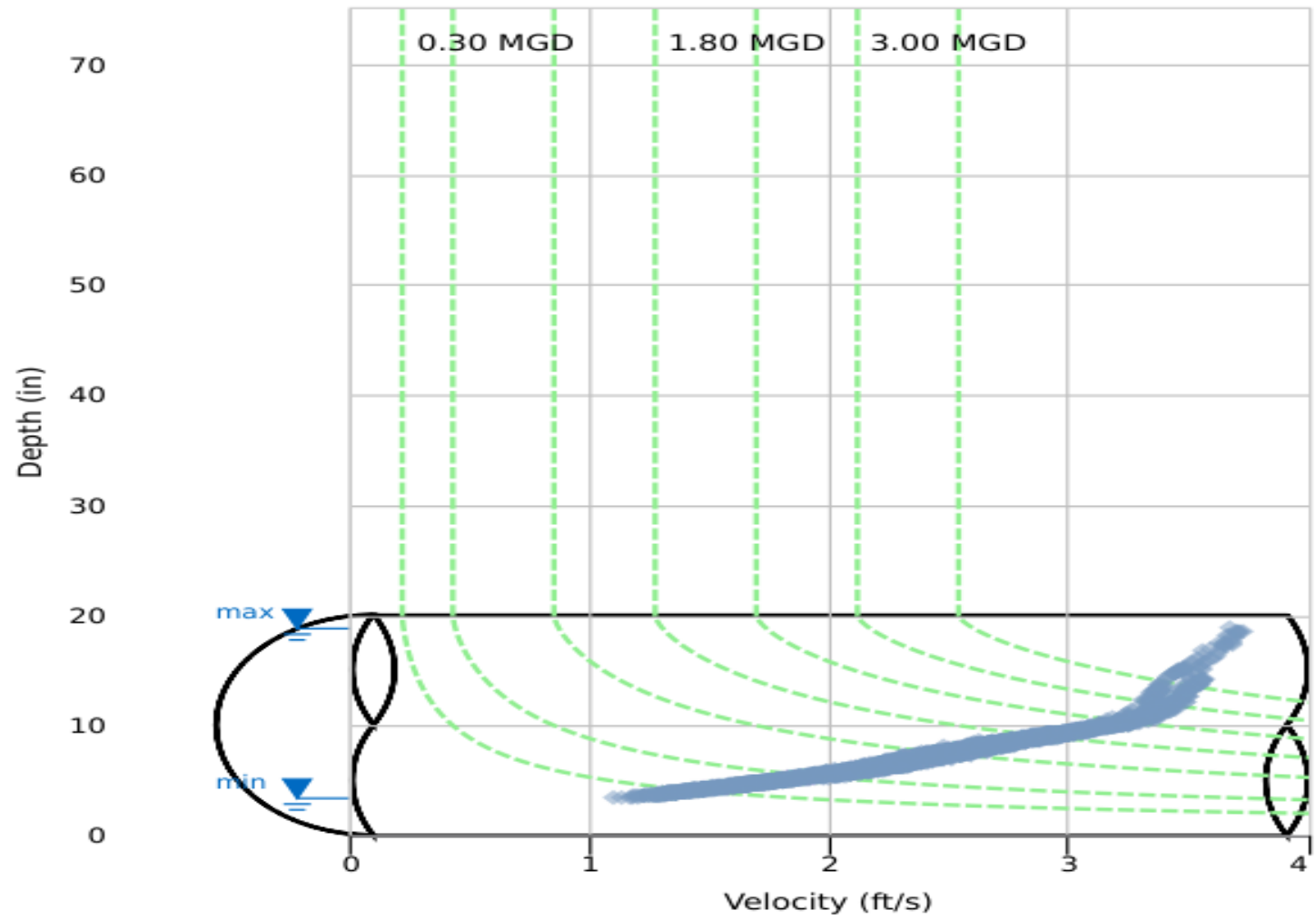


Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_51123 Pipe: Elliptical (20 in H x 20.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	23:50	5.80	21:30	8.39	7.16	23:50	2.17	21:30	2.69	2.45	23:50	0.742	21:30	1.522	1.123	0.710	-
01/16/2025	03:30	4.69	17:40	8.36	6.47	03:30	1.70	17:40	2.60	2.26	03:30	0.431	17:40	1.464	0.914	0.914	0.01
01/17/2025	04:30	4.46	09:15	7.96	6.27	04:30	1.62	09:15	2.59	2.21	04:30	0.383	09:15	1.367	0.858	0.858	-
01/18/2025	03:35	4.21	09:55	7.89	6.14	03:35	1.52	19:00	2.59	2.16	03:35	0.330	19:00	1.330	0.825	0.825	-
01/19/2025	05:05	4.01	10:00	7.93	6.07	05:05	1.44	10:00	2.57	2.12	05:05	0.292	10:00	1.348	0.802	0.802	-
01/20/2025	04:35	3.95	17:50	8.08	6.12	04:35	1.41	19:35	2.57	2.13	04:35	0.280	10:00	1.363	0.812	0.812	-
01/21/2025	05:25	3.91	20:45	8.03	5.89	05:25	1.39	20:45	2.54	2.07	05:25	0.271	20:45	1.352	0.749	0.749	-
01/22/2025	04:00	3.72	08:15	7.89	5.84	03:10	1.31	20:55	2.51	2.05	04:00	0.240	20:55	1.285	0.738	0.738	-
01/23/2025	04:05	3.64	21:00	7.78	5.80	04:05	1.27	12:20	2.50	2.05	04:05	0.224	21:00	1.257	0.728	0.728	-
01/24/2025	04:10	3.64	11:05	7.86	5.75	04:10	1.28	11:05	2.52	2.04	04:10	0.226	11:05	1.303	0.715	0.715	-
01/25/2025	04:35	3.55	09:50	8.22	5.72	03:45	1.24	11:10	2.56	2.02	04:35	0.211	09:50	1.396	0.712	0.712	-
01/26/2025	05:00	3.58	10:40	7.91	5.81	05:00	1.24	11:15	2.57	2.04	05:00	0.214	10:40	1.323	0.739	0.739	-
01/27/2025	02:40	3.65	18:55	8.00	5.77	02:40	1.26	18:55	2.56	2.03	02:40	0.223	18:55	1.359	0.719	0.719	-
01/28/2025	02:45	3.53	08:45	7.64	5.62	02:45	1.24	08:50	2.45	1.98	02:45	0.209	08:45	1.215	0.679	0.679	-
01/29/2025	04:00	3.61	19:45	7.87	5.65	02:30	1.23	19:45	2.54	1.98	02:30	0.216	19:45	1.321	0.681	0.681	-
01/30/2025	03:40	3.44	09:10	7.52	5.58	03:35	1.17	08:10	2.44	1.96	03:40	0.191	09:10	1.175	0.665	0.665	-
01/31/2025	00:55	4.02	18:35	8.72	6.76	00:55	1.39	16:20	2.74	2.29	00:55	0.283	18:35	1.618	1.008	1.008	0.60
02/01/2025	04:10	5.01	10:20	8.59	6.63	04:05	1.79	10:20	2.74	2.28	04:05	0.499	10:20	1.599	0.952	0.952	0.12
02/02/2025	05:45	4.47	12:50	8.36	6.47	05:45	1.55	10:45	2.61	2.20	05:45	0.367	12:50	1.442	0.906	0.906	0.07
02/03/2025	03:15	4.30	19:40	8.08	6.25	04:15	1.50	21:30	2.64	2.15	04:15	0.338	19:40	1.372	0.838	0.838	0.02
02/04/2025	04:40	4.08	08:20	8.08	6.03	03:55	1.43	08:20	2.54	2.09	04:40	0.298	08:20	1.361	0.779	0.779	0.01
02/05/2025	03:55	3.97	20:15	7.96	6.28	04:55	1.38	20:45	2.58	2.15	03:55	0.278	20:15	1.356	0.857	0.857	0.19
02/06/2025	04:05	4.70	19:15	8.20	6.49	04:50	1.67	19:55	2.71	2.24	04:50	0.426	19:15	1.436	0.912	0.912	-
02/07/2025	04:20	4.62	18:05	8.12	6.18	03:30	1.64	18:05	2.56	2.17	04:20	0.408	18:05	1.382	0.825	0.825	-
02/08/2025	03:25	4.41	10:25	8.28	6.59	03:25	1.54	11:25	2.70	2.26	03:25	0.358	10:25	1.482	0.955	0.955	0.25
02/09/2025	04:10	4.62	11:35	8.31	6.60	04:10	1.63	11:00	2.69	2.27	04:10	0.405	11:05	1.478	0.953	0.953	0.05
02/10/2025	03:45	4.52	22:30	8.01	6.33	04:10	1.59	19:40	2.51	2.18	03:40	0.385	22:30	1.329	0.861	0.861	-
02/11/2025	04:25	4.23	19:40	7.90	6.18	04:25	1.48	20:45	2.56	2.14	04:25	0.323	19:40	1.333	0.822	0.822	0.01
02/12/2025	04:10	4.27	07:30	7.92	6.12	04:55	1.50	07:25	2.58	2.13	04:10	0.338	07:25	1.350	0.806	0.806	-
02/13/2025	04:20	4.32	19:55	7.86	6.20	04:20	1.52	09:20	2.54	2.16	04:20	0.342	19:55	1.303	0.835	0.835	-
02/14/2025	05:15	4.09	10:10	8.06	6.15	05:15	1.43	11:05	2.58	2.14	05:15	0.297	11:05	1.310	0.825	0.825	0.07
02/15/2025	04:15	4.40	10:50	8.30	6.46	04:15	1.58	12:00	2.69	2.24	04:15	0.366	12:00	1.485	0.921	0.921	0.09
02/16/2025	03:30	5.49	20:45	9.65	7.62	05:25	2.00	19:50	3.09	2.56	03:30	0.637	20:45	2.066	1.317	1.317	0.77
02/17/2025	23:15	8.39	10:25	11.12	9.70	23:15	2.79	16:55	3.31	3.09	23:15	1.578	10:25	2.661	2.116	2.116	0.39
02/18/2025	23:40	7.27	08:10	9.37	8.28	23:50	2.46	08:40	2.94	2.71	23:40	1.152	08:10	1.918	1.507	1.507	0.02
02/19/2025	04:45	6.10	09:45	9.95	8.58	04:45	2.21	10:20	3.14	2.80	04:45	0.810	09:45	2.192	1.658	1.658	0.40
02/20/2025	03:55	7.11	08:20	9.14	8.13	12:45	2.32	19:05	2.91	2.65	03:55	1.089	08:20	1.821	1.442	1.442	-
02/21/2025	05:15	6.03	08:30	9.07	7.41	05:15	2.17	08:30	2.84	2.49	05:15	0.783	08:30	1.779	1.199	1.199	0.04
02/22/2025	04:00	5.59	23:55	11.23	7.72	03:45	1.99	23:50	3.26	2.59	04:00	0.646	23:50	2.678	1.351	1.351	0.84
02/23/2025	00:05	10.43	16:05	19.05	15.02	00:05	3.26	15:45	3.74	3.50	00:05	2.439	16:30	5.203	3.978	3.978	1.07
02/24/2025	04:05	10.51	19:25	14.53	12.43	05:20	3.25	19:50	3.59	3.44	05:20	2.464	19:25	3.923	3.191	3.191	0.87
02/25/2025	23:55	9.12	00:20	12.77	10.78	23:40	2.97	00:30	3.50	3.33	23:40	1.874	00:20	3.349	2.601	2.601	0.03
02/26/2025	23:55	7.91	03:10	10.25	9.11	23:20	2.66	03:15	3.21	2.96	23:55	1.400	03:10	2.346	1.864	1.864	-
02/27/2025	04:25	6.91	08:10	9.35	8.19	04:25	2.39	08:40	2.95	2.70	04:25	1.041	08:10	1.914	1.481	1.481	-
02/28/2025	02:40	5.95	08:10	9.19	7.57	03:35	2.20	08:10	2.85	2.55	02:40	0.786	08:10	1.812	1.266	1.266	-
03/01/2025	04:20	5.79	09:20	8.95	7.36	05:25	2.14	11:30	2.83	2.51	03:15	0.733	09:20	1.729	1.206	1.206	-
03/02/2025	04:10	5.27	20:00	8.28	7.13	05:25	1.95	19:35	2.78	2.47	05:25	0.584	19:35	1.538	1.137	1.137	0.05
03/03/2025	03:25	5.12	19:25	8.40	6.91	03:25	1.95	08:10	2.75	2.41	03:25	0.559	19:25	1.547	1.066	1.066	0.07
03/04/2025	03:55	5.13	19:45	8.46	6.94	04:40	1.88	19:45	2.76	2.38	03:55	0.541	19:45	1.574	1.059	1.059	0.12
03/05/2025	04:30	5.15	20:05	8.27	6.77	04:30	1.87	20:10	2.66	2.34	04:30	0.540	20:05	1.470	1.004	1.004	0.01
03/06/2025	03:55	4.82	20:55	8.32	6.57	03:55	1.72	20:55	2.61	2.25	03:55	0.452	20:55	1.460	0.931	0.931	-
03/07/2025	03:30	4.38	08:30	8.15	6.34	03:30	1.53	08:35	2.58	2.17	03:30	0.351	08:30	1.402	0.857	0.857	-
03/08/2025	04:00	4.11	17:45	7.86	6.17	04:00	1.39	11:30	2.59	2.14	04:00	0.291	11:30	1.335	0.822	0.822	-
03/09/2025	04:15	3.93	11:05	8.22	6.30	04:15	1.37	11:05	2.64	2.18	04:15	0.269	11:05	1.451	0.869	0.869	0.20
03/10/2025	23:55	5.43	09:00	8.53	7.24	23:55	1.98	07:20	2.72	2.44	23:55	0.617	07:20	1.563	1.138	1.138	0.22
03/11/2025	02:55	4.69	16:45	8.03	6.51	03:00	1.68	20:40	2.59	2.24	03:00	0.425	20:40	1.369	0.915	0.915	0.02
03/12/2025	03:50	4.50	23:00	9.76	7.62	03:50	1.57	23:00	3.08	2.51	03:50	0.376	23:00	2.116	1.312	1.312	0.83
03/13/2025	23:25	8.95	07:05	12.07	10.44	23:25	2.91	07:10	3.40	3.24	23:25	1.788	07:05	3.041	2.437	2.437	0.49
03/14/2025	23:40	7.92	07:40	9.77	9.01	23:40	2.58	07:20	3.16	2.89	23:40	1.352	07:20	2.169	1.795	1.795	0.16
03/15/2025	04:40	7.19	22:05	10.06	8.76	03:25	2.39	22:10	3.15	2.81	04:40	1.113	22:05	2.245	1.695	1.695	0.60
03/16/2025	23:55	7.87	09:40	10.53	9.47	23:55	2.58	10:35	3.32	3.04	23:55	1.336	10:35	2.505	2.018	2.018	0.16
03/17/2025	23:35	7.19	07:15	9.24	8.40	04:05	2.46	18:50	2.96	2.75	23:35	1.131	07:15	1.878	1.560	1.560	0.19
03/18/2025	23:50	6.16	07:10	8.86	7.77	23:50	2.22	07:10	2.84	2.61	23:50	0.825	07:10	1.725	1.335	1.335	0.02
03/19/2025	02:40	5.74	19:05	8.73	7.39	01:45	2.15	19:45	2.84	2.54	02:40	0.725	19:05	1.677	1.221	1.221	0.07
03/20/2025	03:30	5.47	19:45	8.61	7.24	02:20	2.01	18:45	2.78	2.47	02:20	0.635	19:45	1.622	1.161	1.161	0.11
03/21/2025	03:05	5.41	15:45	12.74	9.27	03:05	1.95	19:10	3.38	2.86	03:05	0.602	15:40	3.207	1.943	1.943	1.12
03/22/2025	23:55	8.30	09:00	11.00	9.75	23:55	2.69	11:10	3.29	3.07	23:55	1.498	09:00	2.618	2.112	2.112	-
03/23/2025	02:30	7.45	10:05	11.31	9.37	02:55	2.50	08:30	3.36	2.96	02:30	1.203	10:05	2.708	1.955	1.955	0.44
03/24/2025	23:20	7.24	07:40	9.54	8.59	23:55	2.46	07:40	2.99	2.75	23:20	1.142	07:40	1.995	1.606	1.606	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	23:40	6.19	18:00	9.34	7.88	01:05	2.22	19:10	2.95	2.60	23:40	0.850	18:00	1.900	1.362	1.362	-
03/26/2025	02:45	5.80	06:45	9.16	7.56	00:35	2.14	20:30	2.88	2.55	02:45	0.730	20:25	1.776	1.266	1.266	0.20
03/27/2025	03:25	5.93	07:05	9.04	7.56	03:25	2.17	07:05	2.86	2.54	03:25	0.765	07:05	1.781	1.256	1.256	0.24
03/28/2025	23:55	6.20	06:50	9.39	7.83	23:55	2.26	06:50	2.92	2.59	23:55	0.848	06:50	1.909	1.340	1.340	0.17
03/29/2025	01:25	5.73	09:45	8.88	7.46	02:10	2.05	09:45	2.83	2.49	01:25	0.699	09:45	1.724	1.220	1.220	0.12
03/30/2025	02:25	5.57	17:20	8.76	7.39	04:10	2.02	17:25	2.77	2.47	02:25	0.654	17:20	1.649	1.195	1.195	0.23
03/31/2025	03:00	6.05	13:00	8.93	7.68	03:55	2.19	13:00	2.80	2.54	03:00	0.795	13:00	1.720	1.283	1.283	0.10
04/01/2025	23:55	5.76	10:30	8.75	7.25	23:30	2.07	10:35	2.71	2.43	23:55	0.705	10:35	1.614	1.137	1.137	0.03
04/02/2025	01:35	5.43	08:25	8.27	6.87	01:30	1.88	07:50	2.59	2.34	01:30	0.588	08:30	1.422	1.019	1.019	0.05
04/03/2025	02:55	4.97	19:35	8.09	6.56	02:50	1.76	19:35	2.60	2.26	02:55	0.484	19:35	1.399	0.925	0.925	0.02
04/04/2025	04:05	4.69	18:35	8.36	6.32	04:05	1.69	10:20	2.49	2.19	04:05	0.428	18:35	1.371	0.858	0.858	-
04/05/2025	03:45	4.41	08:10	8.43	6.22	03:45	1.54	08:15	2.61	2.15	03:45	0.356	08:10	1.479	0.833	0.833	-
04/06/2025	05:00	4.27	19:20	9.00	6.97	02:25	1.48	19:25	2.88	2.33	02:30	0.331	19:25	1.780	1.081	1.081	0.71
04/07/2025	03:35	6.81	11:15	9.59	8.28	03:35	2.37	11:15	2.99	2.67	03:35	1.010	11:15	2.010	1.488	1.488	0.37
04/08/2025	23:55	6.16	07:05	9.12	7.75	23:55	2.20	07:05	2.84	2.53	23:55	0.817	07:05	1.793	1.293	1.293	0.07
04/09/2025	02:30	5.66	17:30	8.69	7.15	23:15	2.01	19:50	2.67	2.39	23:15	0.666	17:35	1.539	1.101	1.101	-
04/10/2025	02:30	5.06	06:30	8.55	7.01	01:40	1.81	20:15	2.69	2.35	02:30	0.516	19:40	1.528	1.061	1.061	0.27
04/11/2025	02:30	5.10	07:05	8.11	6.76	02:30	1.82	07:40	2.57	2.29	02:30	0.519	07:05	1.370	0.978	0.978	0.01
04/12/2025	04:00	4.62	09:40	8.21	6.51	04:00	1.63	09:55	2.65	2.22	04:00	0.403	09:40	1.409	0.912	0.912	0.01
04/13/2025	03:30	4.34	20:15	8.25	6.44	03:30	1.50	19:20	2.61	2.20	03:30	0.341	19:20	1.428	0.898	0.898	-
04/14/2025	03:15	4.26	07:50	8.82	6.25	03:15	1.46	07:50	2.74	2.15	03:15	0.323	07:50	1.654	0.839	0.839	-
04/15/2025	02:30	4.12	06:10	7.98	6.10	02:30	1.44	19:45	2.52	2.11	02:30	0.303	06:10	1.293	0.796	0.796	-
04/16/2025	02:20	4.01	18:40	7.96	6.06	03:10	1.36	06:55	2.50	2.10	02:20	0.279	18:40	1.293	0.786	0.786	-
04/17/2025	03:50	3.81	06:45	7.84	5.98	03:45	1.31	06:45	2.46	2.07	03:45	0.248	06:45	1.271	0.764	0.764	-
04/18/2025	02:00	3.84	07:40	8.08	5.88	02:00	1.31	09:40	2.57	2.05	02:00	0.250	07:45	1.368	0.737	0.737	-
04/19/2025	02:50	3.60	11:25	7.81	5.85	02:50	1.21	09:50	2.49	2.03	02:50	0.210	11:25	1.253	0.733	0.733	0.01
04/20/2025	04:50	3.71	11:20	7.89	5.96	04:50	1.27	11:25	2.53	2.06	04:50	0.230	11:20	1.316	0.769	0.769	0.05
04/21/2025	03:00	3.64	17:30	7.90	5.82	03:00	1.24	17:30	2.50	2.03	03:00	0.219	17:30	1.301	0.724	0.724	0.02
04/22/2025	02:55	3.56	10:55	7.73	5.75	02:55	1.18	20:45	2.45	2.01	02:55	0.202	10:55	1.241	0.707	0.707	-
04/23/2025	02:15	3.58	19:55	7.83	5.71	02:15	1.21	20:00	2.49	1.99	02:15	0.208	20:00	1.279	0.693	0.693	-
04/24/2025	02:15	3.44	19:50	7.87	5.69	02:15	1.15	19:50	2.47	1.99	02:15	0.186	19:50	1.279	0.690	0.690	-
04/25/2025	03:25	3.51	18:25	7.41	5.68	03:25	1.16	07:45	2.41	1.99	03:25	0.195	17:05	1.137	0.686	0.686	-
04/26/2025	02:40	3.49	08:05	7.89	5.72	02:40	1.16	10:00	2.44	1.99	02:40	0.193	08:10	1.240	0.701	0.701	-
04/27/2025	03:40	3.41	11:00	7.70	5.83	03:40	1.13	09:35	2.47	2.01	03:40	0.182	11:00	1.230	0.732	0.732	-
04/28/2025	03:45	3.27	08:55	7.48	5.68	03:45	1.07	08:55	2.38	1.97	03:45	0.162	08:55	1.156	0.686	0.686	-
04/29/2025	01:50	3.54	18:50	8.02	5.78	01:50	1.17	18:55	2.49	2.00	01:50	0.199	18:55	1.314	0.706	0.706	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			118.475	13.62
Average	7.07	2.37	1.132	

CAM_52167

Site Commentary

SITE INFORMATION

Pipe	Elliptical (18.13 in H x 18.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	1.63	3.33	0.221
Minimum	0.54	0.43	0.006
Maximum	5.26	5.50	1.536
Min Time	01/22/2025 04:45:00	04/22/2025 03:30:00	01/22/2025 04:45:00
Max Time	02/18/2025 09:55:00	02/18/2025 09:55:00	02/18/2025 09:55:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_52167

Site Address /Location:	SE Dallas St and SE 3rd Ave, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5833078	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4001589	18.13 X 18.13	Circular



Manhole #	System Characteristics
52167	Industrial
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4), Smart Depth (CS5)	0 - 5 psi

Installation Confirmation:

Time	
2:43:00 PM	
Depth of Flow (Wet DOF) (in)	
1.25	
CS58 Physical Offset (in)	Measurement Confidence (in)
1.38	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.82	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

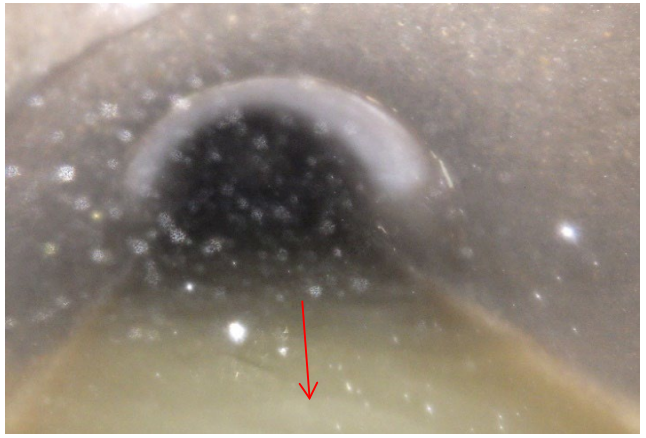
Manhole Depth (Approx. FT):	Manhole Configuration
17.5'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Hollow Tile	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

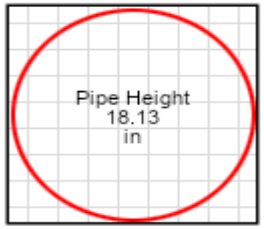
Monitoring Point Inlet	Outlet	NW inlet connection
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_52167

Flow Monitor

CAM_52167



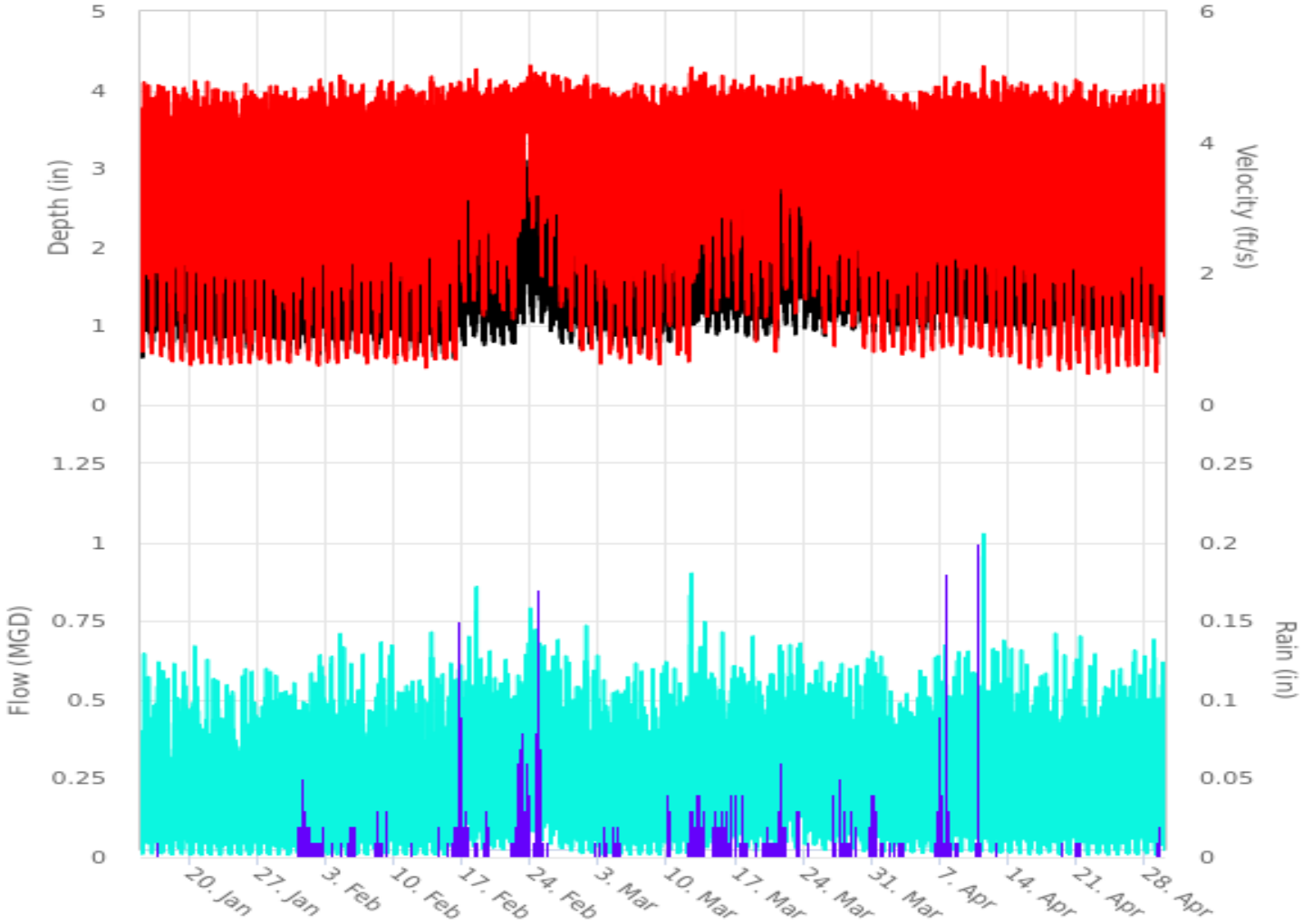
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

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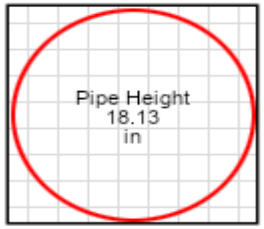
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Scattergraph Report

CAM_52167

Flow Monitor

CAM_52167

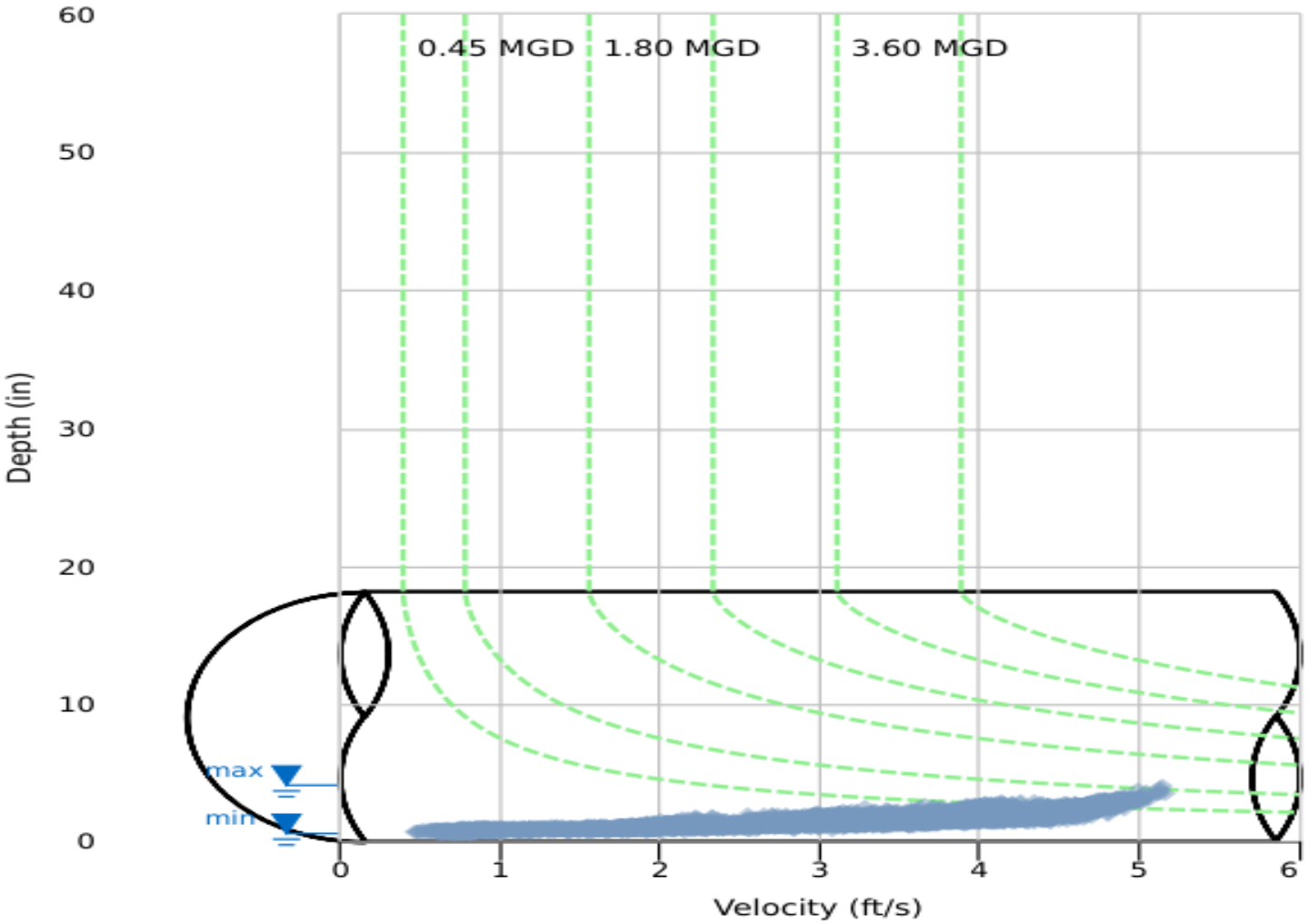


Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_52167 Pipe: Elliptical (18.13 in H x 18.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	0.55	08:30	3.97	1.60	05:45	0.66	08:30	5.21	3.36	04:55	0.008	08:30	0.981	0.214	0.214	-
01/16/2025	03:55	0.63	08:05	4.32	1.59	04:50	0.74	20:00	5.28	3.33	03:55	0.009	08:05	1.118	0.213	0.213	0.01
01/17/2025	06:00	0.68	20:05	4.16	1.51	03:45	0.73	20:05	5.28	3.15	06:00	0.011	20:05	1.057	0.189	0.189	-
01/18/2025	04:30	0.65	10:15	4.26	1.53	06:50	0.63	10:15	5.28	3.13	04:30	0.009	10:15	1.096	0.197	0.197	-
01/19/2025	04:15	0.70	09:25	4.17	1.56	06:40	0.64	16:40	5.26	3.20	04:15	0.010	11:30	1.046	0.203	0.203	-
01/20/2025	03:55	0.59	13:00	4.22	1.53	04:00	0.58	13:00	5.30	3.15	03:55	0.007	13:00	1.084	0.198	0.198	-
01/21/2025	02:50	0.54	18:10	4.14	1.47	05:25	0.61	18:10	5.24	3.09	05:25	0.007	18:10	1.044	0.182	0.182	-
01/22/2025	04:45	0.54	23:35	3.98	1.48	04:45	0.58	12:00	5.15	3.13	04:45	0.006	23:35	0.965	0.186	0.186	-
01/23/2025	05:00	0.55	21:25	4.33	1.45	05:00	0.59	21:25	5.31	3.04	05:00	0.006	21:25	1.129	0.179	0.179	-
01/24/2025	03:45	0.61	08:55	3.95	1.45	05:30	0.60	08:55	5.10	3.09	05:30	0.008	08:55	0.951	0.179	0.179	-
01/25/2025	05:45	0.66	10:20	4.19	1.48	03:30	0.62	10:20	5.31	3.08	04:55	0.009	10:20	1.076	0.189	0.189	-
01/26/2025	05:05	0.63	14:25	4.18	1.46	03:45	0.60	10:35	5.29	3.09	05:15	0.008	14:25	1.064	0.184	0.184	-
01/27/2025	01:25	0.65	21:20	4.06	1.49	04:40	0.66	21:20	5.33	3.08	01:30	0.010	21:20	1.033	0.191	0.191	-
01/28/2025	02:00	0.65	08:00	4.06	1.44	05:35	0.63	08:00	5.26	2.96	03:25	0.009	08:00	1.018	0.178	0.178	-
01/29/2025	04:15	0.65	10:05	4.15	1.41	04:00	0.66	10:05	5.26	2.92	04:10	0.009	10:05	1.051	0.171	0.171	-
01/30/2025	03:55	0.57	20:25	3.97	1.41	05:40	0.57	20:25	5.19	2.94	04:00	0.007	20:25	0.976	0.171	0.171	-
01/31/2025	01:35	0.68	19:40	4.05	1.52	02:40	0.76	19:40	5.22	3.25	02:40	0.013	19:40	1.010	0.197	0.197	0.60
02/01/2025	06:45	0.68	21:45	3.97	1.49	05:45	0.63	19:35	5.18	3.04	05:45	0.010	21:45	0.971	0.187	0.187	0.12
02/02/2025	02:55	0.61	12:05	3.95	1.57	05:45	0.55	10:00	5.25	3.18	05:45	0.007	10:00	0.972	0.211	0.211	0.07
02/03/2025	05:30	0.62	13:20	4.03	1.46	04:00	0.59	13:20	5.14	3.03	04:00	0.008	13:20	0.988	0.181	0.181	0.02
02/04/2025	03:55	0.67	19:30	4.00	1.51	03:55	0.61	19:30	5.20	3.09	03:55	0.008	19:30	0.988	0.194	0.194	0.01
02/05/2025	04:50	0.60	14:05	3.61	1.48	04:35	0.69	17:55	5.09	3.09	05:00	0.008	14:05	0.831	0.188	0.188	0.19
02/06/2025	04:35	0.62	17:25	3.99	1.51	04:35	0.72	19:35	5.16	3.15	04:35	0.009	19:35	0.972	0.194	0.194	-
02/07/2025	03:25	0.59	12:25	3.81	1.44	04:55	0.60	09:55	5.13	2.99	04:55	0.008	12:25	0.906	0.175	0.175	-
02/08/2025	02:10	0.62	22:45	4.02	1.49	05:05	0.68	16:20	5.18	3.07	05:15	0.010	22:45	0.986	0.192	0.192	0.25
02/09/2025	02:30	0.66	18:15	4.05	1.58	05:20	0.62	18:15	5.29	3.27	05:20	0.009	18:15	1.023	0.210	0.210	0.05
02/10/2025	05:50	0.61	16:10	3.93	1.50	03:05	0.62	16:10	5.26	3.17	03:05	0.008	16:10	0.974	0.193	0.193	-
02/11/2025	02:20	0.62	19:55	3.94	1.48	05:10	0.65	19:55	5.20	3.13	02:45	0.009	19:55	0.964	0.188	0.188	0.01
02/12/2025	05:45	0.61	19:05	4.18	1.45	02:50	0.67	19:05	5.29	3.06	02:50	0.009	19:05	1.068	0.184	0.184	-
02/13/2025	06:00	0.64	19:50	4.14	1.48	05:50	0.55	19:50	5.29	3.17	06:00	0.007	19:50	1.054	0.191	0.191	-
02/14/2025	02:00	0.59	19:55	4.18	1.41	04:55	0.64	19:55	5.26	3.00	04:55	0.008	19:55	1.063	0.180	0.180	0.07
02/15/2025	03:25	0.58	19:55	4.17	1.41	05:05	0.56	19:55	5.28	3.11	05:05	0.007	19:55	1.064	0.178	0.178	0.09
02/16/2025	03:40	0.58	20:15	4.10	1.55	06:45	0.66	18:25	5.27	3.39	06:45	0.008	20:15	1.009	0.219	0.219	0.77
02/17/2025	04:40	0.70	07:50	4.25	1.74	04:00	1.03	07:50	5.35	3.80	04:00	0.016	07:50	1.108	0.262	0.262	0.39
02/18/2025	03:35	0.79	09:55	5.26	1.80	04:45	1.22	09:55	5.50	3.78	04:45	0.022	09:55	1.536	0.281	0.281	0.02
02/19/2025	05:25	0.70	19:45	4.44	1.75	04:10	0.93	19:45	5.40	3.84	05:25	0.015	19:45	1.190	0.271	0.271	0.40
02/20/2025	03:30	0.70	16:55	4.22	1.69	04:45	1.02	08:05	5.36	3.72	04:45	0.016	16:55	1.073	0.252	0.252	-
02/21/2025	05:15	0.69	08:40	4.15	1.65	04:35	0.91	15:35	5.36	3.59	04:35	0.013	08:40	1.017	0.239	0.239	0.04
02/22/2025	04:20	0.65	16:55	3.98	1.66	05:05	0.78	19:35	5.13	3.65	05:05	0.011	16:55	0.956	0.241	0.241	0.84
02/23/2025	05:25	0.92	15:55	4.46	2.16	02:35	1.93	10:50	5.39	4.46	04:55	0.047	15:55	1.157	0.385	0.385	1.07
02/24/2025	06:05	0.90	19:45	4.29	2.03	05:40	1.71	08:35	5.42	4.30	05:40	0.039	08:35	1.122	0.344	0.344	0.87
02/25/2025	03:45	0.90	13:10	4.31	1.91	03:45	1.64	13:10	5.44	4.17	03:45	0.035	13:10	1.146	0.304	0.304	0.03
02/26/2025	05:45	0.80	21:05	4.18	1.82	00:55	1.61	06:55	5.25	3.95	00:55	0.031	21:05	1.041	0.282	0.282	-
02/27/2025	05:45	0.70	23:15	3.98	1.69	03:50	0.85	22:00	5.23	3.69	03:50	0.014	22:00	0.977	0.244	0.244	-
02/28/2025	04:05	0.70	15:40	3.43	1.62	03:25	0.86	15:40	5.07	3.61	03:25	0.014	15:40	0.773	0.222	0.222	-
03/01/2025	05:40	0.69	11:25	4.47	1.60	05:40	0.73	11:25	5.37	3.52	05:40	0.010	11:25	1.191	0.221	0.221	-
03/02/2025	05:40	0.71	19:45	4.32	1.64	04:50	0.70	11:00	5.22	3.50	04:50	0.011	19:45	1.098	0.230	0.230	0.05
03/03/2025	04:00	0.67	11:45	4.11	1.59	03:55	0.57	11:45	5.24	3.46	03:55	0.008	11:45	1.035	0.213	0.213	0.07
03/04/2025	05:20	0.68	21:05	4.23	1.55	02:15	0.70	21:05	5.30	3.35	02:15	0.011	21:05	1.088	0.207	0.207	0.12
03/05/2025	03:55	0.65	08:10	4.05	1.54	03:55	0.67	19:50	5.31	3.29	03:55	0.009	08:10	1.019	0.207	0.207	0.01
03/06/2025	04:25	0.62	22:10	4.19	1.52	04:20	0.63	18:15	5.28	3.23	04:25	0.008	22:10	1.067	0.201	0.201	-
03/07/2025	04:00	0.64	08:30	4.09	1.47	01:50	0.69	08:30	5.20	3.10	01:50	0.009	08:30	1.020	0.185	0.185	-
03/08/2025	04:10	0.64	12:00	3.85	1.48	03:00	0.62	09:10	5.21	3.12	03:00	0.009	12:00	0.920	0.185	0.185	-
03/09/2025	04:25	0.65	18:00	4.24	1.58	03:00	0.59	20:35	5.34	3.20	03:00	0.008	10:50	1.090	0.211	0.211	0.20
03/10/2025	05:15	0.79	17:15	4.14	1.59	06:10	1.01	17:15	5.26	3.29	06:10	0.018	17:15	1.046	0.209	0.209	0.22
03/11/2025	02:10	0.71	07:10	3.79	1.54	02:10	0.75	20:45	5.14	3.22	02:10	0.011	19:20	0.877	0.196	0.196	0.02
03/12/2025	03:55	0.70	09:45	4.33	1.82	03:55	0.65	09:45	5.43	3.58	03:55	0.010	09:45	1.154	0.281	0.281	0.83
03/13/2025	04:50	0.92	14:35	4.42	1.83	04:45	1.41	14:35	5.41	3.83	04:50	0.032	14:35	1.183	0.279	0.279	0.49
03/14/2025	01:20	0.80	21:05	4.19	1.80	01:20	0.90	21:05	5.33	3.71	01:20	0.016	21:05	1.080	0.270	0.270	0.16
03/15/2025	04:45	0.85	15:50	4.19	1.78	04:45	0.86	15:50	5.27	3.70	04:45	0.017	15:50	1.070	0.264	0.264	0.60
03/16/2025	06:20	0.81	18:35	4.35	1.85	04:05	0.98	18:35	5.37	3.79	04:05	0.018	18:35	1.148	0.284	0.284	0.16
03/17/2025	02:00	0.83	19:20	4.36	1.77	02:00	0.99	19:20	5.33	3.67	02:00	0.019	19:20	1.144	0.261	0.261	0.19
03/18/2025	03:40	0.77	18:30	4.20	1.72	03:05	0.90	18:30	5.28	3.58	03:40	0.017	18:30	1.074	0.246	0.246	0.02
03/19/2025	03:20	0.79	13:10	4.17	1.67	01:55	0.82	13:10	5.37	3.50	01:55	0.016	13:10	1.083	0.232	0.232	0.07
03/20/2025	02:50	0.79	19:15	4.12	1.65	02:50	0.70	13:20	5.32	3.47	02:50	0.012	19:15	1.029	0.228	0.228	0.11
03/21/2025	02:15	0.78	15:45	4.33	1.82	04:05	0.77	15:45	5.35	3.76	04:05	0.014	15:45	1.137	0.277	0.277	1.12
03/22/2025	23:20	0.94	13:30	4.22	1.89	03:40	1.44	20:55	5.32	3.92	03:40	0.035	13:30	1.072	0.295	0.295	-
03/23/2025	02:10	0.83	15:15	4.36	1.88	02:10	0.96	15:15	5.39	3.92	02:10	0.018	15:15	1.156	0.295	0.295	0.44
03/24/2025	00:40	0.89	13:50	4.13	1.80	01:45	1.32	04:30	5.18	3.77	01:45	0.029	13:50	1.010	0.268	0.268	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:55	0.86	19:00	4.30	1.76	23:50	1.09	19:00	5.26	3.67	23:50	0.023	19:00	1.105	0.254	0.254	-
03/26/2025	01:10	0.83	06:55	4.34	1.73	03:10	0.80	10:05	5.28	3.58	03:10	0.016	06:55	1.111	0.245	0.245	0.20
03/27/2025	00:30	0.85	23:40	3.85	1.73	01:55	0.79	06:35	5.27	3.54	01:55	0.016	12:15	0.929	0.242	0.242	0.24
03/28/2025	03:05	0.91	12:25	4.30	1.74	01:40	1.09	15:10	5.34	3.55	05:05	0.025	12:25	1.117	0.247	0.247	0.17
03/29/2025	01:45	0.89	19:25	4.06	1.74	01:45	0.87	19:25	5.18	3.50	01:45	0.018	19:25	1.003	0.243	0.243	0.12
03/30/2025	01:00	0.88	11:45	4.29	1.73	02:30	0.76	11:45	5.26	3.43	02:30	0.016	11:45	1.104	0.240	0.240	0.23
03/31/2025	04:30	0.87	07:15	4.01	1.71	04:30	0.75	07:15	5.24	3.35	04:30	0.015	07:15	0.997	0.231	0.231	0.10
04/01/2025	04:35	0.87	21:05	4.20	1.63	03:40	0.79	21:05	5.20	3.25	01:10	0.016	21:05	1.056	0.212	0.212	0.03
04/02/2025	03:45	0.85	20:50	4.04	1.59	03:45	0.84	20:50	5.15	3.17	03:45	0.017	20:50	0.991	0.199	0.199	0.05
04/03/2025	03:00	0.82	13:05	3.65	1.58	05:00	0.71	18:15	5.02	3.09	01:55	0.014	13:05	0.831	0.194	0.194	0.02
04/04/2025	03:35	0.75	21:30	4.15	1.55	03:35	0.68	23:10	5.20	3.07	03:35	0.011	21:30	1.041	0.189	0.189	-
04/05/2025	04:35	0.79	16:25	4.20	1.58	04:35	0.67	16:25	5.24	3.09	04:35	0.012	16:25	1.066	0.196	0.196	-
04/06/2025	03:15	0.85	10:45	4.21	1.73	04:15	0.82	16:20	5.30	3.44	03:15	0.016	16:20	1.079	0.238	0.238	0.71
04/07/2025	04:25	0.88	06:35	4.34	1.78	03:30	0.77	06:35	5.32	3.47	03:30	0.017	06:35	1.131	0.249	0.249	0.37
04/08/2025	05:00	0.91	16:40	4.40	1.74	03:30	0.76	16:40	5.36	3.44	03:30	0.017	16:40	1.163	0.241	0.241	0.07
04/09/2025	02:25	0.92	06:35	4.02	1.76	02:20	0.72	14:00	5.23	3.39	02:25	0.017	14:00	0.997	0.242	0.242	-
04/10/2025	01:35	0.87	12:00	4.13	1.71	04:05	0.72	12:00	5.24	3.35	03:15	0.016	12:00	1.039	0.228	0.228	0.27
04/11/2025	05:10	0.88	09:35	5.07	1.82	02:45	0.73	09:35	5.34	3.41	02:45	0.015	09:35	1.416	0.266	0.266	0.01
04/12/2025	03:40	0.85	08:05	4.30	1.67	05:40	0.73	18:45	5.31	3.33	02:45	0.015	08:05	1.109	0.224	0.224	0.01
04/13/2025	04:30	0.78	19:05	4.31	1.66	04:30	0.64	19:05	5.31	3.28	04:30	0.011	19:05	1.122	0.227	0.227	-
04/14/2025	02:25	0.78	19:10	4.26	1.63	02:25	0.71	19:10	5.27	3.28	02:25	0.012	19:10	1.093	0.217	0.217	-
04/15/2025	03:00	0.73	09:20	4.06	1.64	03:00	0.52	09:20	5.20	3.18	03:00	0.008	09:20	1.009	0.216	0.216	-
04/16/2025	02:55	0.72	18:45	3.92	1.58	02:55	0.55	18:45	5.10	3.08	02:55	0.008	18:45	0.942	0.196	0.196	-
04/17/2025	03:10	0.75	18:45	4.03	1.59	03:10	0.54	18:45	5.22	3.00	03:10	0.009	18:45	1.003	0.201	0.201	-
04/18/2025	04:55	0.87	21:45	4.25	1.61	01:50	0.75	21:45	5.29	3.03	01:50	0.015	21:45	1.093	0.199	0.199	-
04/19/2025	04:10	0.79	16:30	4.10	1.60	04:10	0.52	16:30	5.19	2.92	04:10	0.009	16:30	1.019	0.196	0.196	0.01
04/20/2025	05:10	0.73	21:20	4.29	1.65	05:10	0.53	21:20	5.27	3.07	05:10	0.008	21:20	1.102	0.214	0.214	0.05
04/21/2025	02:35	0.73	07:30	4.17	1.58	02:35	0.58	07:30	5.29	2.94	02:35	0.009	07:30	1.064	0.196	0.196	0.02
04/22/2025	03:30	0.68	20:20	4.40	1.60	03:30	0.43	20:20	5.26	2.99	03:30	0.006	20:20	1.141	0.201	0.201	-
04/23/2025	03:55	0.76	20:55	4.05	1.57	03:55	0.53	20:55	5.18	2.92	03:55	0.009	20:55	1.001	0.187	0.187	-
04/24/2025	03:35	0.65	06:20	4.10	1.61	03:35	0.47	06:20	5.18	2.93	03:35	0.006	06:20	1.017	0.200	0.200	-
04/25/2025	03:40	0.67	10:50	4.33	1.57	03:40	0.58	10:50	5.27	2.88	03:40	0.008	10:50	1.121	0.189	0.189	-
04/26/2025	05:10	0.78	21:15	4.33	1.62	05:10	0.57	21:15	5.27	2.98	05:10	0.010	21:15	1.120	0.202	0.202	-
04/27/2025	05:15	0.71	18:10	3.91	1.63	05:15	0.58	18:10	5.22	2.97	05:15	0.009	18:10	0.958	0.210	0.210	-
04/28/2025	03:05	0.75	20:15	4.35	1.57	03:05	0.55	20:15	5.31	2.97	03:05	0.009	20:15	1.136	0.194	0.194	-
04/29/2025	02:50	0.67	15:10	3.95	1.55	02:25	0.49	15:10	5.20	2.95	02:50	0.007	15:10	0.968	0.190	0.190	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			23.166	13.62
Average	1.63	3.33	0.221	

CAM_81189

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12.13 in H x 12.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were experienced during the study. Backwater conditions were observed.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.07	1.91	0.117
Minimum	0.98	0.37	0.017
Maximum	4.16	2.85	0.295
Min Time	04/11/2025 02:50:00	02/21/2025 04:30:00	04/22/2025 02:20:00
Max Time	04/23/2025 08:25:00	04/01/2025 10:45:00	02/06/2025 15:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

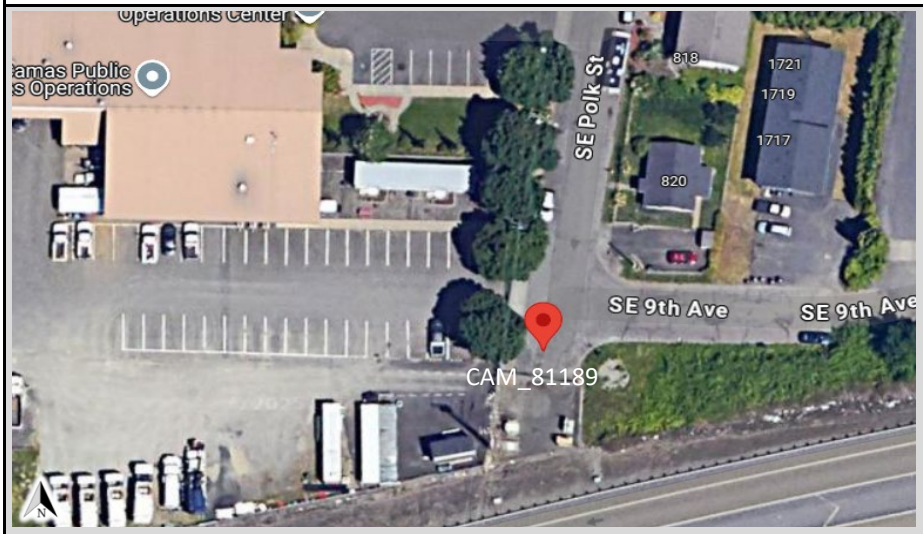
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_81189

Site Address /Location:	820 SE Polk St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.580146	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.39157	12.13 x 12.13	Circular



Manhole #	System Characteristics
81189	Residential
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
10:17:00 AM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.57	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

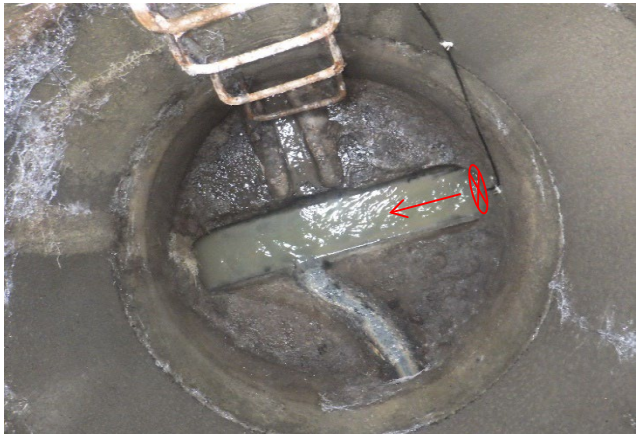
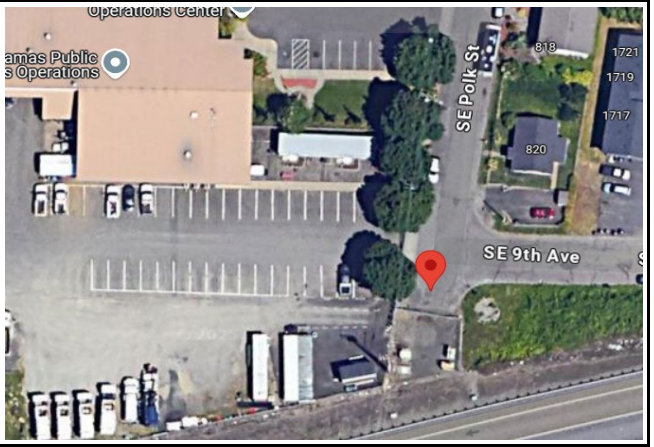
Manhole Depth (Approx. FT):	Manhole Configuration
7.5	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

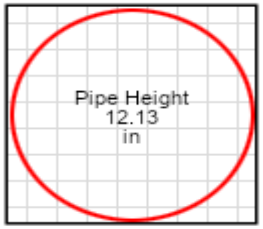
Monitoring Point Inlet	Outlet	West connection
		
Top Down	**Location**	**Map**
		
East Connection	**KEY**	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_81189

Flow Monitor

CAM_81189



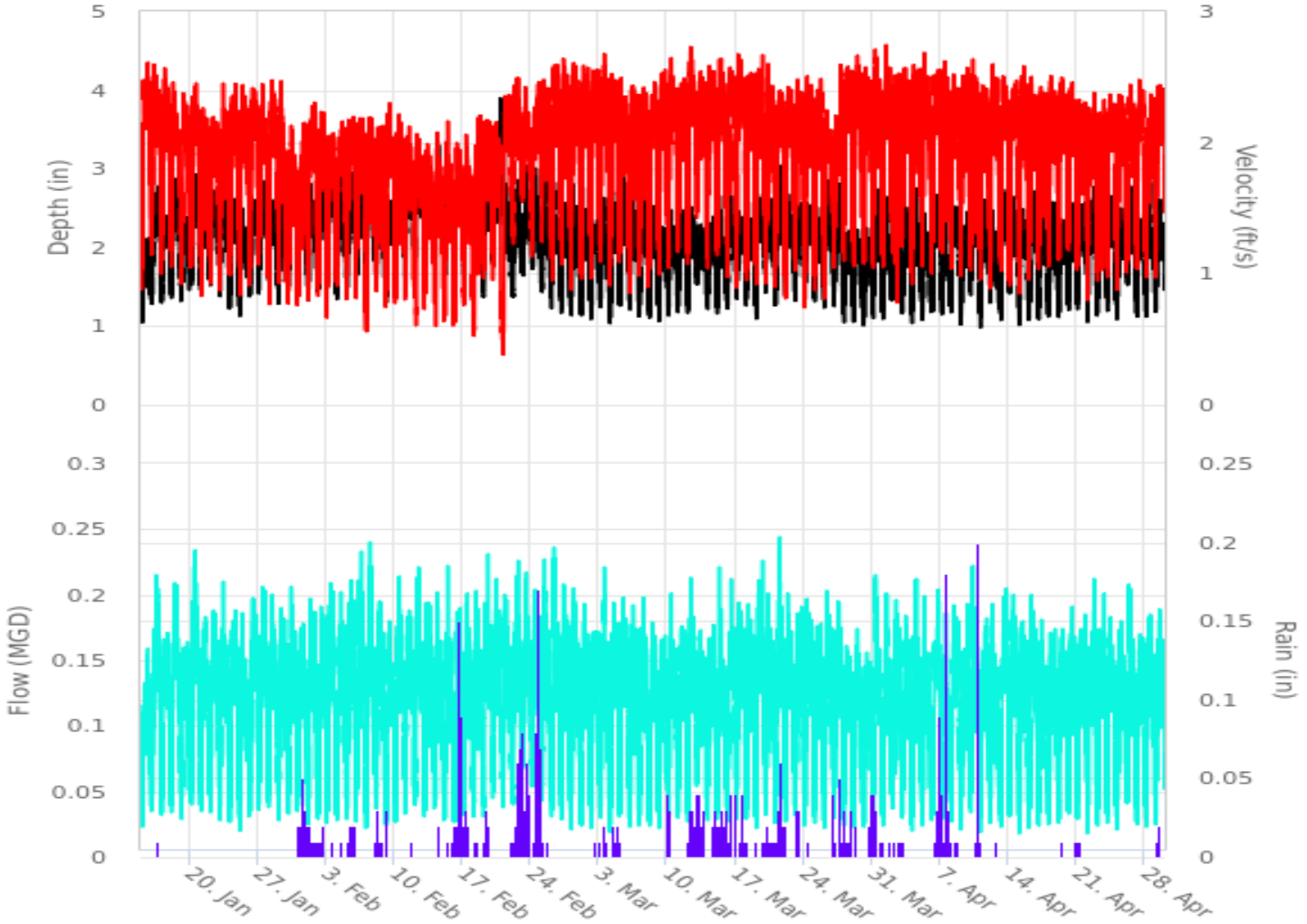
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

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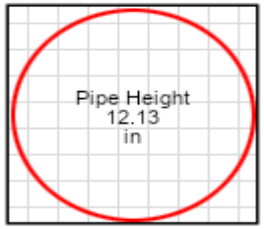
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Scattergraph Report

CAM_81189

Flow Monitor

CAM_81189

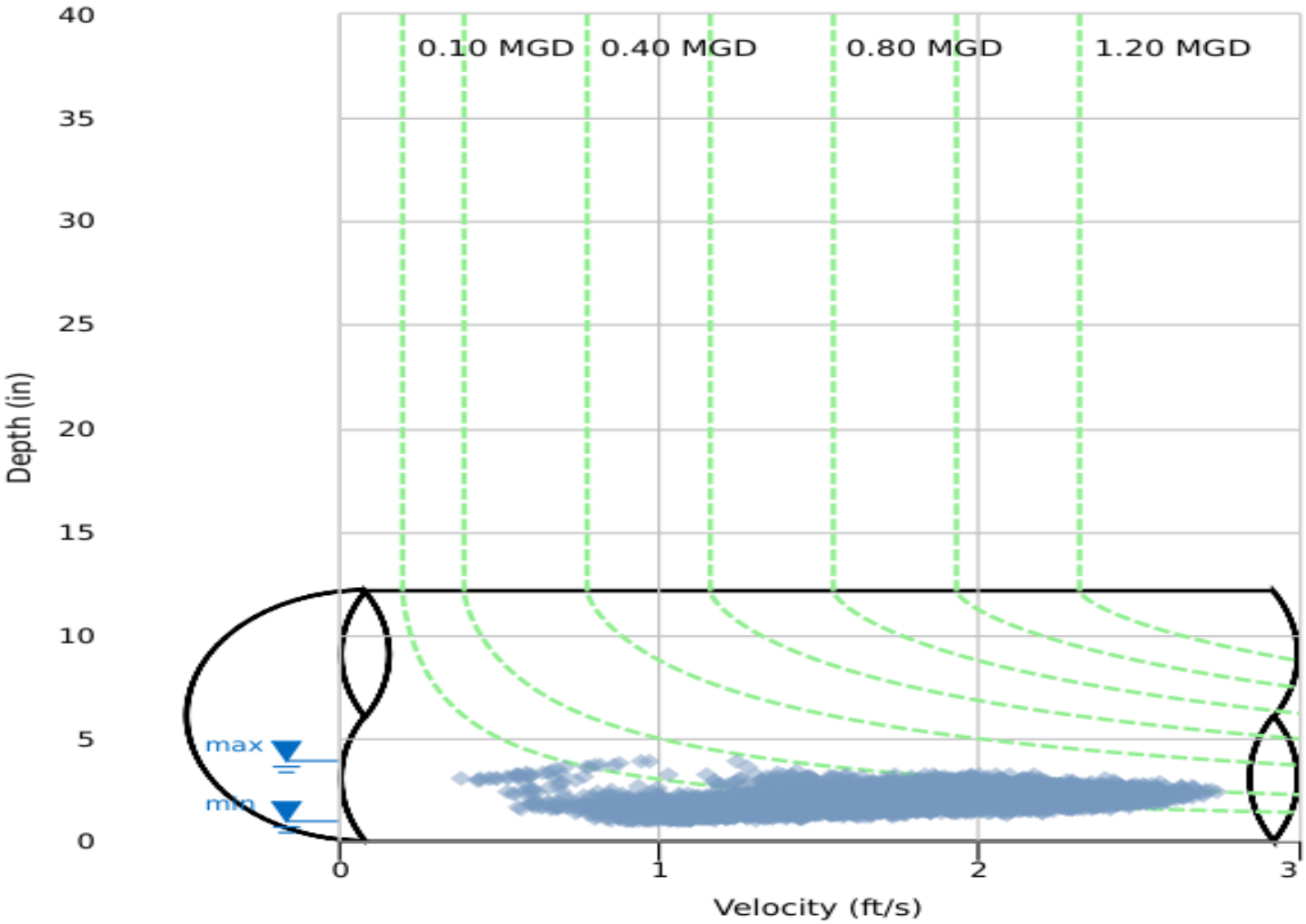


Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_81189 Pipe: Elliptical (12.13 in H x 12.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	1.03	09:30	2.34	1.63	02:55	0.86	15:35	2.71	2.08	04:55	0.022	15:35	0.168	0.090	0.090	-
01/16/2025	04:20	1.26	18:25	2.91	2.11	04:35	0.89	09:15	2.65	2.09	04:35	0.026	14:20	0.217	0.133	0.133	0.01
01/17/2025	05:05	1.26	13:55	2.70	1.97	03:45	0.95	11:30	2.66	2.03	05:05	0.030	12:20	0.203	0.115	0.115	-
01/18/2025	04:20	1.31	12:00	2.93	2.19	04:20	1.03	04:25	2.50	1.92	04:20	0.031	12:00	0.226	0.129	0.129	-
01/19/2025	03:05	1.30	16:40	2.70	1.92	06:20	0.87	16:40	2.60	1.82	05:15	0.028	16:40	0.224	0.101	0.101	-
01/20/2025	04:15	1.49	13:45	3.00	2.27	06:15	0.92	11:35	2.63	1.94	06:15	0.037	11:35	0.253	0.137	0.137	-
01/21/2025	03:50	1.41	14:55	2.97	2.09	06:00	0.77	08:20	2.35	1.82	04:25	0.031	15:30	0.196	0.112	0.112	-
01/22/2025	03:55	1.48	15:05	3.08	2.22	05:15	0.74	11:25	2.30	1.78	03:55	0.032	12:05	0.203	0.121	0.121	-
01/23/2025	03:20	1.37	12:55	3.26	2.17	04:15	0.86	11:30	2.60	1.84	04:15	0.028	11:30	0.234	0.121	0.121	-
01/24/2025	02:50	1.22	14:20	2.77	2.05	04:40	0.90	14:15	2.61	1.91	04:40	0.025	14:15	0.222	0.118	0.118	-
01/25/2025	04:45	1.09	11:05	2.53	1.85	04:45	0.80	18:05	2.50	1.91	04:45	0.019	11:05	0.194	0.101	0.101	-
01/26/2025	05:10	1.37	19:55	2.69	2.10	02:30	0.90	08:10	2.51	1.94	02:45	0.030	13:50	0.205	0.123	0.123	-
01/27/2025	03:25	1.39	20:20	2.89	2.21	03:25	1.02	11:30	2.51	1.86	03:25	0.034	11:35	0.224	0.125	0.125	-
01/28/2025	06:25	1.52	18:20	2.94	2.10	05:35	0.63	11:45	2.50	1.91	03:25	0.037	11:50	0.206	0.117	0.117	-
01/29/2025	03:05	1.22	20:50	3.16	2.18	22:25	0.80	10:10	2.52	1.72	03:05	0.024	10:10	0.204	0.113	0.113	-
01/30/2025	05:10	1.47	09:25	3.13	2.34	03:15	0.73	06:10	2.19	1.55	05:10	0.029	10:45	0.209	0.114	0.114	-
01/31/2025	02:20	1.72	15:20	3.07	2.38	04:30	0.70	19:55	2.30	1.57	02:20	0.034	15:55	0.207	0.116	0.116	0.60
02/01/2025	05:00	1.30	09:50	2.89	2.13	05:05	0.78	14:05	2.39	1.80	05:05	0.024	14:05	0.206	0.116	0.116	0.12
02/02/2025	03:55	1.42	19:10	2.99	2.18	05:15	0.79	18:55	2.60	1.74	05:20	0.028	12:00	0.215	0.117	0.117	0.07
02/03/2025	03:45	1.50	16:05	3.30	2.41	02:40	0.64	18:55	2.27	1.66	02:40	0.024	14:35	0.236	0.128	0.128	0.02
02/04/2025	03:45	1.31	13:10	3.19	2.15	01:20	0.88	17:25	2.59	1.73	03:40	0.028	13:15	0.249	0.114	0.114	0.01
02/05/2025	04:10	1.39	15:35	3.41	2.24	02:55	0.75	20:00	2.27	1.77	02:55	0.028	15:35	0.233	0.124	0.124	0.19
02/06/2025	02:55	1.38	15:30	3.78	2.30	02:55	0.78	19:40	2.33	1.76	02:55	0.025	15:30	0.295	0.127	0.127	-
02/07/2025	05:45	1.49	15:10	3.53	2.40	05:05	0.55	08:05	2.44	1.60	02:30	0.022	13:25	0.252	0.125	0.125	-
02/08/2025	02:05	1.55	17:45	3.26	2.44	04:55	0.74	20:10	2.33	1.58	04:55	0.033	20:10	0.228	0.121	0.121	0.25
02/09/2025	05:00	1.27	23:05	2.81	2.02	03:20	0.71	09:20	2.51	1.70	05:00	0.021	13:25	0.196	0.104	0.104	0.05
02/10/2025	02:50	1.36	15:20	3.24	2.32	02:15	0.77	12:10	2.27	1.71	04:00	0.025	10:45	0.229	0.126	0.126	-
02/11/2025	02:45	1.57	18:20	2.95	2.38	04:45	0.72	13:05	2.24	1.61	04:45	0.029	13:10	0.207	0.121	0.121	0.01
02/12/2025	03:05	1.75	12:40	3.28	2.55	05:55	0.60	07:00	2.15	1.55	03:05	0.034	12:00	0.230	0.129	0.129	-
02/13/2025	04:10	1.58	13:40	3.20	2.43	02:40	0.72	07:45	2.01	1.50	02:40	0.030	07:45	0.207	0.116	0.116	-
02/14/2025	04:30	1.61	13:35	3.65	2.38	06:55	0.55	10:30	2.11	1.48	02:50	0.028	10:25	0.207	0.111	0.111	0.07
02/15/2025	06:20	1.62	12:05	3.12	2.38	02:05	0.61	12:05	2.20	1.45	06:20	0.026	12:05	0.232	0.109	0.109	0.09
02/16/2025	03:00	1.60	15:45	3.32	2.40	01:30	0.54	10:30	2.12	1.45	06:10	0.025	10:30	0.207	0.113	0.113	0.77
02/17/2025	03:25	1.62	12:30	3.15	2.46	03:25	0.70	09:05	2.20	1.46	03:25	0.029	09:05	0.215	0.116	0.116	0.39
02/18/2025	23:15	1.81	14:20	3.31	2.40	04:50	0.48	16:10	2.29	1.53	03:35	0.028	10:35	0.219	0.112	0.112	0.02
02/19/2025	04:05	1.35	15:15	3.34	2.22	04:05	0.82	17:45	2.27	1.75	04:05	0.026	15:20	0.238	0.121	0.121	0.40
02/20/2025	04:35	1.74	21:45	3.99	2.55	22:55	0.63	09:15	2.25	1.60	05:50	0.040	12:05	0.221	0.127	0.127	-
02/21/2025	23:40	1.63	00:00	3.38	2.45	04:30	0.37	10:00	2.53	1.64	04:30	0.036	12:45	0.224	0.112	0.112	0.04
02/22/2025	04:45	1.33	19:35	3.08	2.08	05:25	1.15	08:25	2.56	1.99	04:45	0.036	17:15	0.235	0.124	0.124	0.84
02/23/2025	06:20	1.59	14:00	3.11	2.25	23:15	1.35	11:10	2.43	1.94	06:20	0.057	11:40	0.226	0.131	0.131	1.07
02/24/2025	04:50	1.66	12:45	3.09	2.19	05:30	1.06	20:25	2.52	1.95	04:50	0.046	12:40	0.215	0.128	0.128	0.87
02/25/2025	04:20	1.39	11:55	3.24	2.08	23:05	1.11	08:25	2.55	2.00	04:20	0.037	11:55	0.251	0.124	0.124	0.03
02/26/2025	03:50	1.21	10:05	2.96	2.08	04:55	0.91	17:50	2.72	2.11	03:50	0.030	10:05	0.264	0.132	0.132	-
02/27/2025	03:25	1.14	12:40	2.87	2.01	04:35	0.98	08:30	2.68	2.10	03:25	0.026	11:05	0.225	0.125	0.125	-
02/28/2025	05:00	1.11	09:35	3.31	1.96	03:30	0.86	10:10	2.71	2.04	05:00	0.021	11:25	0.215	0.118	0.118	-
03/01/2025	03:55	1.12	22:00	2.89	1.91	05:15	0.83	09:35	2.67	2.07	05:15	0.020	12:00	0.202	0.115	0.115	-
03/02/2025	04:30	1.08	19:50	2.40	1.88	04:30	0.93	11:10	2.65	2.08	04:30	0.021	12:15	0.185	0.114	0.114	0.05
03/03/2025	04:30	1.21	13:50	2.77	1.95	01:50	1.03	13:05	2.73	2.13	04:30	0.028	13:50	0.237	0.121	0.121	0.07
03/04/2025	03:50	1.02	08:45	3.19	1.95	03:40	0.89	13:20	2.70	2.02	03:40	0.019	21:55	0.214	0.115	0.115	0.12
03/05/2025	02:25	1.25	12:25	3.34	2.09	02:15	1.05	07:15	2.65	1.94	02:15	0.031	12:50	0.219	0.121	0.121	0.01
03/06/2025	04:40	1.20	12:15	2.75	2.07	04:35	0.85	10:45	2.53	1.90	04:35	0.023	12:10	0.198	0.117	0.117	-
03/07/2025	02:35	1.10	14:55	2.65	1.96	23:30	0.71	11:50	2.57	1.91	02:35	0.023	14:35	0.203	0.110	0.110	-
03/08/2025	05:00	1.09	13:15	2.72	1.89	04:45	0.86	13:40	2.53	1.99	04:45	0.021	13:10	0.198	0.109	0.109	-
03/09/2025	04:20	1.06	12:25	2.40	1.83	04:20	0.98	12:25	2.59	2.05	04:20	0.022	12:25	0.188	0.107	0.107	0.20
03/10/2025	03:45	1.12	10:15	2.52	1.91	03:40	0.99	10:15	2.71	2.09	03:40	0.024	10:15	0.211	0.115	0.115	0.22
03/11/2025	01:45	1.16	14:05	2.55	1.95	01:45	1.00	09:50	2.62	2.08	01:45	0.025	10:20	0.189	0.117	0.117	0.02
03/12/2025	02:40	1.16	10:00	2.63	1.94	02:35	1.07	09:50	2.80	2.15	02:35	0.027	10:00	0.230	0.122	0.122	0.83
03/13/2025	23:50	1.30	18:15	2.34	1.89	23:50	1.25	19:20	2.62	2.12	23:50	0.037	10:50	0.180	0.112	0.112	0.49
03/14/2025	04:05	1.20	11:00	2.52	1.89	04:05	0.98	08:05	2.76	2.04	04:05	0.026	18:15	0.203	0.111	0.111	0.16
03/15/2025	03:20	1.16	08:35	2.68	1.89	00:45	1.08	11:15	2.71	2.12	03:25	0.028	08:30	0.225	0.116	0.116	0.60
03/16/2025	04:20	1.21	13:15	2.88	1.93	04:45	0.89	15:20	2.63	2.06	04:45	0.025	13:15	0.238	0.116	0.116	0.16
03/17/2025	03:30	1.33	08:25	2.63	2.00	02:00	0.80	13:40	2.79	2.12	03:30	0.026	13:45	0.206	0.124	0.124	0.19
03/18/2025	02:30	1.25	08:20	2.61	1.95	03:30	0.91	10:10	2.79	2.05	02:30	0.028	08:20	0.199	0.116	0.116	0.02
03/19/2025	03:40	1.09	08:20	2.76	2.06	03:20	0.85	18:45	2.79	2.02	03:20	0.021	18:45	0.236	0.126	0.126	0.07
03/20/2025	02:15	1.40	12:30	2.67	2.04	02:00	0.90	08:15	2.71	1.96	02:00	0.030	08:15	0.214	0.117	0.117	0.11
03/21/2025	01:25	1.24	13:50	3.12	2.15	02:35	0.81	12:20	2.52	1.93	02:35	0.024	13:45	0.256	0.127	0.127	1.12
03/22/2025	02:40	1.38	08:40	2.72	2.09	03:35	0.69	09:30	2.53	1.93	03:35	0.024	08:35	0.205	0.121	0.121	-
03/23/2025	02:20	1.28	11:15	2.61	2.07	02:20	0.97	09:10	2.49	1.96	02:20	0.028	11:15	0.197	0.121	0.121	0.44
03/24/2025	03:35	1.31	16:15	2.64	2.10	02:00	0.71	09:00	2.60	1.96	03:35	0.022	18:10	0.202	0.124	0.124	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:15	1.30	08:15	2.67	1.98	03:35	0.84	09:05	2.65	1.98	03:35	0.025	10:40	0.205	0.115	0.115	-
03/26/2025	02:40	1.22	07:40	3.02	2.15	02:35	0.77	07:40	2.37	1.81	02:35	0.021	07:40	0.239	0.120	0.120	0.20
03/27/2025	01:50	1.22	12:05	2.90	2.08	01:50	1.00	18:55	2.65	1.89	01:50	0.027	12:10	0.209	0.117	0.117	0.24
03/28/2025	03:35	1.03	19:55	2.55	1.78	03:35	1.04	13:05	2.71	2.11	03:35	0.022	09:00	0.169	0.105	0.105	0.17
03/29/2025	02:10	1.04	11:00	2.38	1.75	03:30	1.04	09:55	2.70	2.14	03:30	0.023	12:25	0.178	0.105	0.105	0.12
03/30/2025	02:55	0.99	11:00	2.42	1.65	04:35	1.01	18:30	2.66	2.08	04:35	0.021	11:00	0.181	0.093	0.093	0.23
03/31/2025	03:40	1.09	13:30	2.79	1.91	02:05	0.99	07:50	2.77	2.10	03:45	0.023	08:50	0.218	0.116	0.116	0.10
04/01/2025	03:25	1.08	13:50	2.88	1.80	03:25	1.02	10:45	2.85	2.06	03:25	0.023	10:45	0.225	0.105	0.105	0.03
04/02/2025	02:50	1.29	14:05	3.92	2.03	14:20	0.69	16:20	2.72	1.99	02:50	0.035	11:15	0.211	0.115	0.115	0.05
04/03/2025	03:55	1.14	10:45	2.65	1.87	02:25	1.18	17:25	2.65	2.08	02:25	0.030	08:05	0.200	0.110	0.110	0.02
04/04/2025	02:55	1.02	10:20	2.89	1.91	02:55	0.91	23:00	2.71	2.02	02:55	0.019	10:20	0.235	0.113	0.113	-
04/05/2025	03:55	1.06	09:05	2.49	1.77	02:45	1.00	08:45	2.73	2.09	03:55	0.023	09:05	0.207	0.103	0.103	-
04/06/2025	01:05	1.13	19:10	2.83	1.95	03:35	0.94	19:45	2.64	2.10	03:35	0.024	19:45	0.219	0.120	0.120	0.71
04/07/2025	04:15	1.15	14:00	2.99	1.73	13:30	0.91	11:15	2.65	2.10	04:25	0.024	13:55	0.199	0.098	0.098	0.37
04/08/2025	03:45	1.17	14:55	2.57	2.02	02:35	0.97	04:25	2.61	2.03	02:35	0.025	09:20	0.199	0.122	0.122	0.07
04/09/2025	02:45	1.01	18:15	2.50	1.86	02:15	0.96	18:15	2.68	2.03	02:50	0.021	18:15	0.206	0.108	0.108	-
04/10/2025	03:25	1.38	09:25	2.89	2.11	03:25	1.02	11:45	2.77	2.06	03:25	0.033	08:30	0.236	0.130	0.130	0.27
04/11/2025	02:50	0.98	13:55	2.71	1.96	02:45	0.95	06:30	2.47	1.97	02:50	0.019	17:50	0.193	0.114	0.114	0.01
04/12/2025	23:55	1.19	09:05	2.52	1.83	02:10	0.88	09:00	2.66	2.02	02:25	0.026	09:00	0.207	0.104	0.104	0.01
04/13/2025	05:40	1.07	20:05	2.79	2.06	05:20	0.99	10:20	2.58	1.99	05:20	0.023	20:00	0.215	0.124	0.124	-
04/14/2025	01:50	1.38	12:55	2.68	2.02	03:30	0.86	19:25	2.58	2.01	03:30	0.029	14:15	0.207	0.119	0.119	-
04/15/2025	02:35	1.01	10:50	2.55	1.87	02:35	0.83	13:30	2.70	1.98	02:35	0.017	10:50	0.195	0.108	0.108	-
04/16/2025	01:55	1.05	14:05	2.85	1.99	01:55	0.90	08:30	2.56	1.98	01:55	0.020	08:30	0.206	0.116	0.116	-
04/17/2025	02:50	1.04	14:00	2.61	1.88	02:45	0.96	07:45	2.57	1.98	02:50	0.021	09:00	0.188	0.106	0.106	-
04/18/2025	02:20	1.10	13:45	2.79	1.88	02:15	0.92	06:40	2.68	2.04	02:15	0.021	13:40	0.193	0.110	0.110	-
04/19/2025	03:40	1.10	15:15	2.41	1.91	05:35	1.08	10:55	2.59	2.05	02:20	0.026	10:55	0.180	0.113	0.113	0.01
04/20/2025	04:25	1.16	13:05	2.74	2.00	02:35	0.94	07:10	2.50	2.01	02:35	0.026	13:05	0.211	0.118	0.118	0.05
04/21/2025	02:15	1.16	07:20	2.90	2.08	01:05	0.99	06:55	2.44	1.94	02:15	0.025	10:40	0.197	0.120	0.120	0.02
04/22/2025	02:35	1.05	18:35	2.87	2.07	02:20	0.73	11:05	2.45	1.88	02:20	0.017	18:35	0.226	0.117	0.117	-
04/23/2025	00:40	1.13	08:25	4.16	2.16	12:25	0.65	19:30	2.35	1.78	03:40	0.019	19:35	0.210	0.117	0.117	-
04/24/2025	03:30	1.18	08:55	2.97	2.01	01:30	0.93	09:55	2.57	1.91	03:30	0.025	08:55	0.210	0.113	0.113	-
04/25/2025	02:45	1.08	11:15	2.58	1.98	02:40	0.82	08:20	2.50	1.92	02:40	0.019	08:25	0.191	0.112	0.112	-
04/26/2025	04:05	1.40	10:35	3.07	2.16	02:40	0.87	11:20	2.53	1.95	04:05	0.031	10:35	0.231	0.126	0.126	-
04/27/2025	02:15	1.11	20:15	2.51	1.92	02:20	0.88	09:30	2.51	2.00	02:20	0.021	12:30	0.182	0.112	0.112	-
04/28/2025	01:30	1.07	10:55	2.93	2.03	03:15	0.92	12:50	2.50	1.92	01:30	0.021	12:50	0.216	0.116	0.116	-
04/29/2025	01:00	1.15	11:35	2.83	2.00	02:25	0.96	10:45	2.50	2.04	02:25	0.025	11:35	0.218	0.119	0.119	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			12.250	13.62
Average	2.07	1.91	0.117	

CAM_RG

Site Commentary

SITE INFORMATION

Rain Collector Dimensions	8”

OBSERVATIONS

A review of the hydrograph indicates CAM_RG functioned under normal conditions during the study.

The total rainfall recorded during the monitoring period was 13.62 inches.

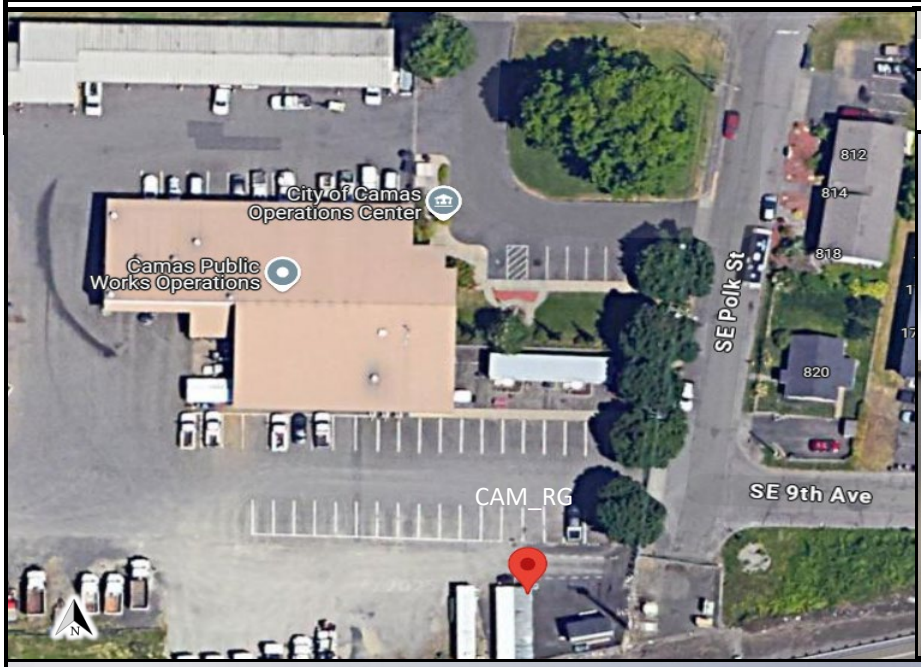
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
Rain	100

Camas.Carollo.TFM.WA24		Site Name
Rainfall Monitoring Site Report		CAM_RG

Site Address /Location:	1620 SE 8th Ave, Camas, WA 98607			Monitor Series	Location Type
				Rain Alert III	Temporary
Site Access Details:	On Roof	Latitude:	45.5800529	Installation Date	
		Longitude:	-122.3918594	1.14.2025	



Location	
On Roof	
Access	Traffic
Drive	None





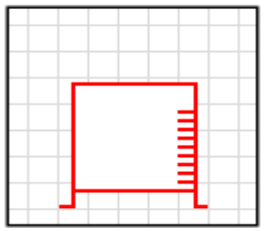
ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23081.11.325

Hydrograph Report

CAM_RG

Rain Gauge

CAM_RG

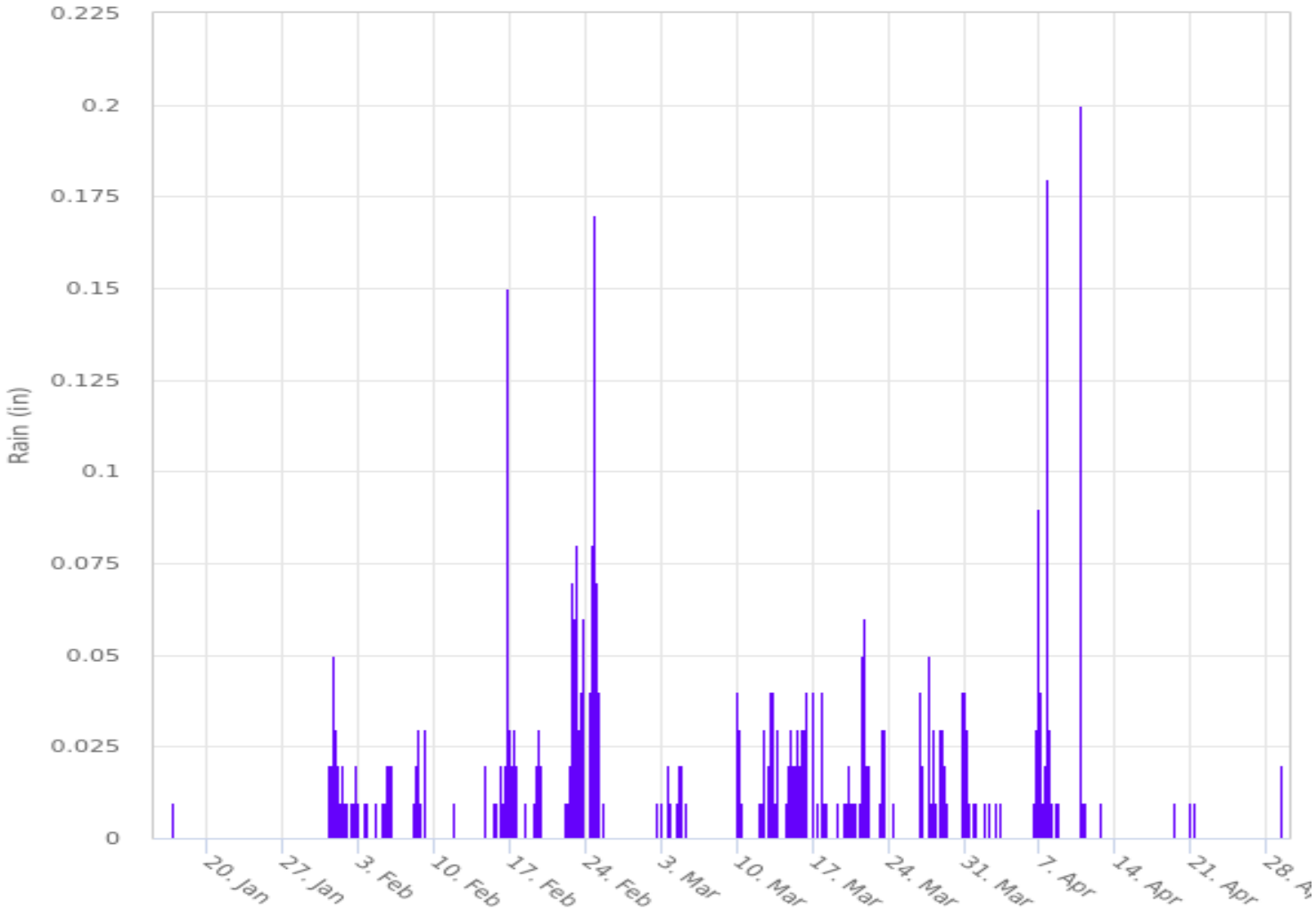


Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL



846 Industry Dr.
Tukwila, WA 98188

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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_RG

Date	RAIN FINAL (in) Total
01/15/2025	-
01/16/2025	0.01
01/17/2025	-
01/18/2025	-
01/19/2025	-
01/20/2025	-
01/21/2025	-
01/22/2025	-
01/23/2025	-
01/24/2025	-
01/25/2025	-
01/26/2025	-
01/27/2025	-
01/28/2025	-
01/29/2025	-
01/30/2025	-
01/31/2025	0.60
02/01/2025	0.12
02/02/2025	0.07
02/03/2025	0.02
02/04/2025	0.01
02/05/2025	0.19
02/06/2025	-
02/07/2025	-
02/08/2025	0.25
02/09/2025	0.05
02/10/2025	-
02/11/2025	0.01
02/12/2025	-
02/13/2025	-
02/14/2025	0.07
02/15/2025	0.09
02/16/2025	0.77
02/17/2025	0.39
02/18/2025	0.02
02/19/2025	0.40
02/20/2025	-
02/21/2025	0.04
02/22/2025	0.84
02/23/2025	1.07
02/24/2025	0.87
02/25/2025	0.03
02/26/2025	-
02/27/2025	-
02/28/2025	-
03/01/2025	-
03/02/2025	0.05
03/03/2025	0.07
03/04/2025	0.12
03/05/2025	0.01
03/06/2025	-
03/07/2025	-
03/08/2025	-
03/09/2025	0.20
03/10/2025	0.22
03/11/2025	0.02
03/12/2025	0.83
03/13/2025	0.49
03/14/2025	0.16
03/15/2025	0.60
03/16/2025	0.16
03/17/2025	0.19
03/18/2025	0.02
03/19/2025	0.07
03/20/2025	0.11
03/21/2025	1.12
03/22/2025	-
03/23/2025	0.44
03/24/2025	0.01
03/25/2025	-

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01/15/2025 00:00 - 04/29/2025 23:59

	RAIN FINAL (in)
Date	Total
03/26/2025	0.20
03/27/2025	0.24
03/28/2025	0.17
03/29/2025	0.12
03/30/2025	0.23
03/31/2025	0.10
04/01/2025	0.03
04/02/2025	0.05
04/03/2025	0.02
04/04/2025	-
04/05/2025	-
04/06/2025	0.71
04/07/2025	0.37
04/08/2025	0.07
04/09/2025	-
04/10/2025	0.27
04/11/2025	0.01
04/12/2025	0.01
04/13/2025	-
04/14/2025	-
04/15/2025	-
04/16/2025	-
04/17/2025	-
04/18/2025	-
04/19/2025	0.01
04/20/2025	0.05
04/21/2025	0.02
04/22/2025	-
04/23/2025	-
04/24/2025	-
04/25/2025	-
04/26/2025	-
04/27/2025	-
04/28/2025	-
04/29/2025	0.13

	RAIN FINAL (in)
Total	13.62
Average	

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TECHNICAL MEMORANDUM

Subject: Camas, WA Flow Monitoring Wet Weather Analysis

Prepared For: Carollo

Prepared By: Paul Mitchell, Regional Engineer

Date: May 23, 2025

Background

In addition to sewer flow monitoring and data delivery conducted as part of this temporary deployment of 4 flow monitors, ADS also conducted a wet weather analysis which also takes into account rain data collected from the single deployed temporary rain gauge. This wet weather analysis was conducted to assess Rainfall Dependent Infiltration and Inflow (RDII) attributed to each of the 4 monitored tributaries which could then be used to assist in relative prioritization of those tributary areas (or basins) based on computed and normalized RDII volume per inch rain per acre (converted to % rainfall ingress).

Methodology

The methodology used for this evaluation includes the following primary tasks:

- Evaluate the available data using ADS' Sliicer™ application for evaluating RDII. This includes determination of typical net average dry day flow (ADF).
- Determine RDII for each storm event meeting minimum criteria discussed herein and compute RDII volume associated with each rain event.
- Generate an RDII volume vs. rainfall volume chart (called a Q-vs-i chart) from each storm event data point for each evaluated site/basin and fit a regression line through the data on the Q-vs-i chart.
- Normalize the RDII using the Q-vs-i chart by dividing the slope of the regression line (Gallons RDII per inch rain) by acreage to generate values of % ingress attributed to each site/basin. Use this result to rank relative RDII performance of the site/basins.

Wet Weather Analysis

This section describes an evaluation of wet weather impacts on system flows, defined as Rainfall Dependent Infiltration and Inflow (RDII). This evaluation was based on available flow data provided during the approximate 3 month duration of the flow study. This is done by evaluating excess flow volumes from the studied sewer shed areas (basins) associated with each flow monitoring site during rain events that occurred during the available data periods at each of the 4 locations. This section also describes an evaluation of dry weather flow data for purposes of determining base wastewater flows (to compare wet weather flows against).

Each flow monitoring site represents a defined tributary area (or basin) and each was identified with a simple alpha-numeric ID – CAM_100290, CAM_51123, etc. The Sliicer™ application recognizes basins as having the same name as the monitors used to determine tributary flows (i.e. sites and basins have the same ID). One of the flow sites, CAM_51123, relied upon subtracting flow from a flow monitor upstream (CAM_100290) to define net flow for basin CAM_51123. Table 1 provides a summary of site/basins, site schematic defining each evaluated basin, and size of each basin (acres).

Dry Weather Flow

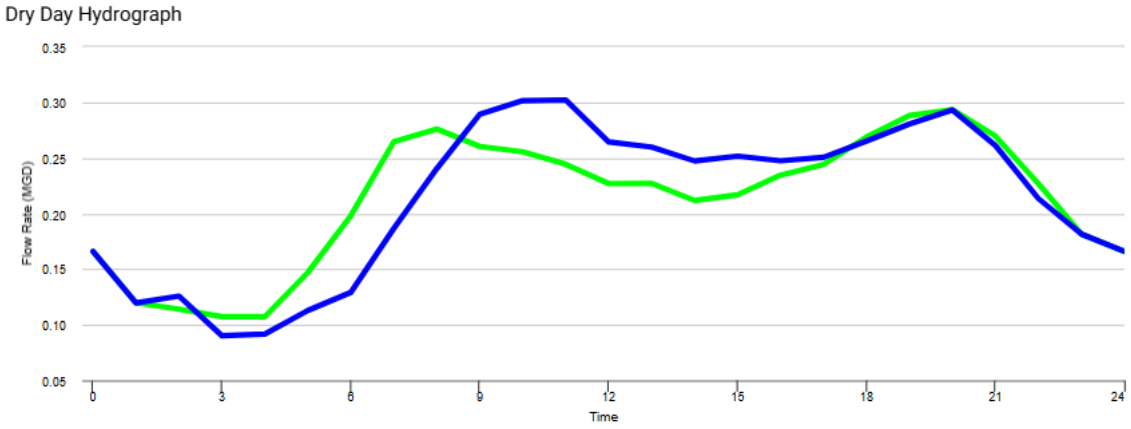
Prior to conducting a wet weather analysis, dry weather flow patterns must first be determined by reviewing data obtained during dry weather conditions at each location. For this analysis, a *dry day* is defined as any day in which there was less than 0.10 in. of rain in the previous day, less than 0.50 in. of rain in the previous three days, and less than 1.00 in. of rain in the previous five days. This process automatically eliminates the selection of most wet weather events and the periods associated with recovery from these events. Once the initial dry days are selected, they are compared to one another to make sure that the flow pattern for each day is repeatable. Any days that have an inconsistent flow pattern are removed from consideration. The resulting dry days are then averaged to establish an average diurnal flow pattern from the site, called an Average Dry day (ADF) pattern. The dry weather analysis evaluates the weekday pattern separate from the weekend pattern to account for differences often observed.

Dry weather flows were evaluated for each flow monitor location from the available data provided. Recorded flow rates from the sanitary sewer monitoring location for each dry day are overlaid on a hydrograph, enabling a hydrograph of the Average Dry day Flow (ADF) to be determined for Weekdays (green curve) and Weekends (blue curve) as depicted in Figure 1 for site/basin CAM_100290. ADF hydrographs for each site are included in Appendix A. Table 1 summarizes the ADF values (weekdays) for each site/basin.

Table 1
Basin Summary Data

Site/ Basin	Pipe Diameter (in)	Added or Upstream Subtracted FM Sites to Determine Net Basin Flow	Basin Size (Acres)	Gross ADDF Weekday (mgd)	Net ADDF Weekday (mgd)
CAM_100290	19	+(CAM_100290)	476	0.22	0.22
CAM_51123	20	+(CAM_51123) - (CAM_100290)	1159	0.77	0.55
CAM_52167	18	+(CAM_52167)	299	0.19	0.19
CAM_81189	12	+(CAM_81189)	136	0.12	0.12
		Total	2071		1.08

Figure 1
Average Dry Day Flow (ADF) Hydrograph – Site/Basin CAM_100290



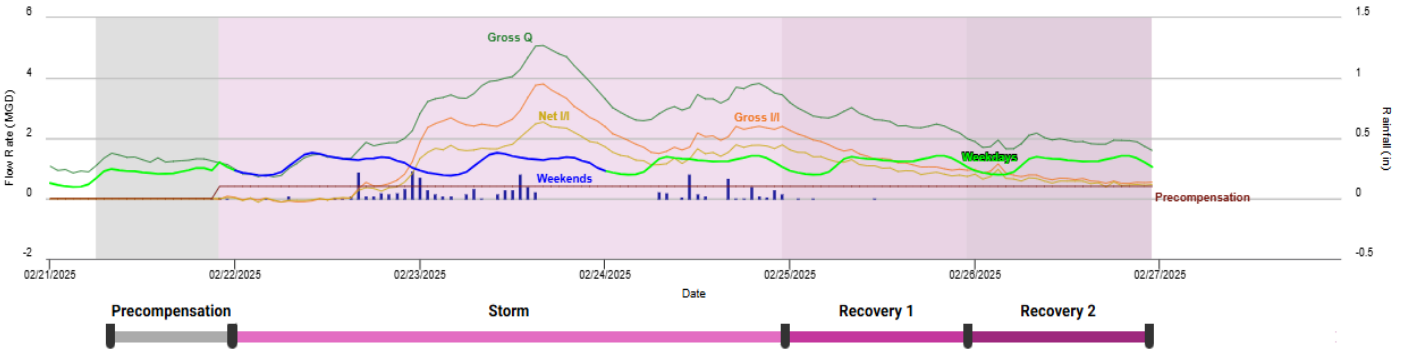
Wet Weather RDII Analysis

A wet weather RDII analysis is performed by comparing specific wet weather events to average dry weather flows (ADF). Based on criteria for a “storm” as being a rain event with at least 0.8 inch of rain with no rain interruption of more than 12 hours, there were 5 rain “storm” events captured during the flow study period. Captured storm volumes ranged from 1.15 inches (April 6, 2025) to 2.84 inches (February 21, 2025). Based on the concurrent periods of flow and rain “storm” data available at each site, an RDII analysis was conducted to characterize the impact of wet weather on flow measured in the basins.

Recorded flow rates for a specific storm event are plotted against average dry weather conditions. The difference observed represents the rain-dependent inflow and infiltration

(RDII or I/I) entering the sanitary sewer system upstream from each monitoring location and is called a storm hydrograph. Figure 2 depicts a storm hydrograph for site/basin CAM_51123 during the largest captured storm event period (from February 21 to 26, 2025).

Figure 2
Storm Hydrograph – Site/Basin CAM_51123



RDII calculations are made for each storm event (the ~5 day period depicted by purple colored bands above for the storm event starting February 21). The first period (shown as a 3 day duration in Figure 2) following the onset of rain is referred to as the Storm Period. The darker purple period following the Storm Period is referred to as Recovery 1, and the next period is referred to as Recovery 2. For purposes of this evaluation, the entire "Event" was used for this analysis which covers the Storm and both Recovery periods. Figure 2 also depicts precompensation which is an upward adjustment made to the ADF pattern so that pattern and the actual flow on storm onset were the same. This effectively compensates for flow that is already elevated leading into a given storm event; enabling a more accurate RDII response to be quantified only from the indicated storm under evaluation.

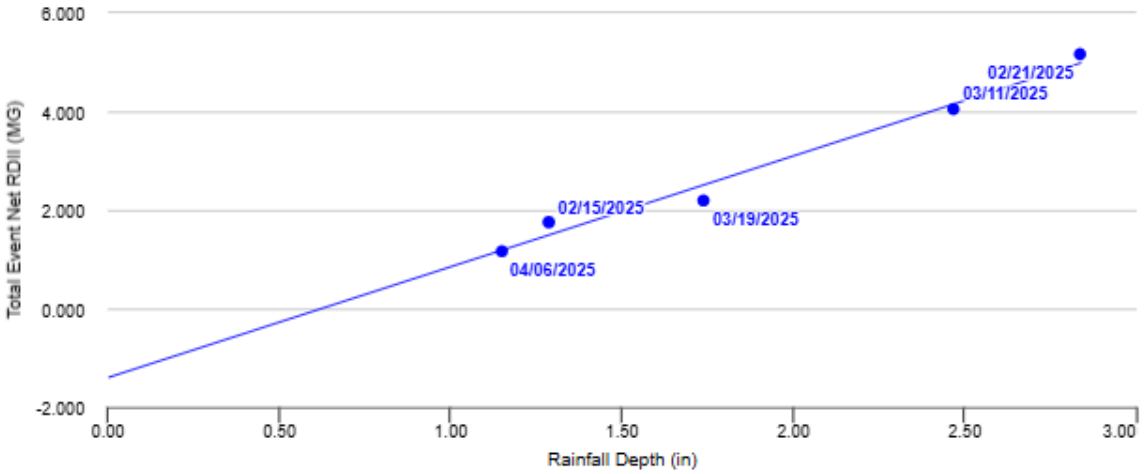
The storm hydrographs for this location showed excess flow responses (shown as "Gross I/I" in the above hydrograph) follow closely with a slight delay to the rainfall pattern. The Gross I/I is the difference between the actual recorded flow (shown as "Gross Q") minus the ADF weekend and weekday pattern. For cases where the net RDII for a basin is determined by subtraction of an upstream flow site (see Table 1), the hydrographs also show a "Net I/I" component as is the case for site/basin CAM_51123 above.

Also, in the case of CAM_51123, the delayed and significant yet muted or delayed response to rainfall may be indicative of predominantly indirect storm drainage pathways (i.e., the infiltration component of RDII). Storm hydrographs of the 5 selected storms for all locations are included in Appendix A.

Once the calculations were complete for each storm event, excess wet weather flow volumes were plotted as a function of rainfall volume on graphs commonly referred to as

Q-vs-i graphs; each with best fit regression lines drawn. The rain volume vs. excess flow volume Q-vs-i chart is shown in Figure 3 for site/basin CAM_51123. These charts for all other locations are included in Appendix A.

Figure 3
Q-vs-i graph for CAM_51123



These volume-based Q-vs-i graphs for the basins generally show a good visual (regression line) correlation between excess wastewater volume and rainfall. The Q-vs-i graph for CAM_51123 projects about 2 million gallons of I/I would be generated from about 1.5 inches of rain. However, there is an apparent threshold (X-intercept) of about 0.5 or 0.6 inches of rain in the above Q-vs-i graph; below which there is little to no RDII response. This means projected RDII vs rainfall volumes based on regression line slope will be greater than individual storm values. These graphs are included for all the site/basins in Appendix A. Caution is warranted in attempting to extrapolate higher rainfall responses from these Q-vs-i graphs since the linear extrapolation may not remain fully intact during significantly stronger storm events. A summary of individual RDII response data points (MG/inch) per storm is provided in Table 2.

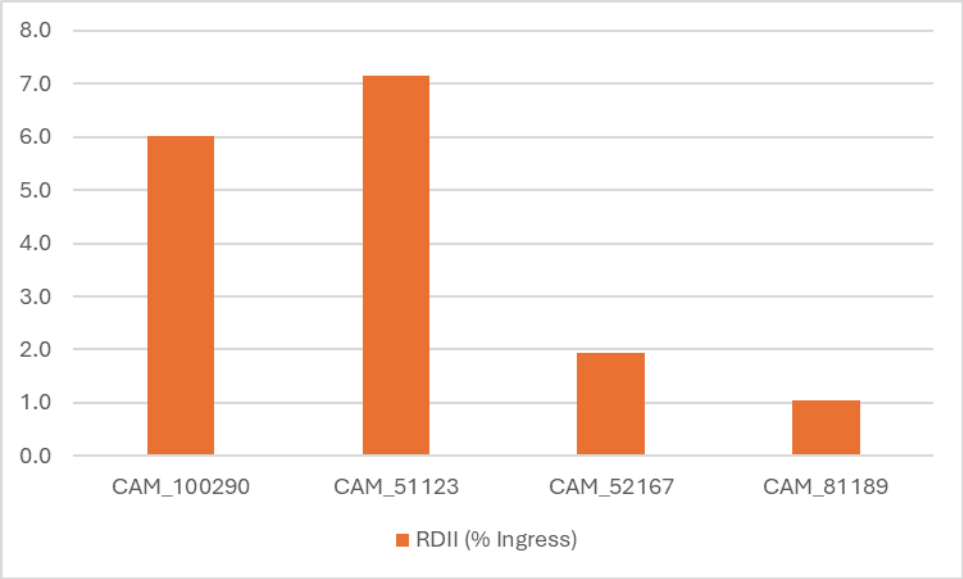
Table 2
Basin RDII Storm Response Summary

	Storm RDII (MG/inch)				
Site/ Basin	2/15/2025 (1.29")	2/21/2025 (2.84")	3/11/2025 (2.47")	3/19/2025 (1.74")	4/6/2025 (1.15")
CAM_100290	0.57	0.68	0.64	0.48	0.52
CAM_51123	1.36	1.82	1.64	1.26	1.01
CAM_52167	0.16	0.14	0.20	0.12	0.17
CAM_81189	0.01	0.03	0.01	0.03	0.00

To properly characterize relative I/I performance among the sites/basins evaluated, the wet weather I/I responses must also be normalized according to basin size. This is done by taking the slope of the Q-vs-i responses described above (gallons RDII / inch rain) and dividing by basin area (acres – see Table 1) to yield normalized values of RDII response in terms of projected % rainfall ingress. These rain and size normalized % ingress values based on Q-vs-i projected slopes are summarized in Figure 4.

As a general rule, basins may be considered to yield excessive RDII if such normalized values are much greater than 5. Two of the 4 site/basins evaluated slightly exceeded this value.

Figure 4
Projected RDII (% Rainfall Ingress)



The computed values for ADF and rain & area normalized projected RDII volumes (including % Ingress) are summarized in Table 3. Hydrographs of the flow monitoring period, dry day hydrographs, storm hydrographs, and volume-based Q vs i graphs are included in Appendix A.

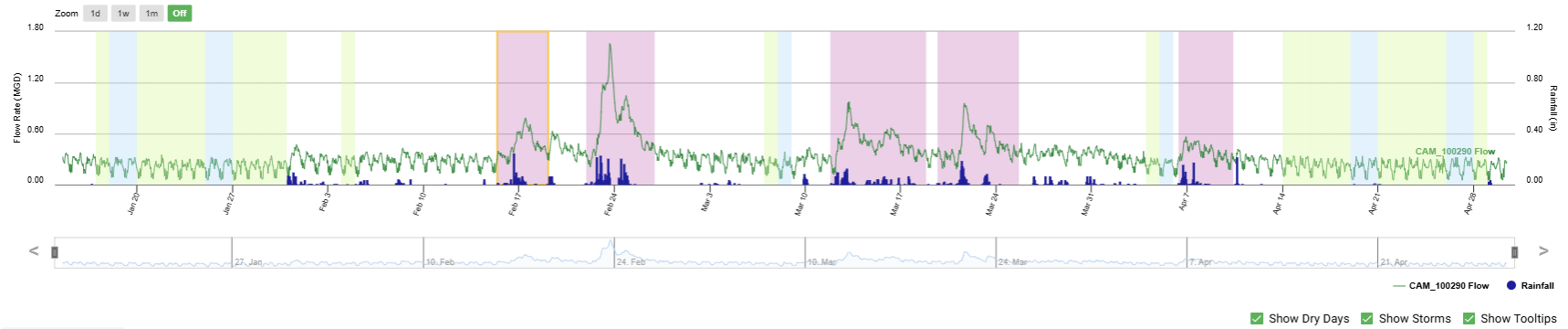
Table 3
Basin Dry and Wet Weather Performance Summary

Site/ Basin	Pipe Diameter (in)	Basin Size (Acres)	Net ADDF Weekday (mgd)	Projected Net RDII (MG/in)	Projected Net RDII (%rain ingress)
CAM_100290	19	476	0.22	0.78	6.0
CAM_51123	20	1159	0.55	2.25	7.1
CAM_52167	18	299	0.19	0.16	1.9
CAM_81189	12	136	0.12	0.04	1.0

Appendix A

Study period Hydrographs, ADF hydrographs, Storm hydrographs, and Q vs i graphs

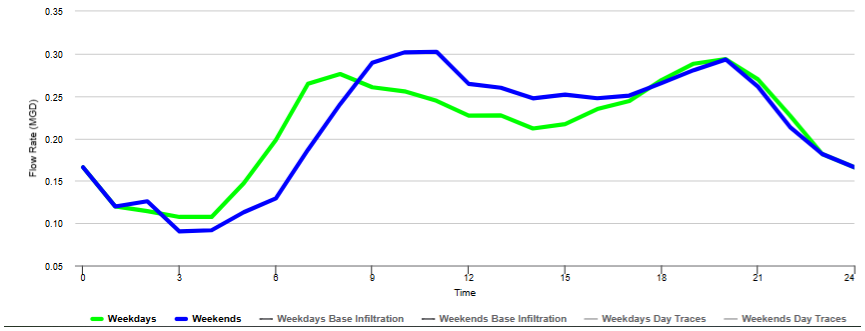
Hydrograph with Basin Rainfall: 01/14/2025 - 04/30/2025 | Basin CAM_100290 | Edit Dry Days

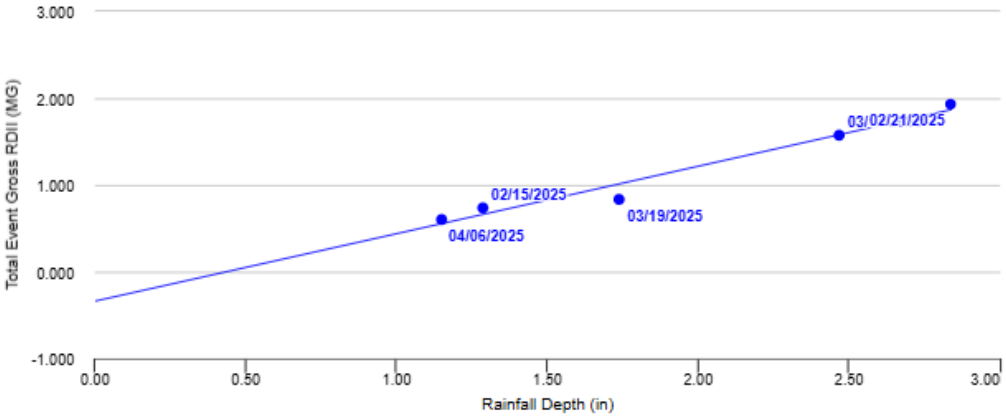


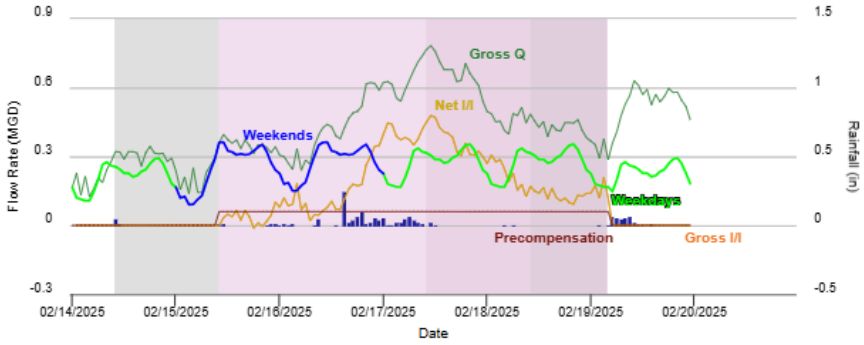
Show Dry Days | Show Storms | Show Tooltips

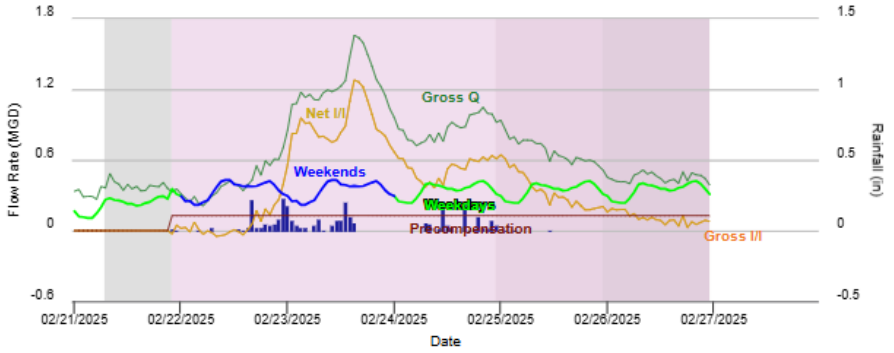
DRY DAYS | STORM EVENTS | STATISTICS

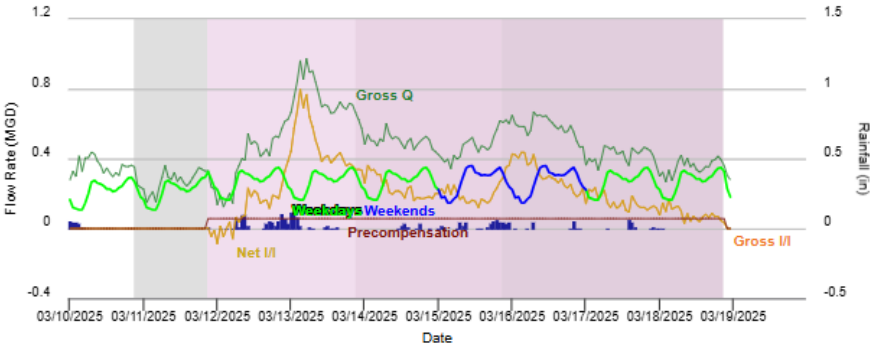
Dry Day Hydrograph

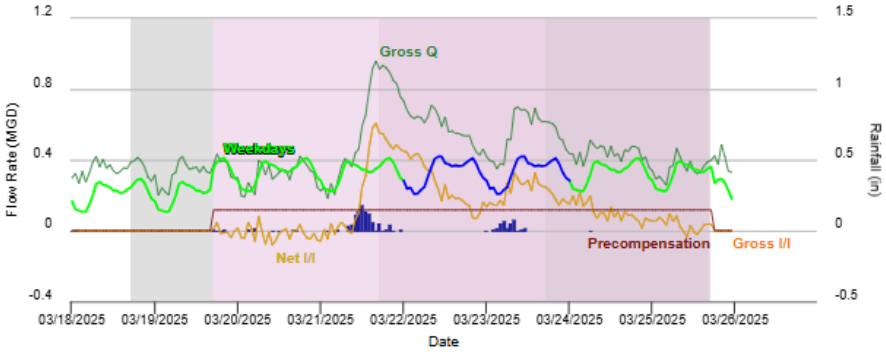


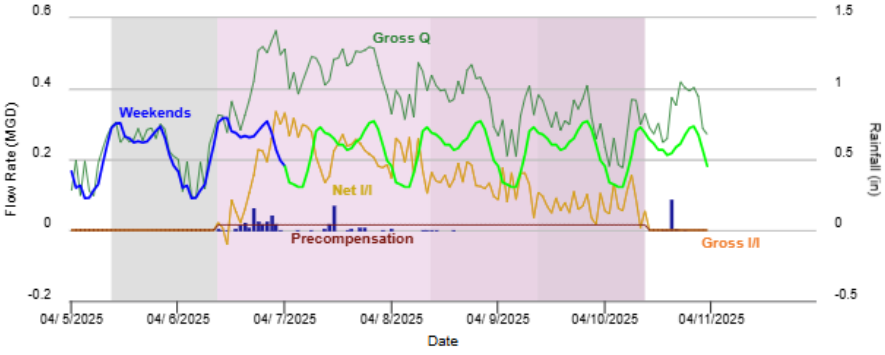



Gross Q
Net I/I
Weekends
Weekdays
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
0.9
0.6
0.3
0
-0.3
1.5
1
0.5
0
-0.5
02/14/2025
02/15/2025
02/16/2025
02/17/2025
02/18/2025
02/19/2025
02/20/2025

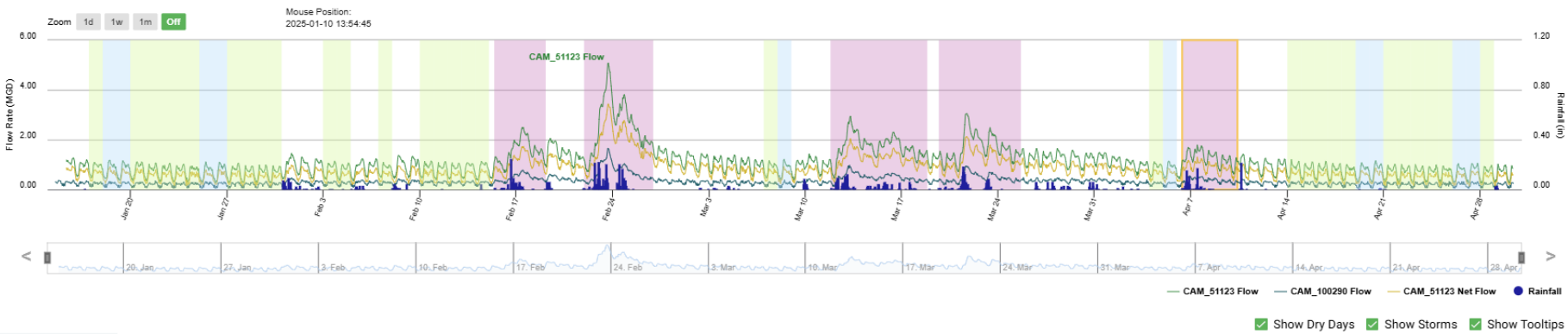

Gross Q
Net I/I
Weekends
Weekdays
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
1.8
1.2
0.6
0
-0.6
1.5
1
0.5
0
-0.5
02/21/2025
02/22/2025
02/23/2025
02/24/2025
02/25/2025
02/26/2025
02/27/2025


Gross Q
Weekdays
Weekends
Precompensation
Net I/I
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
1.2
0.8
0.4
0
-0.4
1.5
1
0.5
0
-0.5
03/10/2025
03/11/2025
03/12/2025
03/13/2025
03/14/2025
03/15/2025
03/16/2025
03/17/2025
03/18/2025
03/19/2025


Gross Q
Weekdays
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
1.2
0.8
0.4
0
-0.4
1.5
1
0.5
0
-0.5
03/18/2025
03/19/2025
03/20/2025
03/21/2025
03/22/2025
03/23/2025
03/24/2025
03/25/2025
03/26/2025

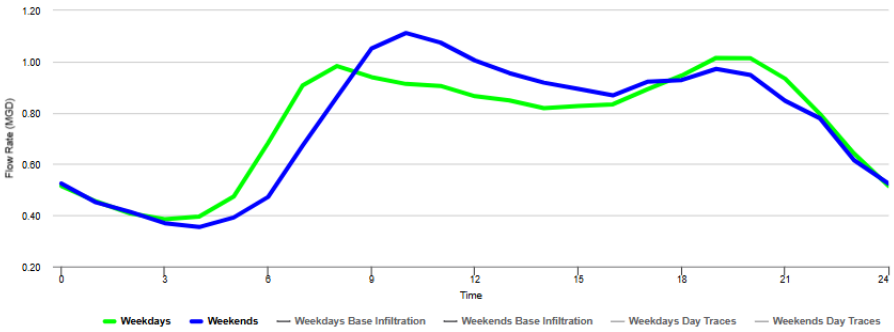

Gross Q
Weekends
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
0.6
0.4
0.2
0
-0.2
1.5
1
0.5
0
-0.5
04/ 5/2025
04/ 6/2025
04/ 7/2025
04/ 8/2025
04/ 9/2025
04/10/2025
04/11/2025

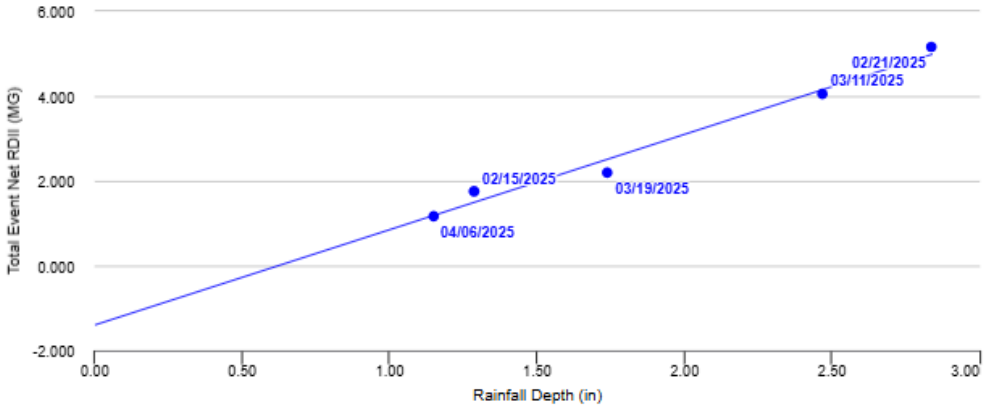
Hydrograph with Basin Rainfall: 01/14/2025 - 04/30/2025 | Basin CAM_51123 | Edit Dry Days

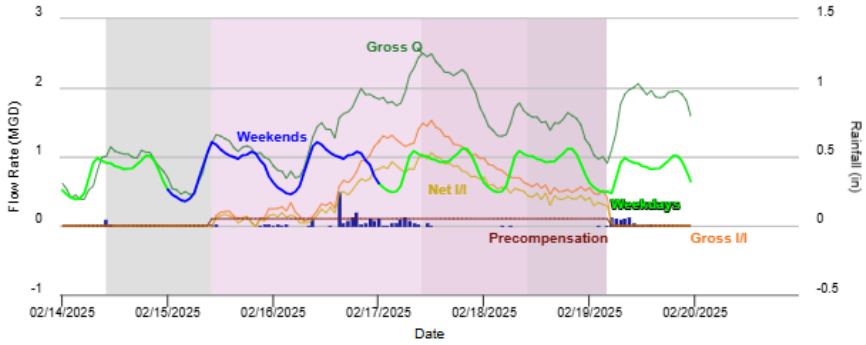


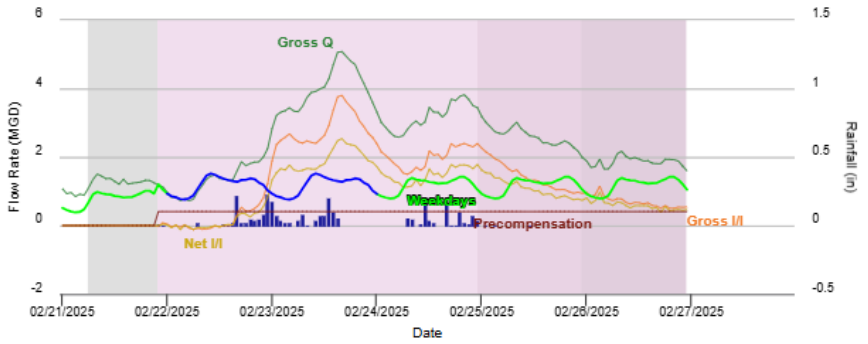
DRY DAYS | STORM EVENTS | STATISTICS

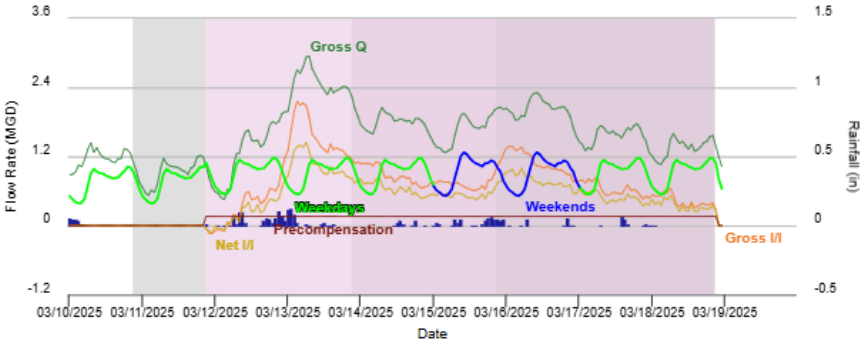
Dry Day Hydrograph

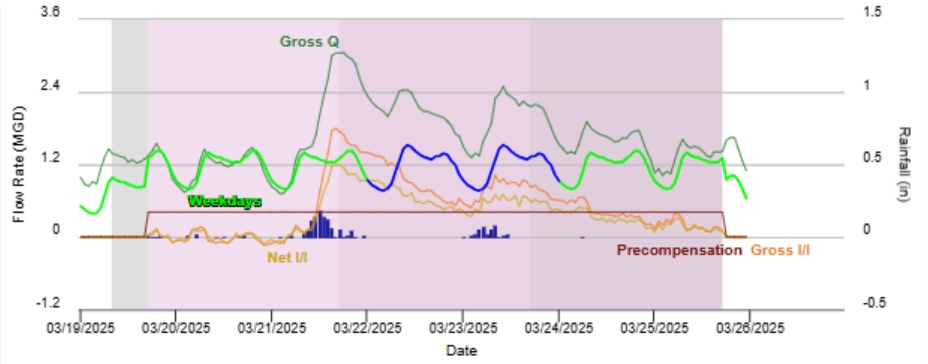


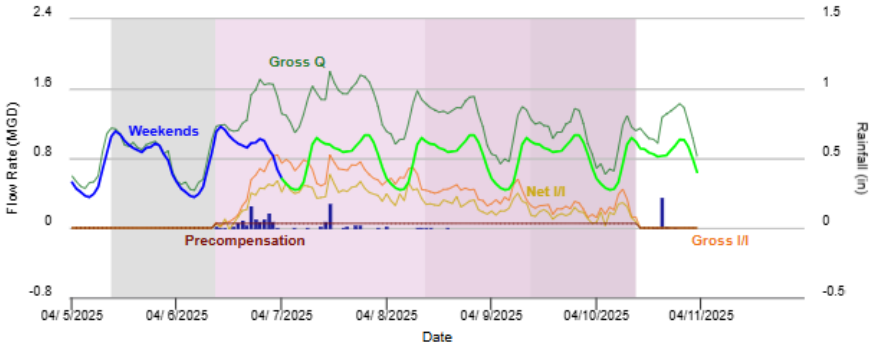



Gross Q
Weekends
Net I/I
Weekdays
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
02/14/2025
02/15/2025
02/16/2025
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02/19/2025
02/20/2025

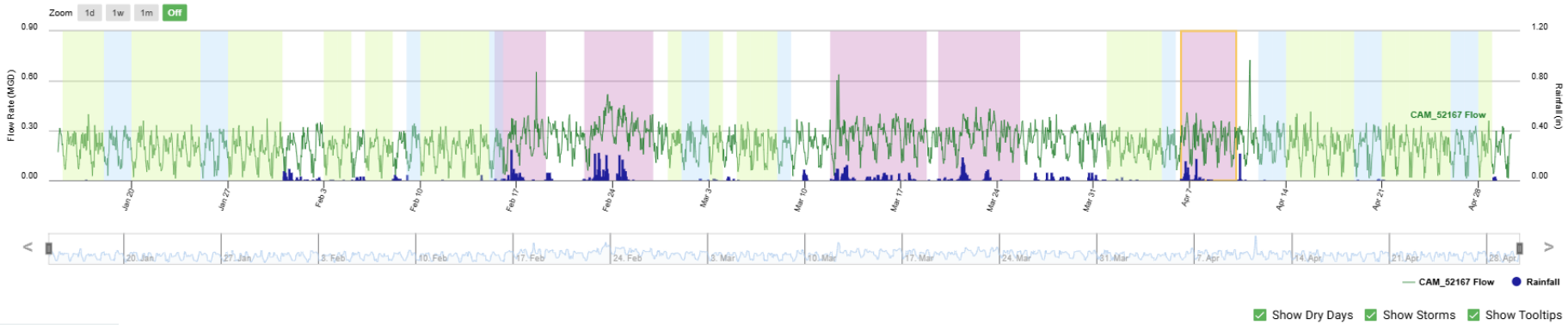

Gross Q
Weekdays
Precompensation
Gross I/I
Net I/I
Flow Rate (MGD)
Rainfall (in)
Date
02/21/2025
02/22/2025
02/23/2025
02/24/2025
02/25/2025
02/26/2025
02/27/2025


Gross Q
Weekdays
Weekends
Precompensation
Net I/I
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
03/10/2025
03/11/2025
03/12/2025
03/13/2025
03/14/2025
03/15/2025
03/16/2025
03/17/2025
03/18/2025
03/19/2025


Gross Q
Weekdays
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
03/19/2025
03/20/2025
03/21/2025
03/22/2025
03/23/2025
03/24/2025
03/25/2025
03/26/2025


Gross Q
Weekends
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
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04/11/2025

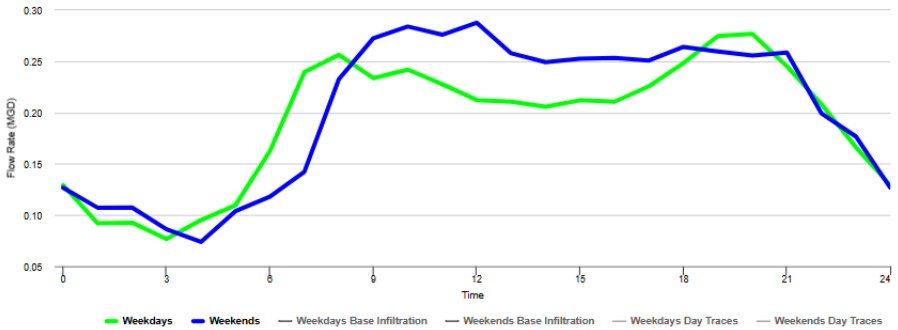
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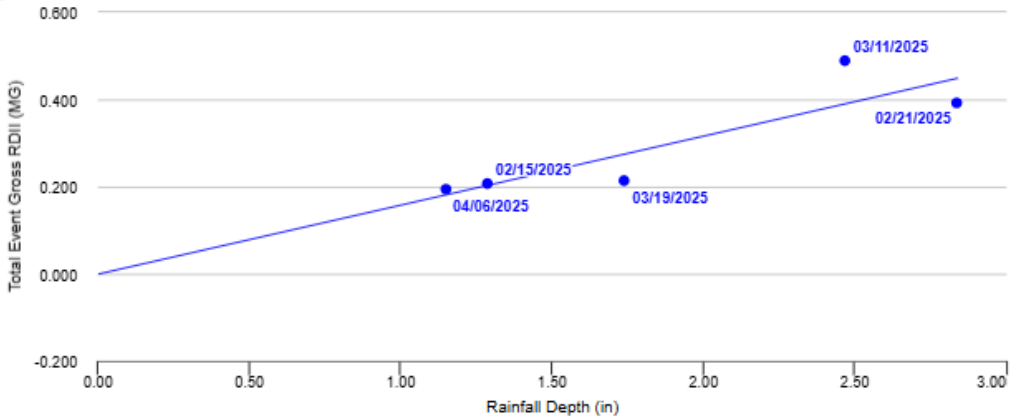


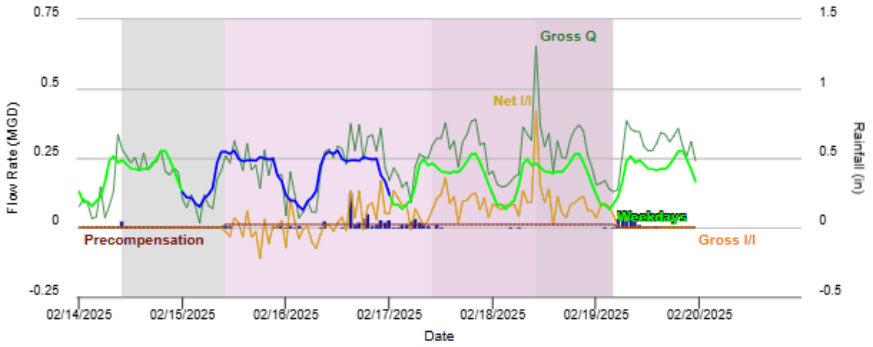
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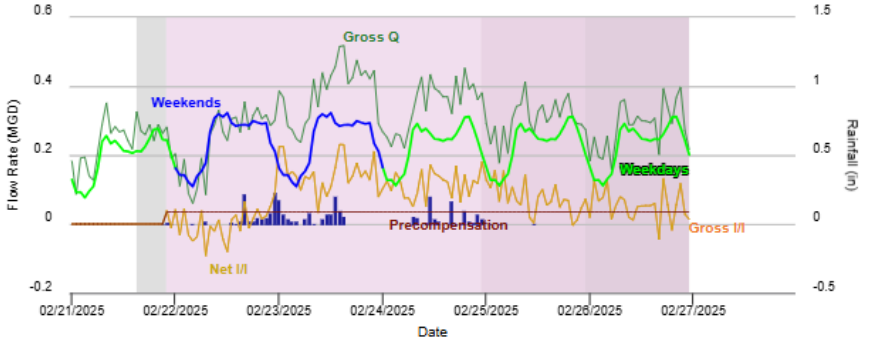
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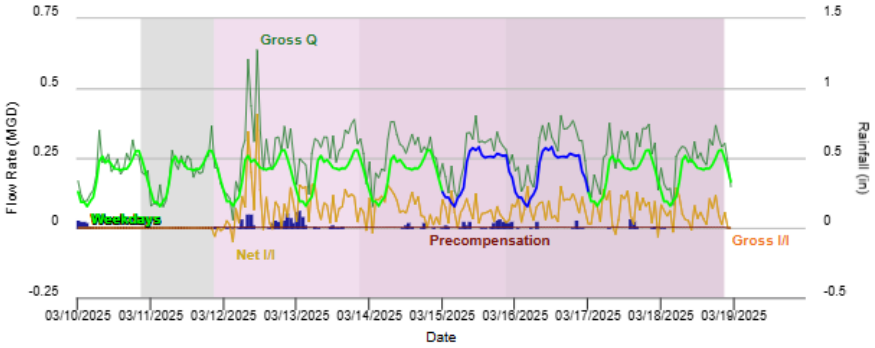
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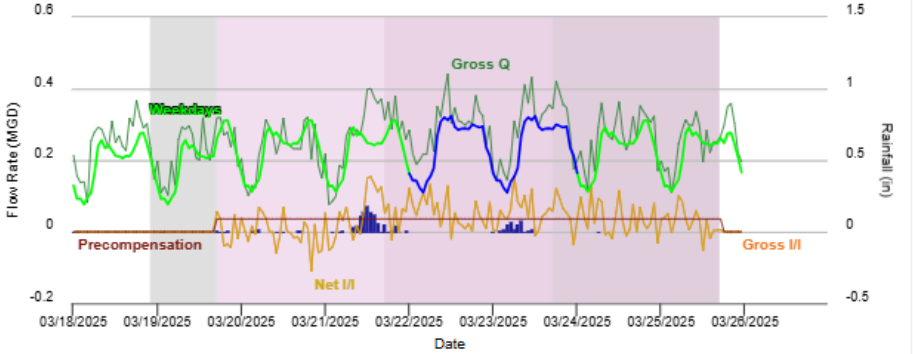


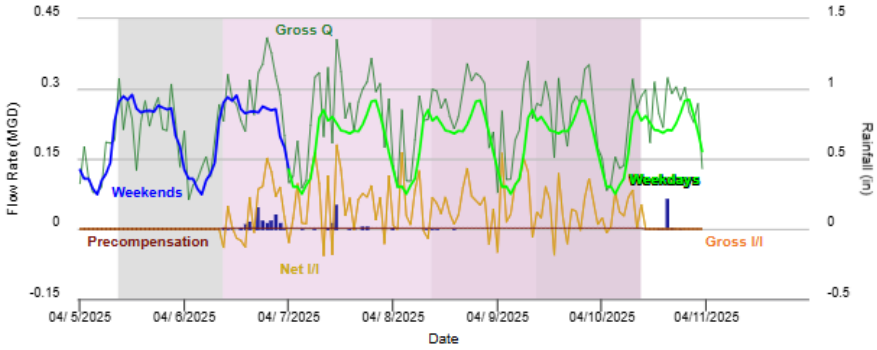



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Weekdays
Precompensation
Gross I/I
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Rainfall (in)
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0.5
0
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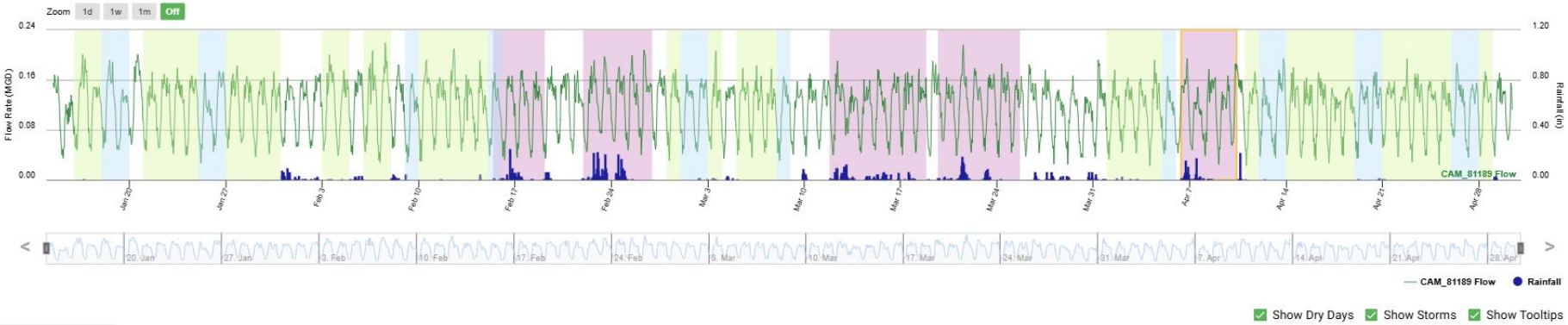

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Weekdays
Precompensation
Gross I/I
Net I/I
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Rainfall (in)
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Gross Q
Weekdays
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Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
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Gross Q
Weekdays
Precompensation
Gross I/I
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Flow Rate (MGD)
Rainfall (in)
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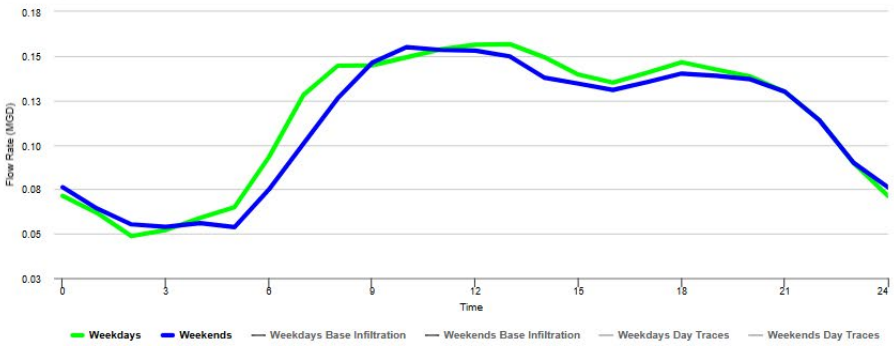

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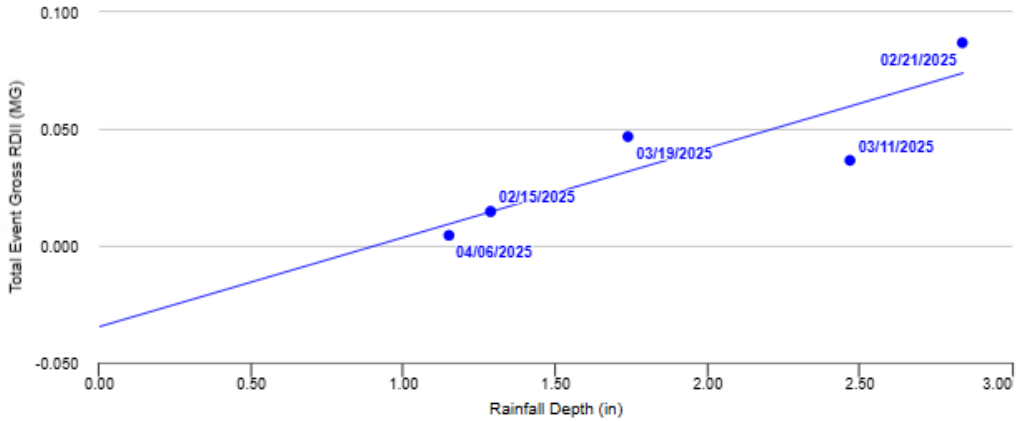
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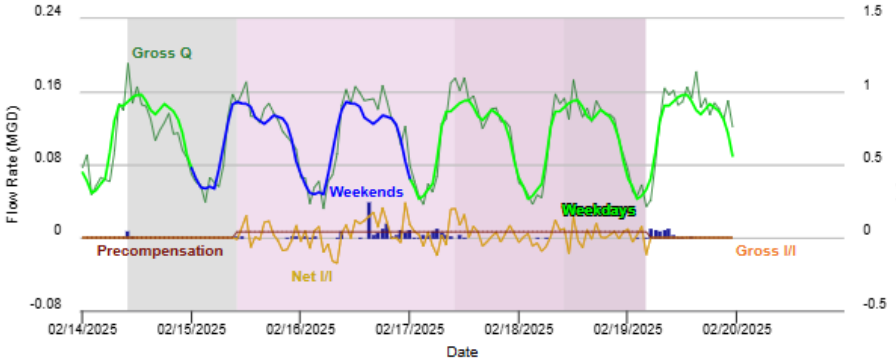


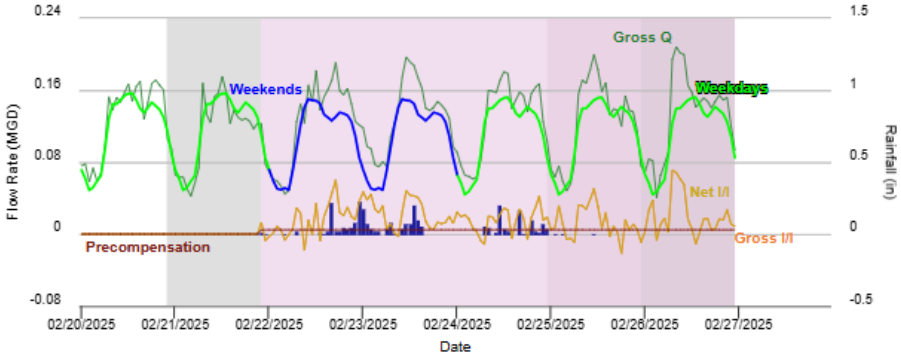
DRY DAYS | STORM EVENTS | STATISTICS

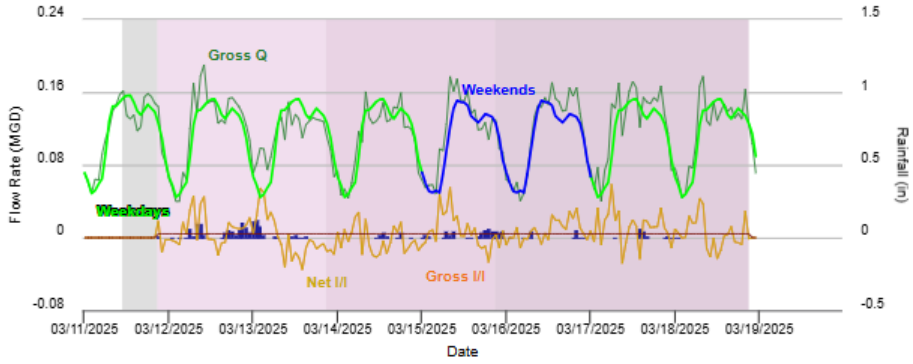
Dry Day Hydrograph

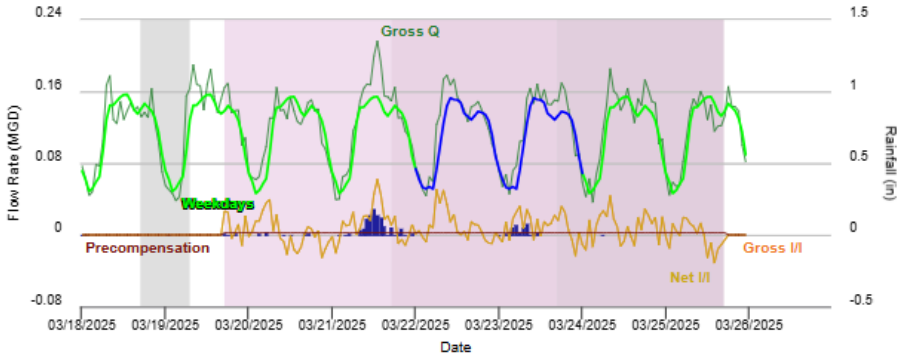


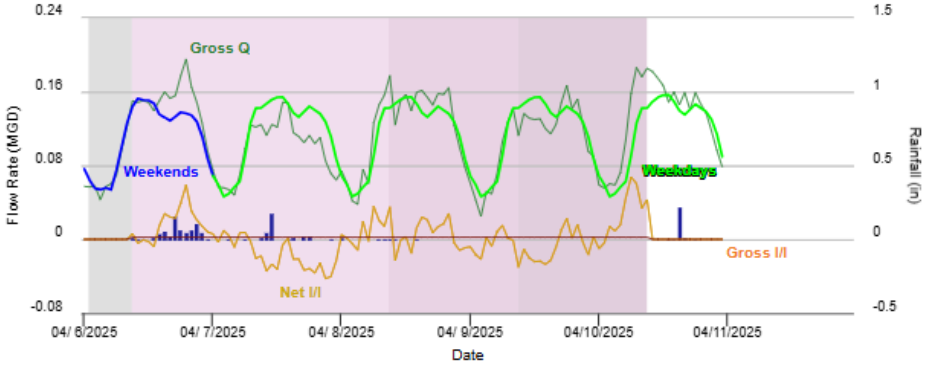



Gross Q
Weekends
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Net I/I
Gross I/I
Flow Rate (MGD)
Rainfall (in)
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02/20/2025


Gross Q
Weekends
Weekdays
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
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Gross Q
Weekends
Weekdays
Net I/I
Gross I/I
Flow Rate (MGD)
Rainfall (in)
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03/18/2025
03/19/2025


Gross Q
Weekdays
Precompensation
Gross I/I
Net I/I
Flow Rate (MGD)
Rainfall (in)
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03/25/2025
03/26/2025


Gross Q
Weekends
Weekdays
Gross I/I
Net I/I
Flow Rate (MGD)
Rainfall (in)
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04/ 6/2025
04/ 7/2025
04/ 8/2025
04/ 9/2025
04/10/2025
04/11/2025

APPENDIX E

HYDRAULIC MODEL UPDATE TECHNICAL MEMORANDUM

General Sewer Plan



Hydraulic Model Update

August 2026 / DRAFT

General Sewer Plan

Hydraulic Model Update

August 2026 / DRAFT

This document is released for the purpose of information exchange review and planning only under the authority of Katherine M. Sun, August 2026, State of Washington PE No, 24001293.

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Abbreviations

ADWF	average dry weather flow
BWF	base wastewater flow
Carollo	Carollo Engineers
City	City of Camas
CIWEM	Chartered Institution of Water and Environmental Management
DWF	dry weather flows
FRC	fast response curve
GIS	geographic information system
gpad	gallons per acre per day
gpm	gallons per minute
GSP	General Sewer Plan
GWI	groundwater infiltration
LS	lift station
mgd	million gallons per day
RDI	rainfall dependent infiltration
RDII	rainfall derived inflows and infiltration
SCADA	supervisory control and data acquisition
SRC	slow response curve
STEP	septic tank effluent pumping
UDG	Urban Drainage Group
UGA	urban growth area
WWF	wet weather flow
WWTF	wastewater treatment facility

SECTION 1 INTRODUCTION

Sanitary sewer collection system models are valuable tools used to assess the performance of collection systems during dry and wet weather conditions, and to support planning for future improvements. These models provide a means to simulate the impact of different sized storms on the collection system and determine where system deficiencies are likely to occur. In addition, a well-calibrated model provides an easy way to test alternative improvement scenarios.

The previous iteration of the City of Camas (City) sewer collection system model was updated in 2019 for the 2024 General Sewer Plan (GSP) using MIKE URBAN software and represented the gravity sewer system. In 2023, the septic tank effluent pumping (STEP) system was developed as a separate model, in MIKE URBAN. For the 2025 GSP update, the gravity and STEP models were combined into a single model and converted to MIKE+ software, with additional system pipes added to reflect new infrastructure and updates since the original model development.

This report summarizes the City's sewer collection system hydraulic model update and calibration for use in the City's sewer system conveyance planning.

SECTION 2 STUDY AREA

The City's service area is shown in Figure 1. The service area is approximately 7,600 acres. The current service area includes the City limits, and the future service area extends to the urban growth area (UGA) which totals to 9,300 acres.

The modeled collection system consists of the gravity system and the STEP that is upstream of the gravity system. Table 1 shows a summary of the City's pipe infrastructure by type.

Table 1 Summary of Pipe Infrastructure by Type

Sewer Type	Modeled Pipe Length (feet)	Pipe Length (feet)	Percent of Modeled System (%)
Gravity Main	113,809	405,499	28.1
Force Main(1)(2)	51,677	65,218	79.2
STEP Main	44,531	290,019	15.4
Total	**210,016**	**760,736**	**27.6**

Notes:
(1) Force main pipe length was determined by using both existing GIS data and newly mapped force main segments in the North Shore area.
(2) The total force main length includes the dual force main installed in the North Shore area.
(3) This Includes STEP Transmission, STEP Main, STEF Main, and STEG Main.
GIS - geographic information system.

Figure 1 shows the current service area outlined by a dashed black line. The service area for the 2045 and buildout scenarios is outlined by a dotted purple line. Figure 2 shows the extent of the hydraulic model for the existing, 2045, and buildout systems.

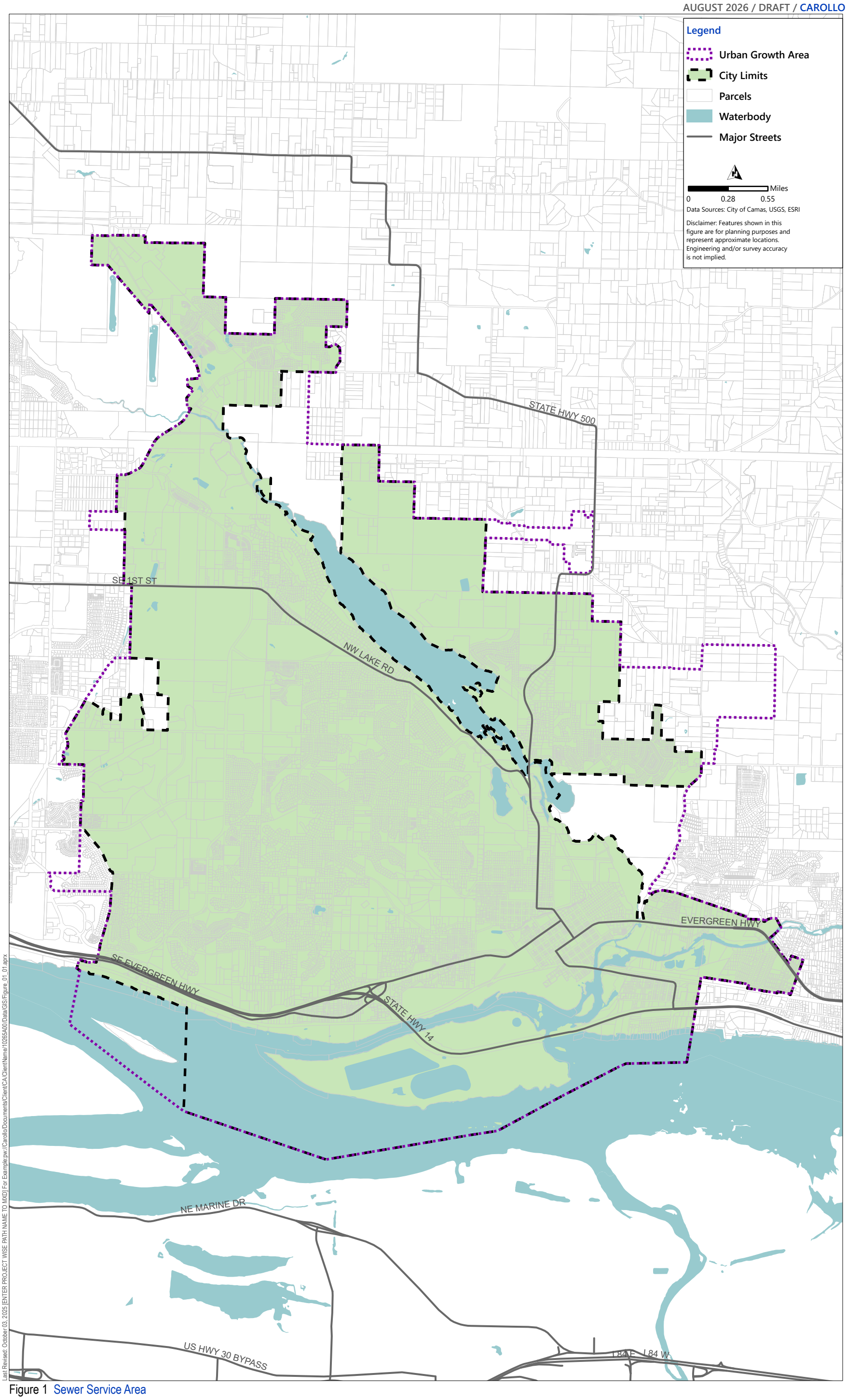


Figure 1 Sewer Service Area

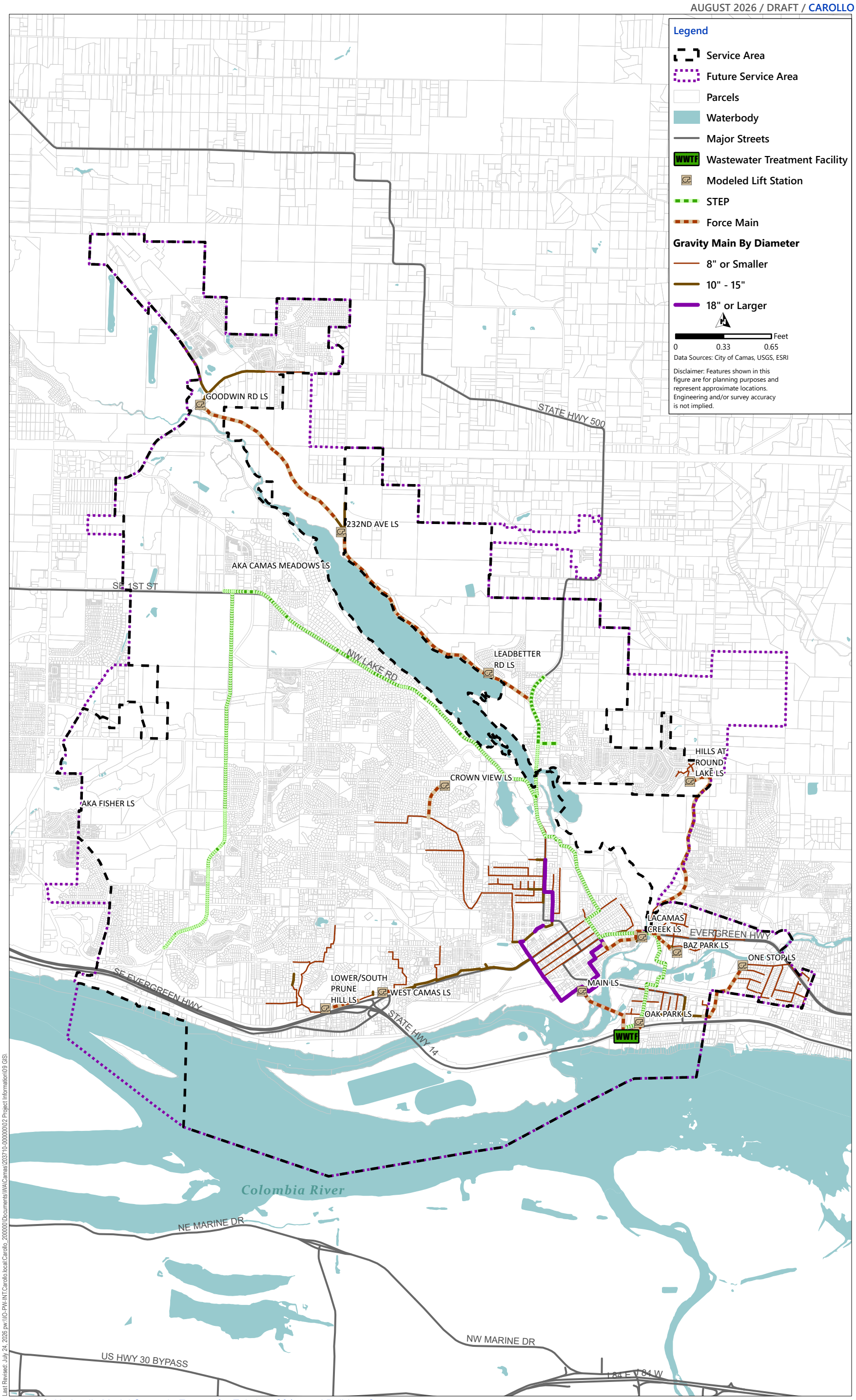


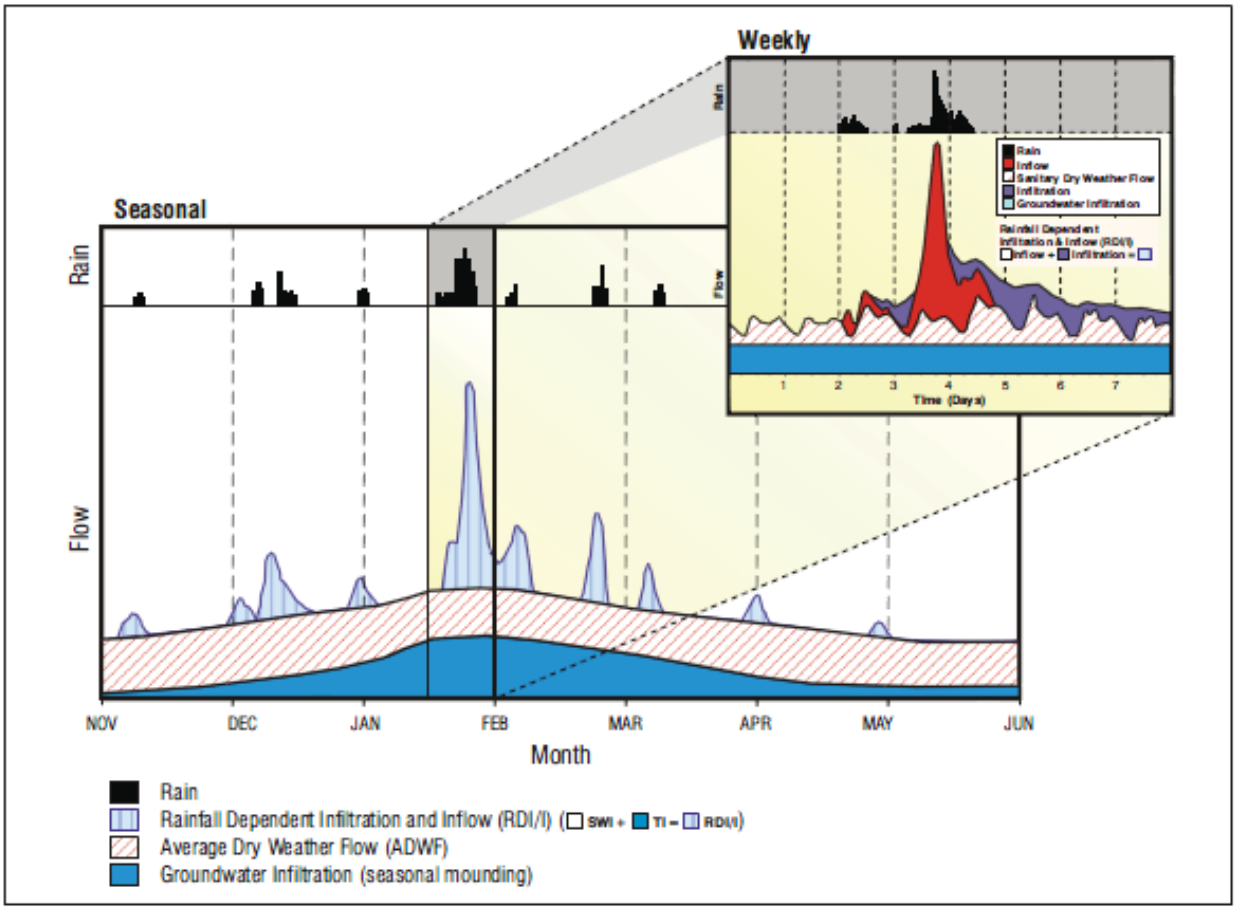
Figure 2 Hydraulic Model Scenario Extents for Existing, 2045, and Buildout Systems

SECTION 3 SEWER COLLECTION FLOWS

Sewer collection systems are intended to convey sanitary flows but frequently have additional flows from other sources. The different flow components are described in the section below and illustrated in Figure 3.

3.1 Dry Weather Flow Components

Average dry weather flow (ADWF) is the flow that is entering the collection system on a daily basis. There are two primary components of ADWF, base wastewater flow and dry weather groundwater infiltration (GWI). ADWF was estimated from an average of dry weather flow (DWF) data at each flow meter from January 15, 2025, to April 30, 2025. Section 4 describes the flow monitoring efforts performed by ADS, which went into determining the ADWF. The ADWF serves as the baseline flow in the hydraulic model.



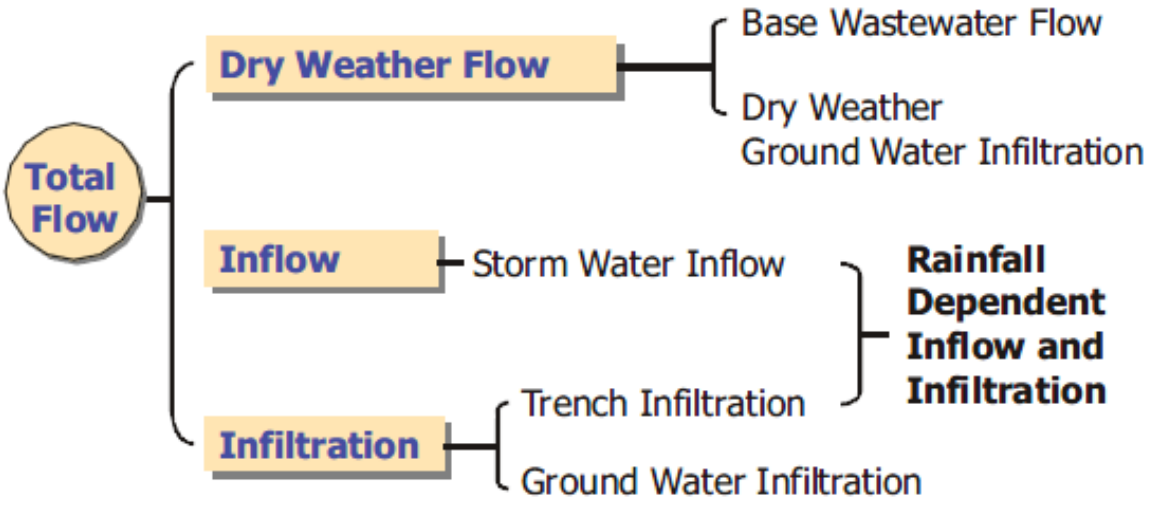


Figure 3 Typical Wastewater Flow Components

Note: This figure is not based on flow data specific to the City.

3.1.1 Base Wastewater Flow

The base wastewater flow (BWF) is the sanitary flow generated by routine water usage of the City's residential, commercial, and industrial customers. Conveying this flow is the primary function of the

collection system. The flow has a diurnal pattern that varies by individual customer's water use patterns. Typically, a residential diurnal pattern has two peaks with the more pronounced peak following the wake-up hours of the day, and a less pronounced peak occurring in the evening. Commercial and industrial patterns, though they vary depending on the type of use, typically have more consistent, higher flow patterns during business hours, and lower flows at night. Furthermore, the diurnal flow pattern of a weekend may vary from the diurnal flow experienced during a weekday. Diurnal (24-hour) patterns for both weekdays and weekends are applied to ADWF and cumulatively make up the flows experienced in the wastewater collection system. The diurnal patterns utilized for the City's collection system basins are developed in Section 4.2.1.

3.1.2 Dry Weather Groundwater Infiltration

Dry weather GWI will enter the sewer system when the relative depth of the groundwater table is higher than the depth of the pipeline and the sanitary sewer pipe allow infiltration through defects such as cracks, misaligned joints, and broken pipelines. Dry weather GWI (or base infiltration) cannot easily be separated from BWF by flow measurement techniques. Therefore, dry weather GWI is typically grouped with BWF.

3.2 Wet Weather Flow

Wet weather flow (WWF) includes two components:

1. Rainfall derived inflow and infiltration (RDII): The stormwater RDII response in the sewer system to rainfall is seen immediately (inflow) or within hours after the storm (infiltration).
2. GWI: Wet weather GWI is not specific to a single rainfall event, but rather to the effects on the sewer system over the entire wet weather season. The depth of the groundwater table rising above the pipe invert elevation causes GWI. Sewer pipes within close proximity to a body of water can be greatly influenced by groundwater effects.

3.2.1 Inflow and Infiltration

Inflow and infiltration are rainfall derived flows in the collection system from specific storm events. Inflow is stormwater that enters the sewer system via a direct connection to the system, such as roof drain and downspout connections, leaky manhole covers, and inappropriate storm drain connections. Infiltration is stormwater that enters the sewer system by percolating through the soil and enters through foundation drains, defects in pipelines, manholes, and joints. Some of the most common sources of RDII are shown in Figure 4. The adverse effect of RDII entering the sewer system is that it increases both the flow volume and peak flows such that the sewer system could be operating at or above its capacity, as illustrated in Figure 5. If too much RDII enter the sewer system, sanitary sewer overflows could occur.

3.2.2 Groundwater Infiltration

GWI, one of the components of RDII, is associated with extraneous water entering the sewer system through defects in pipes and manholes while the ground is saturated during the wet weather season. GWI is related to the condition of the sewer pipes, manholes, and groundwater levels. GWI may occur throughout the year, although rates are typically higher in the late winter and early spring in the Pacific Northwest.

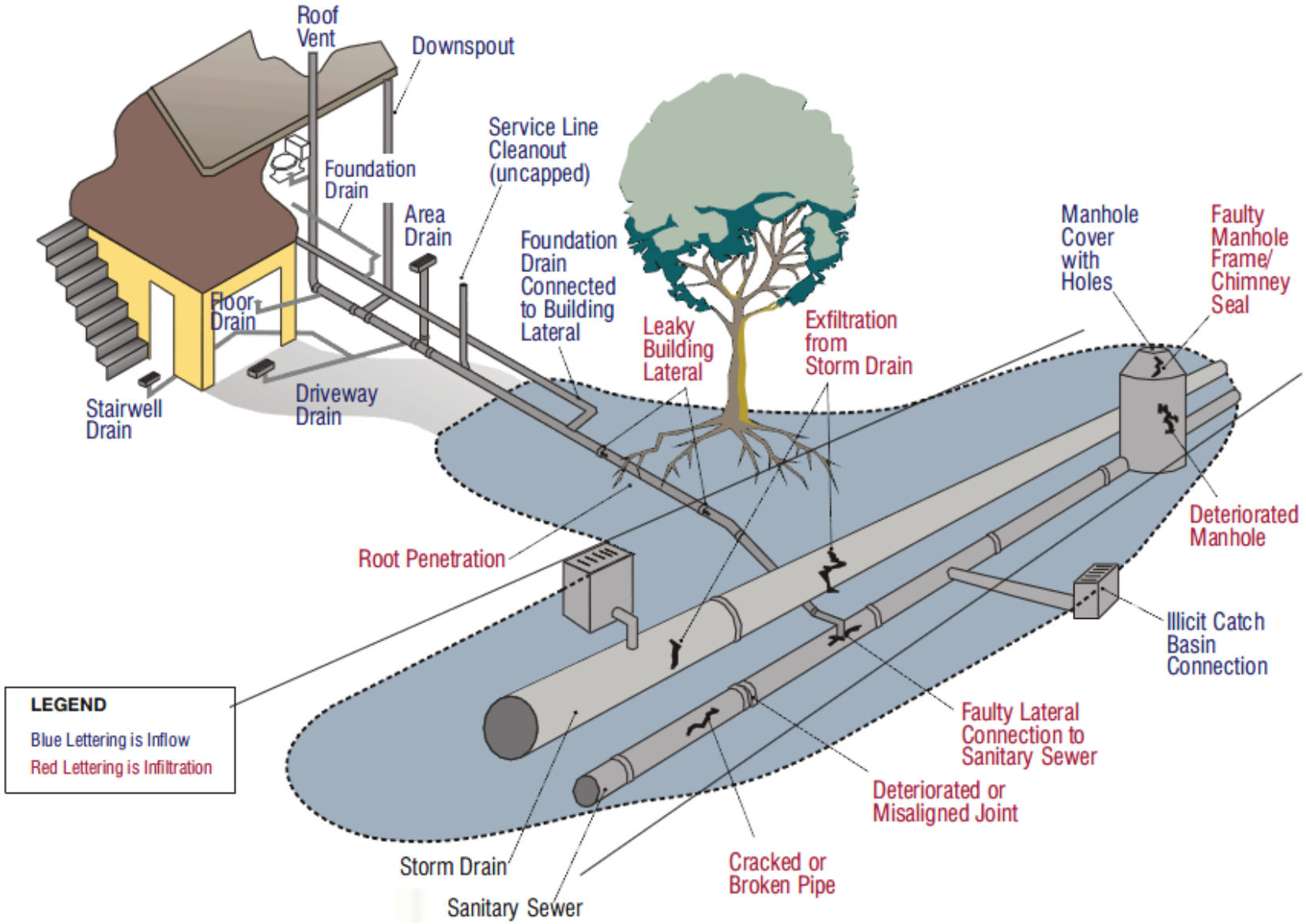


Figure 4 Typical Sources of Inflow and Infiltration

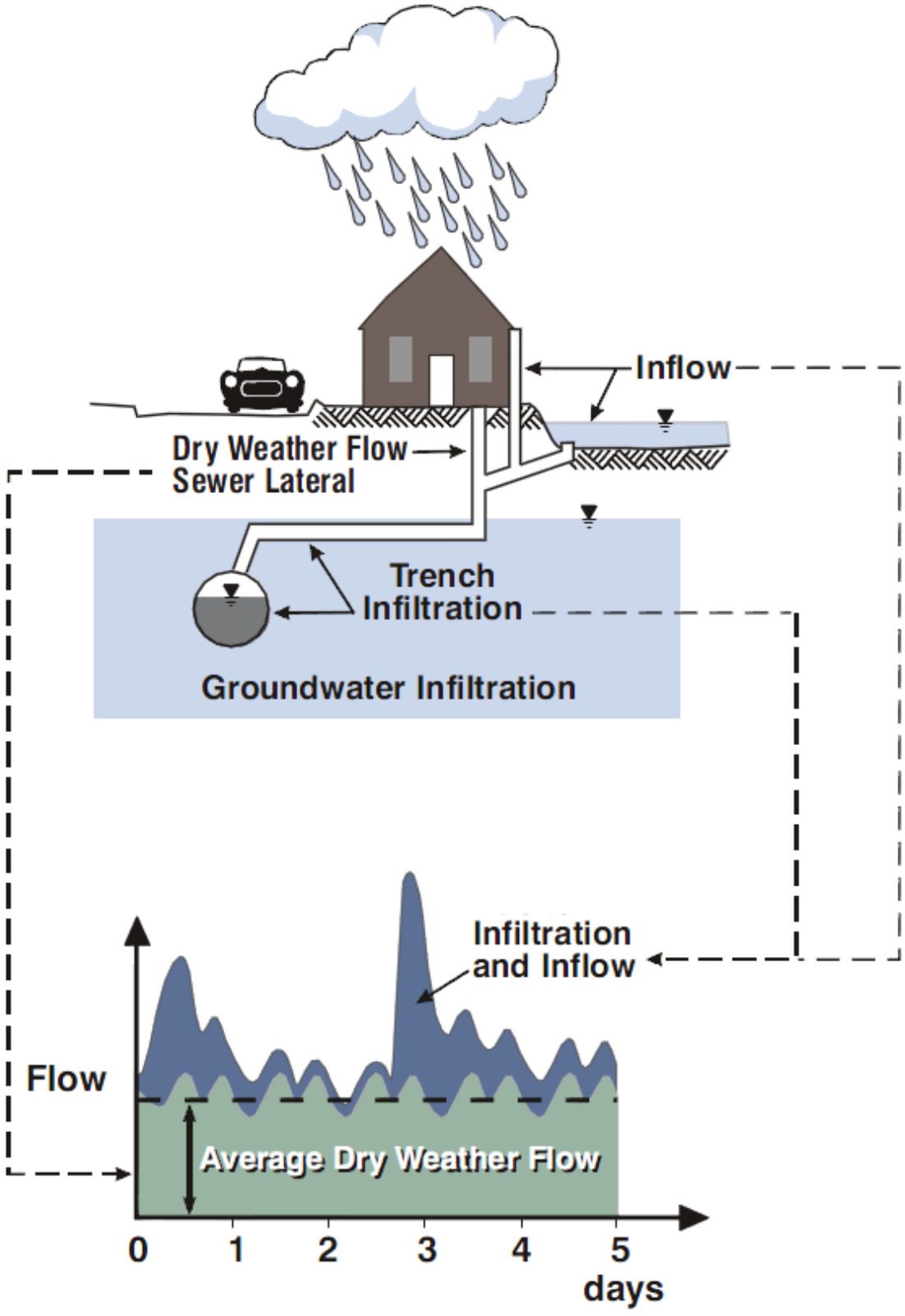


Figure 5 Typical Effects of Inflow and Infiltration

SECTION 4 FLOW MONITORING PROGRAM

As part of the Scope of Services for this GSP Update, Carollo Engineers (Carollo) contracted with ADS to conduct a temporary flow monitoring program within the City's sanitary sewer collection system. The purposes of the flow monitoring program were to correlate actual collection system flows to the hydraulic model predicted flows, evaluate the system's capacity, and estimate basin inflow and infiltration. The temporary flow monitoring data was collected for a period of approximately 105 days from January 15, 2025 to April 30, 2025. The *Camas Flow Monitoring Report 2025* prepared by ADS summarizes the flow monitoring program and was submitted to the City as a stand-alone report. A copy of the report is included in Attachment A.

4.1 Program Description

4.1.1 Flow Monitoring Sites and Tributary Areas

Four sewer basins were monitored during the flow monitoring period. The meter sites were selected to best isolate and model the critical areas and subareas within the sewer system. In addition to these meter basins, three other sewer basins were evaluated using the City's supervisory control and data acquisition (SCADA) data. One of these basins represents the City's STEP system, because this area was not directly monitored by ADS nor the City, flow from the STEP system was estimated using a mass-balance approach based on influent data from the wastewater treatment facility (WWTF). Two additional basins in the North Shore area located upstream in Basin 4-1-3 were also analyzed. These include the basin upstream of the Goodwin Road Lift Station (LS) and the Leadbetter Road LS basin which is located downstream of the Goodwin Road LS but still upstream of Basin 4-1-3.

These seven flow monitoring locations, as well as the area tributary to each site, are shown on Figure 6. Table 2 lists the flow monitoring locations and the diameters for the sewers where the meters were installed. Figure 7 provides a schematic illustrating the flow monitoring locations to help understand how the basins connect. Meter data quality was reviewed at all sites and deemed acceptable to use for model calibration. The quality of meter data and other trends in the flow can be determined from scattergraphs. Which plot the depth versus velocity as compared to the manning's curve for the pipe segment. Scattergraphs for each metered site can be found in the ADS Flow Monitoring Report, Attachment A.

Table 2 Flow Monitoring Locations

Basin ID	ADS Meter ID	Upstream Pipe ID	Upstream Basin Type	Upstream Pipe Slope (%)	Upstream Pipe Diameter (inch)
8-1-2	CAM_81189	SEWER-GMAIN-100313	Gravity	0.18	12
4-1-3	CAM_100290	SEWER-GMAIN-100740	Gravity	0.38	12
5-2-1	CAM_52167	SEWER-GMAIN-101019	Gravity	2.74	18
5-1-2	CAM_51123	SEWER-GMAIN-100236	Gravity	0.23	21
Goodwin Road(1)	-	SEWER-GMAIN-102279	Gravity	2.0	18
Leadbetter Road(1)	-	SEWER-FMAIN-100127	Gravity	0.29	18
STEP(2)	-	N/A	STEP	-	-
WWTF(3)		N/A	Gravity/STEP	-	-

Notes:
(1) Flow information was based on historical wet well flows provided by the City from February 1, 2025 to April 30, 2025.
(2) No upstream pipe ID information was available for the STEP basin. Flow for this area was therefore estimated using GIS-derived upstream drainage data and a mass balance approach using influent flow meter data at the WWTF.
(3) Flow meter information was provided from the City's SCADA system.

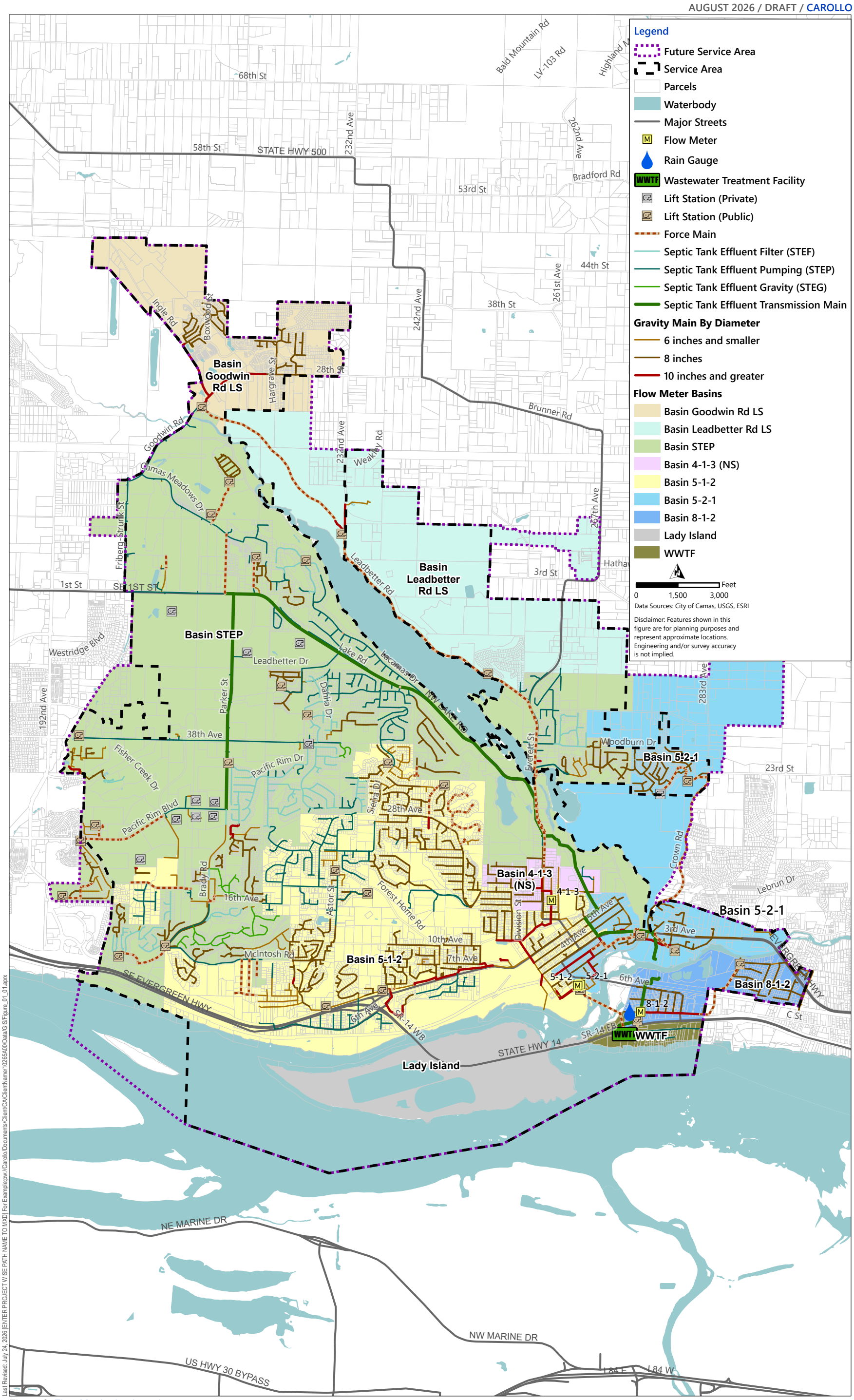


Figure 6 Flow Monitoring Locations

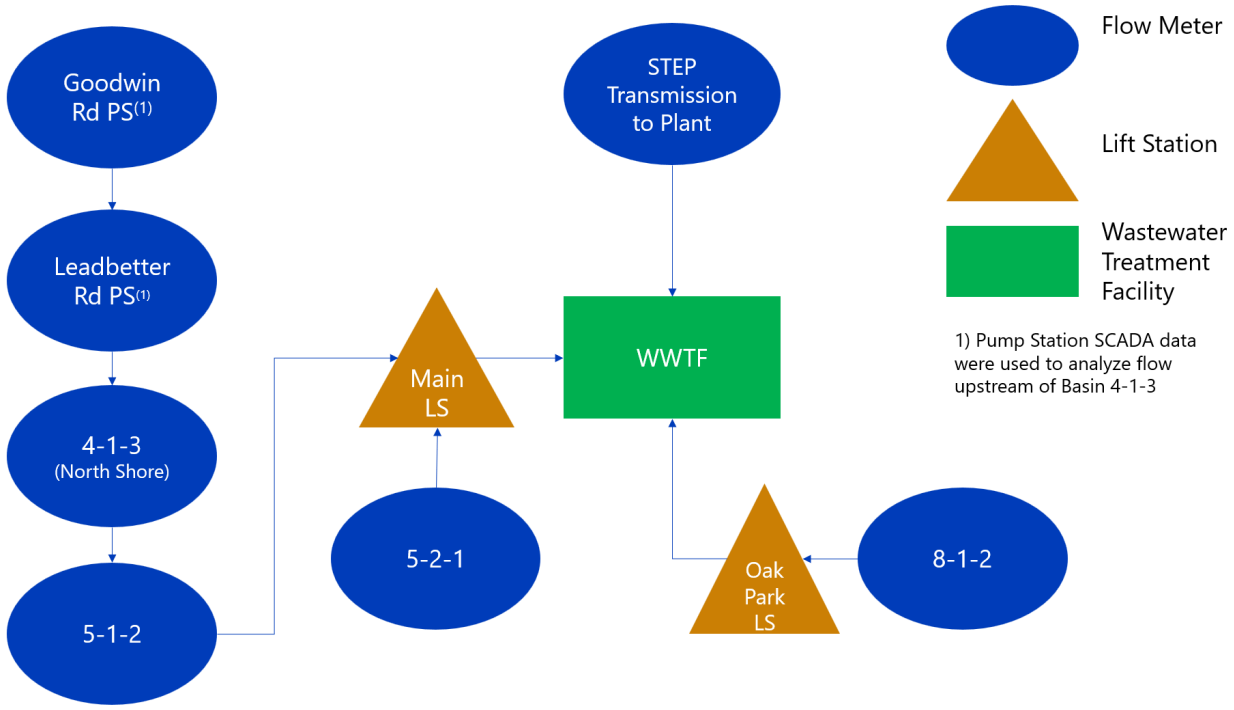


Figure 7 Flow Monitoring Schematic

4.1.2 Flow Meter Installation and Flow Calculation

The flow monitoring equipment used ADS Triton+ monitor. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow. The monitor includes data acquisition sensors and a battery-powered microcomputer with a processor, data storage, and an internal clock to synchronize readings. It was programmed to record flow depth and velocity every 5 minutes.

The Triton+ monitor also provides cross-checking between multiple sensor technologies to improve reliability and can support up to two sets of sensors.

For this project, the Peak Combo Sensor was installed at the bottom of the pipe. This sensor measures flow using three technologies:

- Ultrasonic depth which is measured by using sound waves,
- Pressure depth is determined from hydrostatic pressure, and
- Peak velocity is calculated from reflected ultrasonic signals using digital spectrum analysis.

ADS conducted an analysis of the data retrieved from each flow meter and made adjustments as needed for calibration based on the field measurements. The flow at each meter was then calculated at 15-minute intervals based on the continuity equation:

$$Q = V \times A$$

Where:

- Q = Pipeline flow rate, cubic feet per second.
- V = Average velocity, feet per second.
- A = Cross sectional flow area, square feet.

4.1.3 Rain Gauges

One rain gauge was installed by ADS to record rainfall that occurred throughout the flow monitoring program. The location of the rain gauge is shown in Figure 6.

4.2 Flow Monitoring Results

The flow monitoring program data were evaluated by components including DWF, rainfall, and WWF. Data collected from flow meter Basin 8-1-2 is presented throughout this report as an example of the type of data and the results from the flow monitoring program.

4.2.1 Dry Weather Flow Data

Base flow can be estimated for a wastewater collection system by comparing DWF and WWF at the flow monitoring locations. To estimate ADWF for more specific areas, such as individual wastewater basins, DWFs are typically estimated based on the area contributing to flows and flow coefficients developed for each land use type. This method is based on the assumption that areas with similar land uses, such as low-density residential parcels, produce equivalent quantities of wastewater flow on a per area basis. System-wide flows can be compared to known flows at flow monitors, or at the treatment plant to verify accuracy. This method of estimating base flows is an industry standard for planning and provides sufficiently accurate data for planning purposes. Table 3 shows the ADWF development summary for each flow meters.

Existing ADWFs for each basin were estimated using data from the Flow Monitoring Program for each of the flow monitoring basins. ADWF was developed using the driest days from the flow monitoring period based on the following set of minimum criteria:

- Less than 0.1 inches of rain in the previous day.
- Less than 0.4 inches of rain in the previous three days.
- Less than 1.0 inch of rain in the previous five days.
- In addition, those dry days that exhibited unusual flow patterns were not used to generate net dry day flow values for a basin.

Characteristic dry weather 24-hour diurnal flow patterns for each site were developed from hourly data. The hourly flow data were also used to calibrate the hydraulic model for the observed DWFs during the flow monitoring period. Hourly patterns for weekday and weekend flows vary and were separated to

better define DWF. An example of the DWF patterns from Flow Meter Basin 8-1-2, are shown in Figure 8. Additional patterns for all DWF development for all flow monitoring basins can be found in Attachment B.

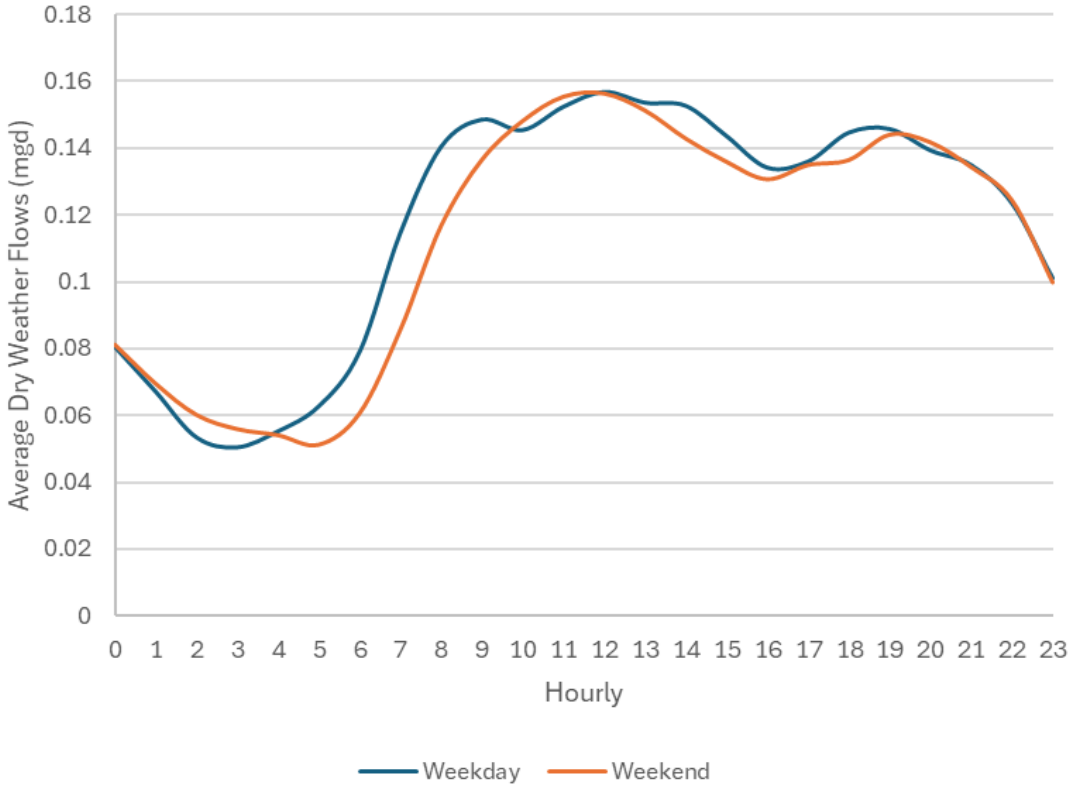


Figure 8 Typical Weekday vs Weekend Dry Weather Flows (Meter 5-1-2)

Carollo used the average weekday and weekend dry weather levels and velocities at each site from the data provided by ADS for use in the model calibration process.

Table 3 ADWF Development Summary

Meter ID	Weekday ADWF (mgd)	Weekend ADWF (mgd)	Weekday/Weekend Ratio	Gross ADWF (mgd)	Net ADWF (mgd)
Meter 8-1-2	0.12	0.11	1.09	0.12	0.12
Meter 4-1-3	0.24	0.24	1.00	0.24	0.11
Meter 5-2-1	0.20	0.21	0.95	0.20	0.20
Meter 5-1-2	0.86	0.84	1.02	0.85	0.61
Leadbetter Road	0.13	0.14	0.91	0.13	0.04
Goodwin Road	0.09	0.10	0.93	0.09	0.09
STEP(1)	-	-	1.00	1.63	1.63
WWTF	2.81	2.79	1.00	2.80	1.63

Notes:
(1) STEP flow was derived using the City's SCADA Data by subtracting the upstream metered flows from the total WWTF's influent flow.
mgd - million gallons per day.

4.2.2 Rainfall Data

An important part of the flow monitoring program is the collection and analysis of rainfall data. Three significant rainfall events occurred during the course of the flow monitoring period, as well as a few other relatively minor events. The storms recorded during the Temporary Flow Monitoring Program caused an RDII response in the collection system and were appropriate for RDII analysis and model calibration purposes. The rainfall data recorded over the course of the flow monitoring program is illustrated in Figure 9. Figure 10 illustrates the total accumulation of rainfall over the course of the flow monitoring period for the ADS tipping bucket type rain gauge. Table 4 summarizes a range of events that occurred during the course of the flow monitoring period available and recorded at the ADS rain gauge for calibration.

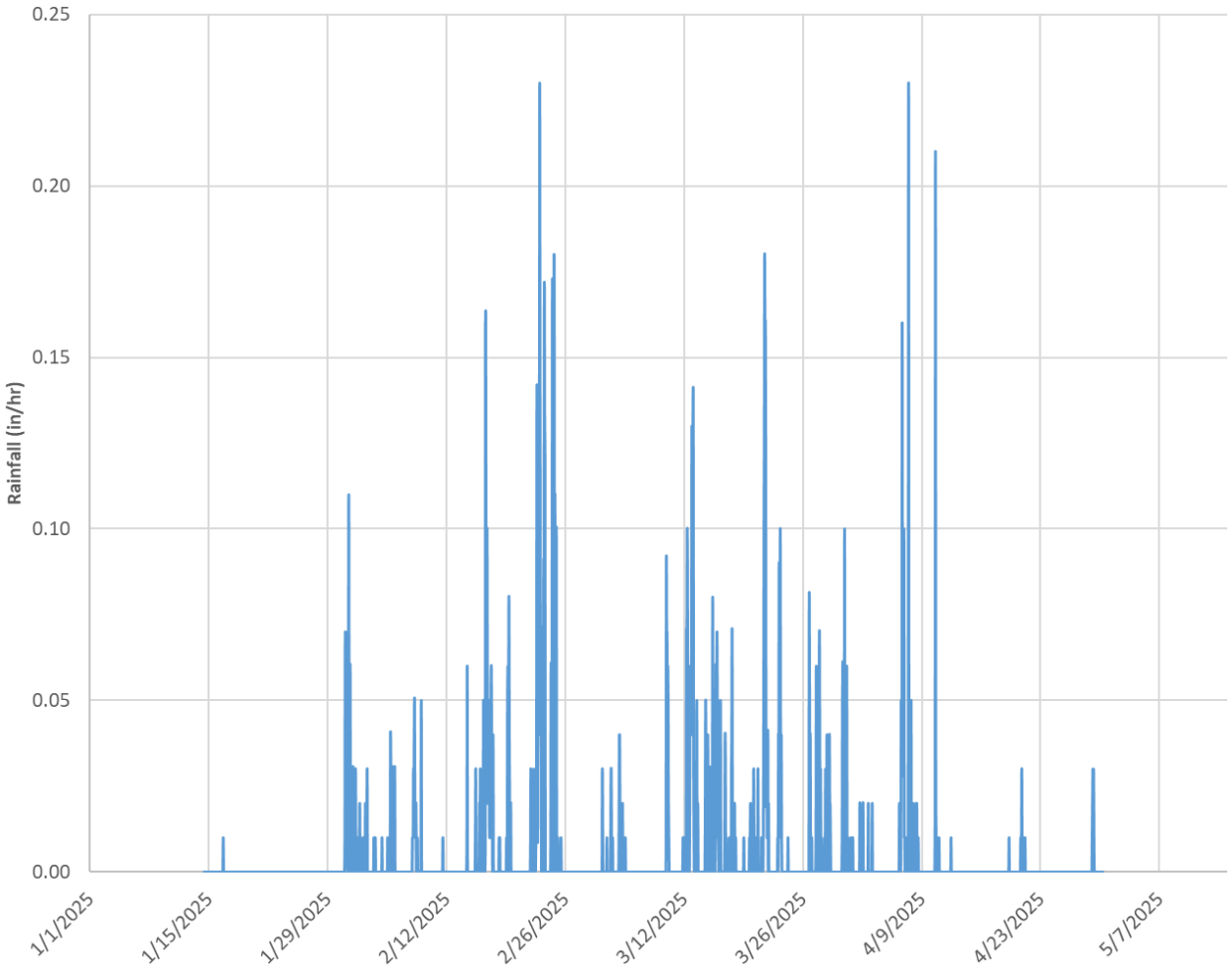


Figure 9 Rainfall Intensity

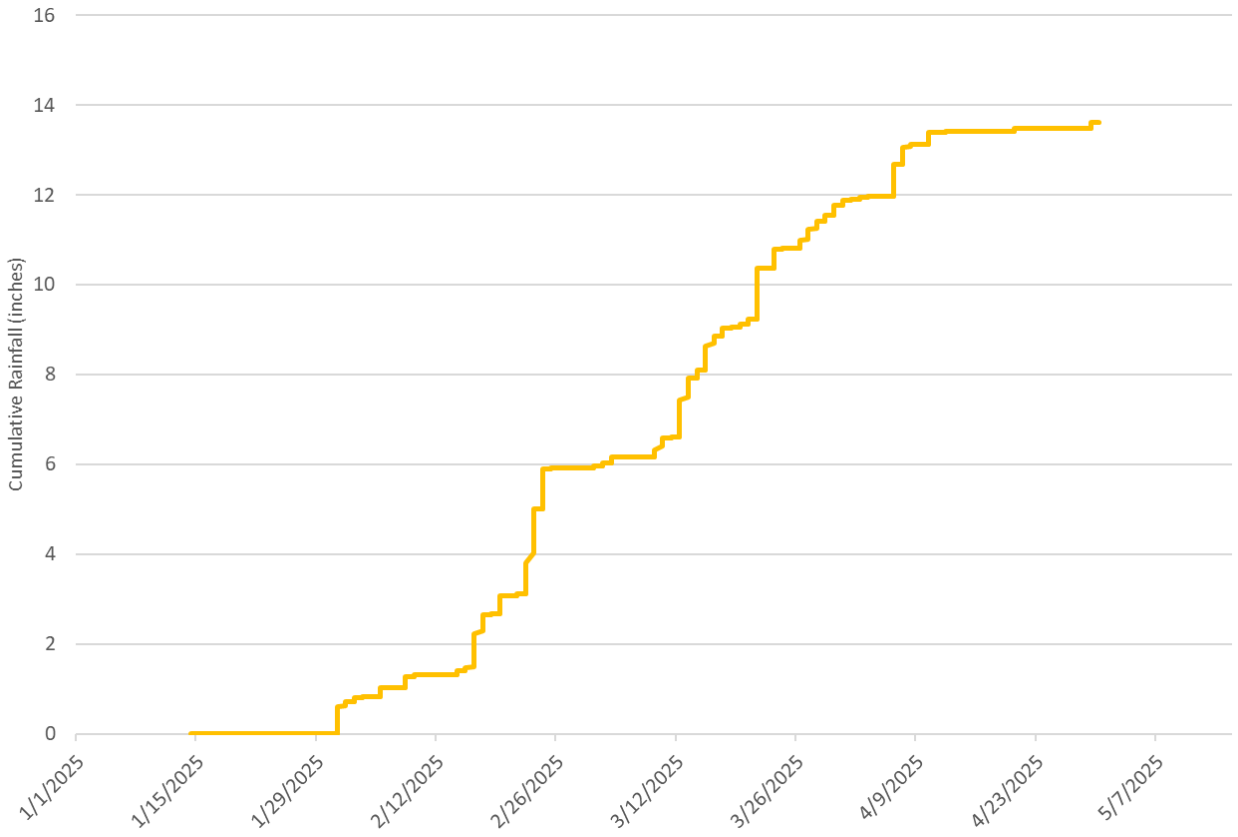


Figure 10 Cumulative Rainfall

Table 4 Identified Storm Events

Storm Event	Start Date	End Date	Total Event Rainfall (inch)	Total 24-hour Volume (inch)	Maximum Peak Intensity (inch/hour)
1	1/31/2025	2/5/2025	0.82	0.63	0.11
2	2/14/2025	2/19/2025	1.34	1.04	0.16
3	2/21/2025	2/25/2025	2.82	1.82	0.23
4	3/2/2025	3/5/2025	0.24	0.13	0.04
5	3/12/2025	3/19/2025	2.45	1.18	0.14
6	3/20/2025	4/1/2025	2.74	1.12	0.18
7	4/5/2025	4/9/2025	1.15	0.94	0.23

4.2.3 Wet Weather Flow Data

The flow monitoring data were also evaluated to determine how the collection system responds to wet weather events. As mentioned above, the flow monitoring program captured three main rainfall events. The rainfall event that occurred on February 23, 2025 was associated with the largest RDII response during the flow monitoring period and is the most appropriate to be used for RDII analysis.

Figure 11 shows an example of the wet weather response at Meter 5-1-2 during the February 23, 2025 rainfall event. This figure also illustrates the volume of RDII that entered the system from the collection system upstream of Meter 5-1-2. The blue line is the base sanitary flow while the yellow line shows the recorded rainfall during the storm event. As can be seen in the figure, the flow increased by 4 to 8 times ADWF due to RDII entering the system during wet weather events.

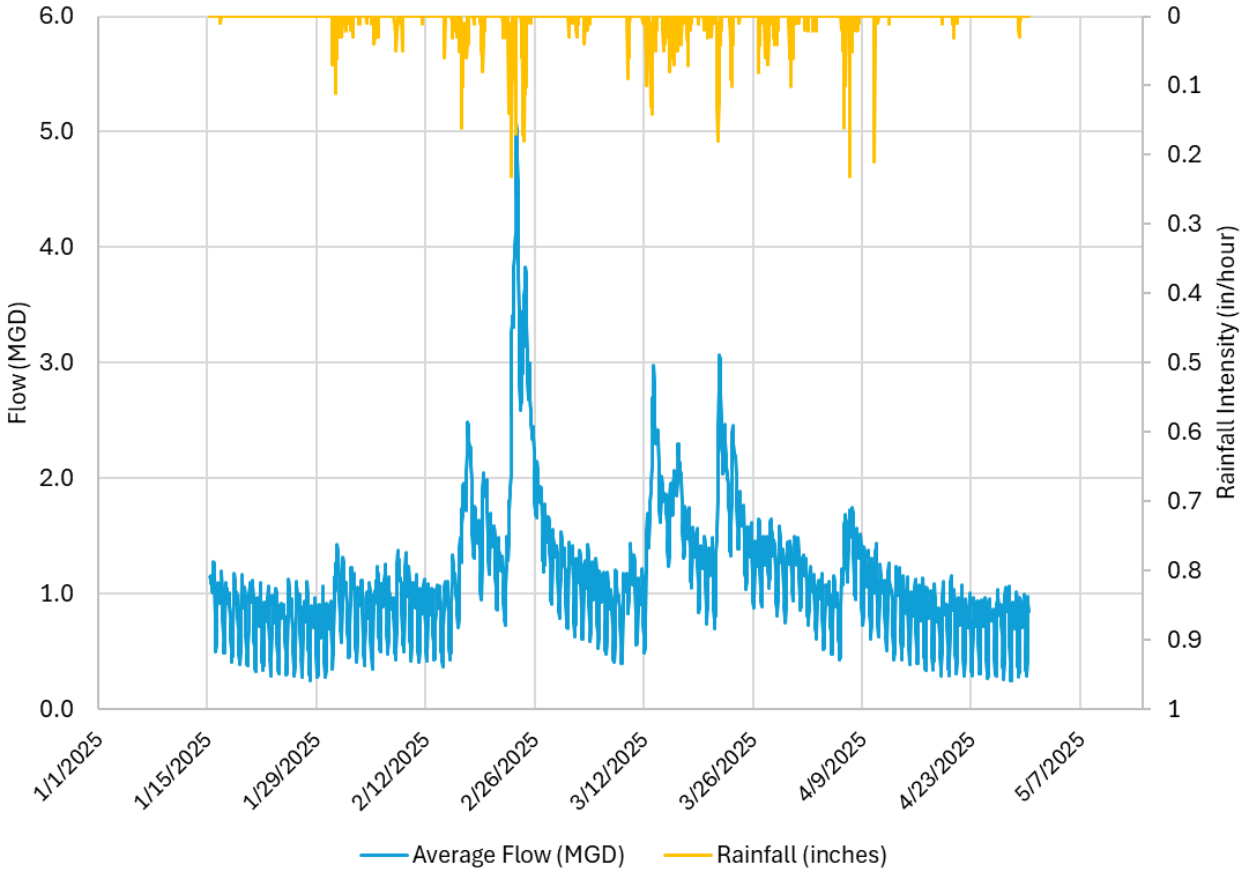


Figure 11 Example of Wet Weather Response (Meter 5-1-2)

SECTION 5 ZONING AND LAND USE DATA

Land use designations and regulations are important when evaluating existing sewer system capacity because they indicate the types and intensity of development that may occur in an area. These uses may include single family and multi-family residential development, as well as commercial and industrial development.

Land use is also an important factor in estimating wastewater flows. The type and intensity of development directly affect the volume of wastewater generated. The service area generally includes both sewered and unsewered areas. Sewered areas contribute flow to the collection system, while unsewered areas such as vacant, undeveloped parcels, or development such as parking facilities without a wastewater connections and do not currently contribute flow to the collection system. The following sections summarize the land use assumptions used for the existing sewer service area and the Study Area. For additional information on zoning and land use data, see Chapter 3 - Basis of Planning of the GSP.

SECTION 6 WASTEWATER FLOW FACTORS

The wastewater flow factors were developed using flow monitoring data, City's SCADA data, land use information, and basin-specific calibration of ADWF. For hydraulic model calibration, basin-specific flow factors were developed for each monitored basin. These basin specific factors were used during DWF calibration and subsequently combined into weighted average flow factors for use in projecting future wastewater flows.

The development of wastewater flow factors, allocation of flows to the collection system for hydraulic model development, and methodology used to project existing and future flows are described in Chapter 3 Section 3.4.3 of the GSP.

SECTION 7 HYDRAULIC MODEL OVERVIEW

A wastewater collection system model is a simplified representation of the real sewer system. Wastewater system models can assess the conveyance capacity of the collection system. The model can be used to size new infrastructure. In addition, sewer system models can perform "what if" scenarios to assess the impacts of future developments and land use changes. The City's collection system hydraulic model was updated and expanded using a multi-step process utilizing data from a variety of sources. This section summarizes the hydraulic model development process, including a description of the modeled collection system, the hydraulic model elements, and the model creation process.

7.1 Selected Hydraulic Modeling Software

The City's previous collection system hydraulic model was developed in MIKE URBAN, a hydraulic modeling software developed by DHI. Since DHI announced it would discontinue support for MIKE URBAN, the model was converted to MIKE+, which is now the current modeling platform. MIKE+ has a 1D engine which is a widely adopted tool for planning, analysis, and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems.

The latest version (2024) of MIKE+ was used for the hydraulic model update. More information about the modeling software can be found in the MIKE+ Collection System User Guide (0F[1]).

7.2 Modeled Collection System and Skeletonization

The City previously had two separate sewer models: a skeletonized model developed during the previous GSP and a model of the STEP system. Carollo combined these two models and extended the system to the North Shore area. Carollo also added gravity pipes larger than 6 inches in diameter, where information from GIS or as-builts was available. The added portions of the gravity collection system includes the downtown area, north of Lacamas Lake Park, Oak Park area, and the neighborhood surrounding

[1] Collection System User Guide, MIKE+ 2024.

Goot Park. As additional data become available and as the City's GIS database is developed, additional gravity system pipes can be added to the model.

Additionally, key sewers 8-inches in diameter and smaller are included in the City's hydraulic model where needed for connectivity, or where it was determined that the pipes in question were considered as primary collectors.

7.3 Elements of a Hydraulic Model

The following provides a brief overview of the various elements of the hydraulic model and the required input parameters associated with each:

- **Nodes:** Sewer manholes, cleanouts, and other locations where pipes begin, pipe sizes change or pipelines intersect are represented by junctions in the hydraulic model. Required inputs for junctions include rim elevation, invert elevation, diameter, and surcharge depth (used to represent pressurized systems). Two different node types are used in the model:
  - **Junctions:** Volume free nodes that function as simple hydraulic connection points between two or more links. Junction nodes are used where flow combines, splits, or transitions through the system and do not provide storage volume or significantly impact hydraulic routing.
  - **Manhole:** Nodes with assigned storage volume that represent physical sewer manholes in the collection system. Manhole nodes incorporate structure geometry into the hydraulic calculations and can influence flow routing, surcharge conditions, and system storage.
- **Pipes:** Gravity sewers and force mains are represented as pipes in the hydraulic model. Input parameters for pipes include length, friction factor (e.g., Manning's n for gravity mains, Hazen Williams C for force mains), invert elevations, diameter, shape, and whether or not the pipe is a force main.
- **Basin:** For collection system modeling, storage nodes typically are used to represent pump station wet wells (although other storage basins, etc., can be modeled as storage nodes). Input parameters for storage nodes include invert elevation, wet well depth, and wet well cross section or a depth-area relationship.
- **Pumps:** Pumps are included in the hydraulic model as links. Input parameters for pumps include pump curves and operational controls.
- **Outlets:** Outlets represent areas where flow can leave the system. For sewer system modeling, an outlet typically represents an overflow point or the connection to the WWTF.
- **Rain Gauges:** Rain gauges are locations where rainfall is input to the hydraulic model for simulation of WWF. The rain can be historical, projected, or theoretical hourly rainfall events.
- **Subcatchments:** Subcatchments represent areas of land whose topography and drainage characteristics direct flow to a single discharge point into the sewer system. Subcatchments can be used to define sanitary flows or to route a portion of the rainfall runoff into the system. Inflow conditions for the subcatchments are defined model inputs.
- **Inflows:** There are two primary flow sources that enter into the collection system, which are input through individual junctions (and storage nodes) in the model:
  - **Dry Weather:** Dry weather inflows simulate base sanitary wastewater flows and represent the average flow. The DWFs can be multiplied by up to four patterns that vary the flow by month, day,

hour, and day of the week (e.g., weekday or weekend). The dry weather diurnal patterns are adjusted during the dry weather calibration process to match the known typical daily flow fluctuations. Two diurnal patterns were developed for each basin, respectively representing weekday and weekend days (see Section 2.9.1).

» **RDII:** RDII are flows into the collection system originating from rainfall. Several models are available in MIKE URBAN to capture these effects. The models have a number of parameters that are adjusted during the wet weather calibration process (see Section 9.3.1) to model the flows into the collection during different storm events.

SECTION 8 HYDRAULIC MODEL EXPANSION AND REFINEMENT

8.1 Flow Monitoring Basins

To identify capacity requirements for specific facilities throughout the system, flows were developed for each flow monitoring basin. These basins are based on the local topography and trunk sewers that drain them. The basins have been defined within the current system boundaries and generally delineate large areas of the conveyance system network that ultimately flow to interceptors that convey the flow to the WWTF.

8.2 Primary Collectors

The City's hydraulic model was expanded and refined to match the latest GIS, which was provided by the City in January 2025. As part of the GSP update, Carollo identified the primary collectors to add to the hydraulic model for improved spatial capture of the City's area. Figure 12 illustrates the additional collection system areas that were added to the model. Approximately, 39.8 miles of pipes ranging from 6- to 36-inches were added to the hydraulic model, 9.8 miles of which were force mains. The model update also added six LSs:

- Goodwin Road LS.
- 232nd Avenue LS.
- Leadbetter Road LS.
- Hills at Round Lake LS.
- Oak Park LS.
- Baz Park LS.

This model updates total is 39.8 miles of the total collection system to the model. The City provided all the as-built drawings of their collection system, which includes the areas in North Shore and the seven LSs mentioned above. Adjustments to inverts and pipe diameter were made as needed. Some field verification was performed at flow meters 5-1-2 to ensure the geometry manhole drop downs was correct. Figure 14 shows the pipelines that were included in the hydraulic model.

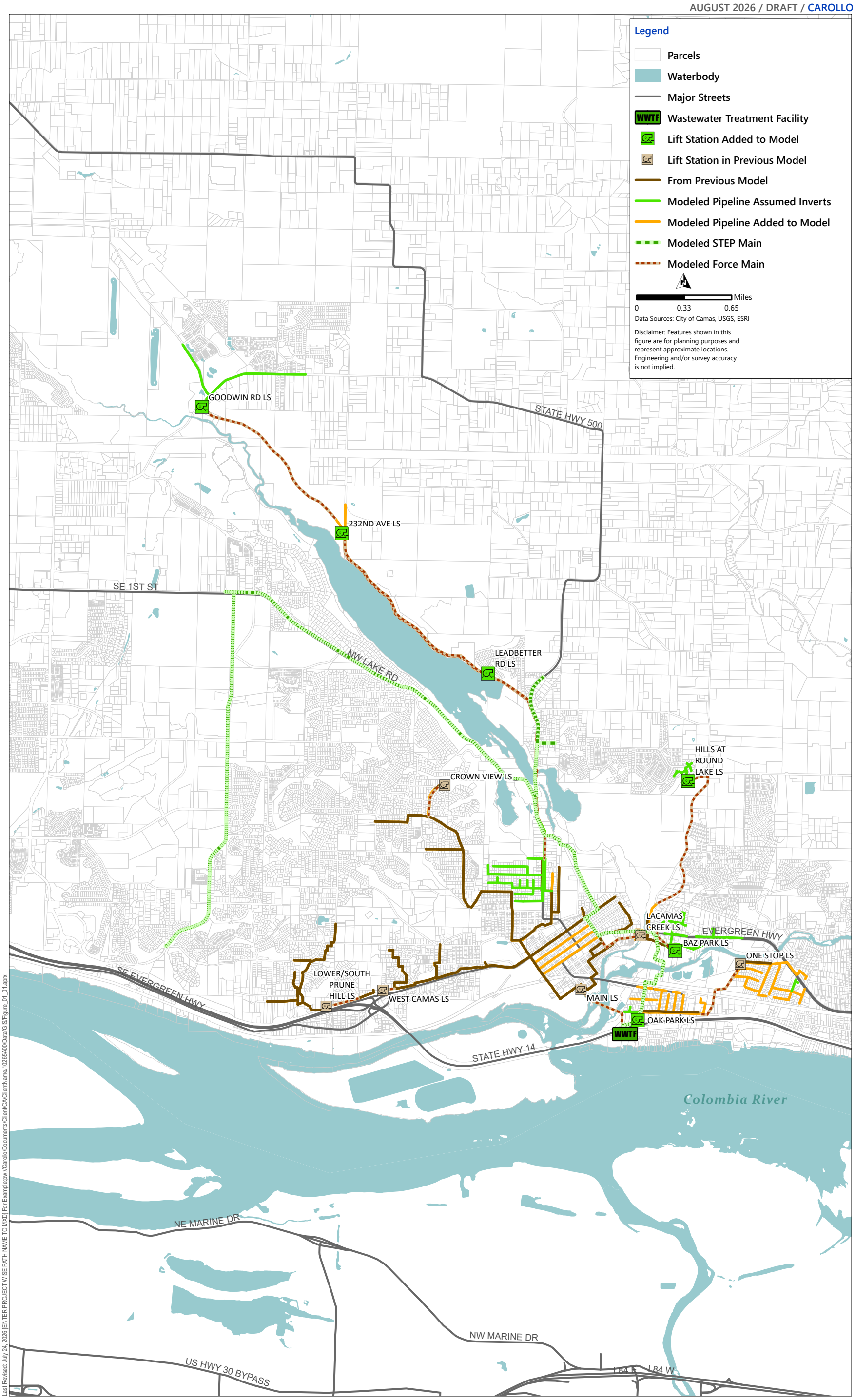


Figure 12 Additional Pipelines and Lift Stations Added to the Model

The modeled sewer system consists of approximately 8.4 miles of STEP pipelines ranging in diameter from 6-inches to 24-inches (or 13.7 percent of the total linear feet of pipes in the collection system) and approximately 21.6 miles gravity sewer pipelines ranging in 6-inches to 36-inches (or 28.1 percent of the total linear feet of pipes in the collection system). There are twelve pump stations in the hydraulic model, of which six were in the previous hydraulic model. The modeled pump station information is summarized Table 5. The pumps stations beyond the modeled system are implicitly included in the loading polygons where they are located. Neglecting the complete details of very small pump stations is common practice in skeletonized collection system models as their low flows are relatively small and steady. The force mains were not included in the model.

Table 6 summarizes the modeled sewer system by pipeline type, diameter, and length of pipe.

Table 5 Modeled Lift Stations

Name	No. of Pumps	Firm Capacity (gpm)	Total Capacity (gpm)	Pump 1 Start Level (feet)	Pump 2 Start Level (feet)	Pump 1 Stop Level (feet)	Pump 2 Stop Level (feet)
Crown View	2	222	444	520.0	516.0	521.0	516.0
Lacamas Creek	2	950	1,900	23.03	21.03	23.73	21.03
One Stop	2	231	462	19.97	16.97	20.97	16.97
South Prune Hills	2	600	1,200	134.53	130.53	135.53	130.53
West Camas	2	1,000	2,000	116.7	111.2	117.7	111.2
Goodwin Road(1)	2	340	680	179.08	177.08	179.58	177.08
232nd Avenue(1)	2	365	730	179.67	177.17	180.17	177.17
Leadbetter Road(1)	2	605	1,210	175.0	172.0	175.5	172.0
Main(2)	3	3,850	7,700	15.5	15.0	16.5	15.0
Hills at Round Lake	2	257	514	319.16	314.56	320.16	314.56
Oak Park	2	350	700	19.5	16.5	20	16.5
Baz Park	2	488	976	21.17	16.77	22.17	16.77

Notes:
(1) Lift Station designed with space for a third pump to be added in the future.
(2) Pump on/off level assumed.
gpm - gallons per minute.

Table 6 Modeled System Pipelines

Diameter (inches)	Gravity Modeled Pipe Length (feet)	STEP Modeled Pipe Length (feet)	Force Main Modeled Pipe Length (feet)	Total Pipe Lengths (feet)	Percent of Modeled System (%)
6	33	66	25,685	25,784	12.3%
8	80,974	3,254	17,752	101,979	48.6%
10	3,431	4,953	2,517	10,902	5.2%
12	17,201	343	3,375	20,919	10.0%
15	1,818	-	-	1,818	0.9%
18	5,913	-	2,348	8,261	3.9%
21	2,828	20,907	-	23,735	11.3%
24	1,238	15,008	-	16,246	7.7%
36	372	-	-	372	0.2%
Total	**113,809**	**44,531**	**51,677**	**210,016**	**100%**

8.3 Wastewater Flow Allocation

Defining the quantity of dry weather wastewater flows generated within a municipality and how the flows are distributed throughout the collection system is an important component of the hydraulic modeling process. Various techniques can be used to assign wastewater flows to individual model nodes, depending on the type of data that is available. Adequate estimates of the volume of sanitary wastewater flows are important in maintaining and sizing sewer system facilities, both for present and future conditions. Baseline wastewater flows were allocated (assigned to specific nodes) in the hydraulic model based on land use data provided by the City and wastewater flow coefficients developed previously in Section 6.

Sanitary sewer flows were developed based on analyses of the City's flow meter data described in Section 6. Measured ADWF for each meter basin was used to develop land use-specific flow factors (in gallons per acre per day [gpad]). The flow factors and land use data specific to each model basin were used to estimate an ADWF, as described below:

- **Step 1:** The City's seven basins were subdivided into 11,950 individual model subcatchments based on tax parcels excluding the right-of-way. Figure 13 shows the subcatchments developed to allocate flows within the hydraulic model. Each subcatchment represents the geographic area contributing flow to a single model node (i.e., trunk system manhole). Although the Camas wastewater model is a skeletonized model rather than an all-pipe model, tax parcels were still used as the basis for the model subcatchments to provide a more detailed distribution of loading throughout the system. In some cases, individual parcels were automatically split between adjacent loading polygons based on the model network layout and downstream assignment, resulting in portions of the same parcel contributing flow to different model nodes.
- **Step 2:** The ADWFs were calculated for each subcatchment using a GIS software program by multiplying the land use flow factors by the land use acreage.
- **Step 3:** The model used a base sewage flow of 2.10 mgd, with the remaining 0.75 mgd of the ADS-monitored flow assigned as groundwater infiltration and distributed among the basins based on pipe length. See Section 8.3.1 for additional details on the development and allocation of groundwater basin-specific infiltration.
- **Step 3:** The subcatchment DWF was allocated to the appropriate node in the sewer system model.
- **Step 4:** The allocated DWFs were adjusted along with the GWI as necessary during the DWF calibration process (see Section 9) to closely match the actual measured DWFs recorded during the flow monitoring period.

8.3.1 Systemwide Base Wastewater Flow and Groundwater Infiltration Allocation

During the 2025 winter flow monitoring period, ADS measured a systemwide ADWF of approximately 2.85 mgd. In comparison, the City's historical WWTF influent data indicated an average summer ADWF of 2.10 mgd. Because groundwater levels are typically higher during the winter, the 0.75 mgd difference was attributed to groundwater infiltration. Therefore, the model used 2.10 mgd as the base wastewater flow.

The estimated groundwater infiltration was allocated to each sewer basin based on its proportion of the system's total pipe length, assuming that basins with more pipes have greater potential for groundwater to enter through pipe defects, joints, and manholes. The infiltration assigned to each basin was then divided by the basin's contributing acreage to calculate a basin-specific infiltration rate in gpad. This rate was applied to the contributing area within each basin to distribute infiltration to the model loading locations. As a result, basins with a greater amount of sewer pipe relative to their contributing area received a higher infiltration rate.

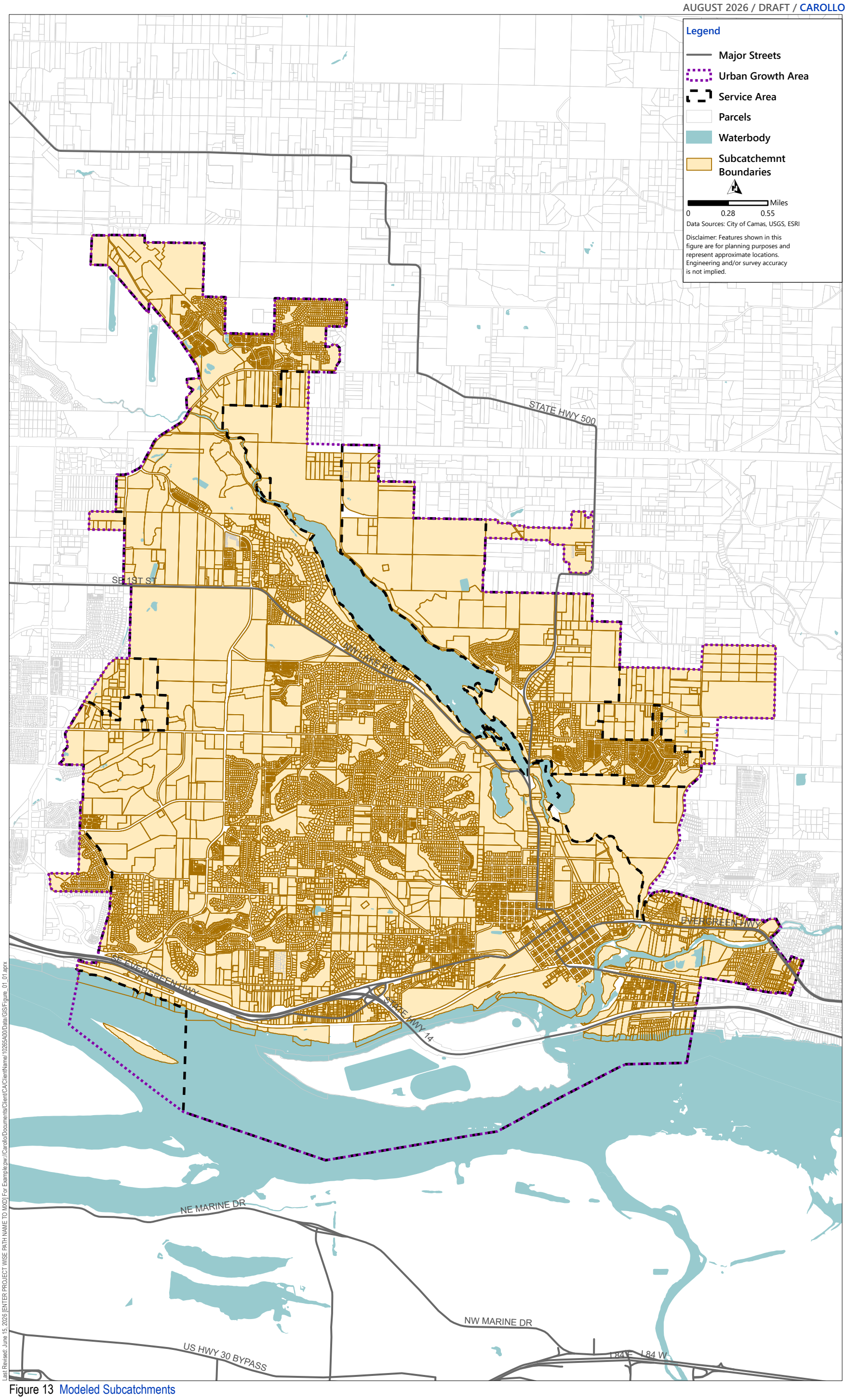


Figure 13 Modeled Subcatchments

8.4 Inflow and Infiltration: Time-Area A and RDI

MIKE+ has several modules to estimate the RDII in each basin. For this study, the Time-Area Model A (Inflow) and rainfall dependent infiltration (RDI) methods were chosen to model RDII, respectively. The Model A includes three primary factors including: time to concentration, a reduction factor representing flow losses, and an initial loss. The model also includes curves representing basin rain response. Basin rain response is essentially how fast flow from different parts of the catchment basin reaches the collection system.

The infiltration component of RDII flow comes from three sources, conceptually represented by different storage zones through the soil column. Figure 14 shows the conceptual RDI model, from DHI (2022). The three sources of flow that enter the collection system as RDI are Overland Flow that enters the system rapidly after a storm, Interflow with a medium response time, and Base Flow with a slower response, which is different than the sanitary Base Flow coming from wastewater customers. The volume of water stored in each zone, the response time, and how water moves between the zones are described by a series of related equations. The equations include 19 parameters that are not directly measurable and must be found through model calibration. An evapotranspiration term is included to simulate drying of the zones. Appendix D presents the resulting parameters after model calibration.

Two important RDII parameters are the areas of "connected pervious" and "connected impervious" land contributing flow to each basin's collection system. These areas represent the equivalent area of land accumulating rainfall to produce the WWF measured at the downstream flow meter. For example, if a flow meter measures a fast response to a storm event, there may be a lot of impervious land that is accumulating rainfall and contributing surface runoff to the collection system. Connected pervious land represents the equivalent amount of land absorbing rainfall and slowly contributing WWF to the collection system when the ground is saturated.

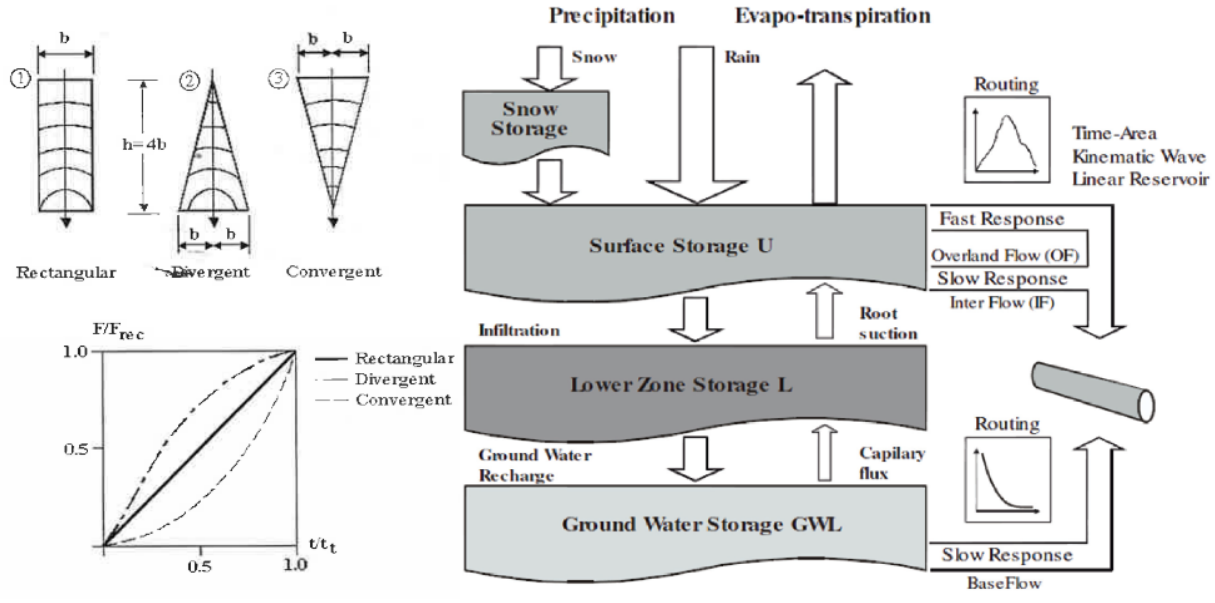


Figure 14 Model A and RDI

The RDI and Model A flow components combine to create a continuous hydrograph of RDII flow from each basin for each storm event. Often during wet periods, additional storms occur while tailing components of the preceding storm are still entering the system, creating complex hydrographs. The model is able to track subsurface groundwater storage through the wet season. Subsurface groundwater conditions are influenced by parameters affecting the interflow (horizontal leakage) and moisture interception by vegetation and root zone storage. Estimated evapotranspiration time series are also included in the model to further represent the physical processes that diminish the quantity of surface and sub-surface water.

8.5 Model Update Process

The City's hydraulic model combines information on the physical and operational characteristics of the wastewater collection system and performs calculations to solve a series of mathematical equations to simulate flows in pipes. The hydraulic model is a dynamic tool that can be changed and updated over time to represent the most recent data available to the City. The following steps outline the process used to update the hydraulic model:

- **Step 1:** The City's GIS shape files for the sewer collection system were obtained.
- **Step 2:** The GIS data were reviewed and deemed not accurate enough to rely on for model updates.
- **Step 3:** The collection system pipeline and facility data were updated based on available as-builts. Physical and operational data for the City's wastewater collection facilities were also updated and provided by the City.
  - Once all the relevant data was updated and input into the hydraulic model, the model was reviewed to verify that the model data was input correctly and that the flow direction and size of the modeled pipelines were logical. Additionally, the modeled pump stations were also checked to verify that they operated correctly.
- **Step 4:** Dry weather wastewater flows were then allocated to the appropriate model junctions. These flows were scaled up or down, as necessary, to match the ADWFs recorded during the flow monitoring period during the dry weather period.
- **Step 5:** The hydraulic model contains certain run parameters that need to be set by the user at the beginning of the project. These include run dates, time steps, reporting parameters, output units, and flow routing method. Once the run parameters were established, the model was debugged to ensure that it ran without errors or critical warnings.

SECTION 9 HYDRAULIC MODEL CALIBRATION

Hydraulic model calibration is a crucial component of the hydraulic modeling effort. Calibrating the model to match data collected during the flow monitoring program ensures the most accurate results possible. The calibration process consists of calibrating to both dry and wet weather conditions.

For this project, both dry and wet weather monitoring was conducted at the four metering sites presented and discussed in Section 4:

- DWF calibration ensures an accurate depiction of base wastewater flow generated within the study area, and diurnal fluctuations.
- WWF calibration consists of calibrating the hydraulic model to a specific storm event or events to accurately simulate the peak flow and volume of RDII into the sewer system. The amount of RDII is essentially the difference between the WWF and DWF components.

9.1 Calibration Standards

The hydraulic model was calibrated in accordance with international modeling recommendations. The Urban Drainage Group (UDG), formerly known as Wastewater Planning Users Group, a section of the Chartered Institution of Water and Environmental Management (CIWEM), has established generally agreed upon principles for model verification. The dry weather and wet weather calibration focused on meeting the recommendations on model verification contained in the "Code of Practice for the Hydraulic Modeling of Urban Drainage Systems," published by the CIWEM UDG[2], as summarized below.

9.1.1 Dry Weather Calibration Standards

Dry weather calibration should be carried out for two dry weather days, and the modeled flows and depths should be compared to the field-measured flows and depths. Both the modeled and field-measured flow hydrographs should closely follow each other in both shape and magnitude. In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:

- The timing of flow peaks and troughs should be within 1 hour.
- The peak flow rate should be within the range of ±10 percent.
- The volume of flow (or the average rate of flow) should be within the range of ±10 percent. If applicable, care should be taken to exclude periods of missing or inaccurate data.
- The unsurcharged depth should be within ±10 percent or ±4 inches, whichever is greater.

9.1.2 Wet Weather Calibration Standards

For each meter, three separate storms should be simulated with the model. For at least two storms out of the three events from the flow monitoring period, the model-simulated flows and depths should match the field-measured flows and depths within the accepted criteria. The modeled and field flow hydrographs for the calibration storms should closely follow each other in both shape and magnitude, until the flow has substantially returned to DWF rates.

In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:

- The timing of the peaks and troughs should be similar with regard to the duration of the events.
- The peak flow rates at significant peaks should be in the range of +25 percent to -15 percent and should be generally similar throughout.

[2] UDG, Code of Practice for the Hydraulic Modelling of Urban Drainage Systems, 1st Edition CIWEM 2017 www.ciwem.org.

- Modeled volume of flow should be within +20 percent to -10 percent of measured volume of flow.
- The depth of surcharge should be in the range of +20-inches to -4-inches.
- The difference between maximum unsurcharged depth should be within the range of ± 4-inches.

The Wet Weather calibration is focused more on the peak observed flows at the monitored location and generally overpredicted for the smaller storm events that generated a lesser peak and/or volume. In other words, if the flow monitoring program captured several back-to-back storms, it may be preferable to use the back-to-back storms events as the calibration storms, as opposed to calibrating to two separate storms that have occurred weeks or months apart. Model calibration simulations should be run for a duration long enough that the RDII response is no longer apparent in the measured data.

9.2 Dry Weather Flow Calibration

9.2.1 Dry Weather Calibration Process

The DWF calibration process consists of several elements, as outlined below:

- The first step in the calibration process was to divide the City into flow meter tributary areas. Seven tributary areas were created, one for each flow meter from the flow monitoring program, plus the treatment facility and the two pump stations in the North Shore area. A map showing the locations of each flow monitoring site and their associated tributary area is provided in Section 4 along with a schematic of the flow meters.
- The next step was to define the flow volumes within each area, which was accomplished in the flow allocation step.
- Create diurnal patterns to match the temporal distribution of flow. A diurnal curve is a pattern of hourly multipliers that are applied to the base flow to simulate the variation in flow that occurs throughout the day. Two diurnal curves were developed for each flow monitoring tributary area, one representing weekday flow and one representing weekend flow. The diurnal patterns were initially developed based on the flow monitoring data and adjusted as part of the calibration process until the model-simulated flows closely matched the field-measured flows. Figure 15 shows the calibrated weekday and weekend diurnal patterns for the area tributary to Meter 8-1-2. Similar diurnal curves were developed for each of the meters and its tributary area. These additional curves are available in Attachment E.

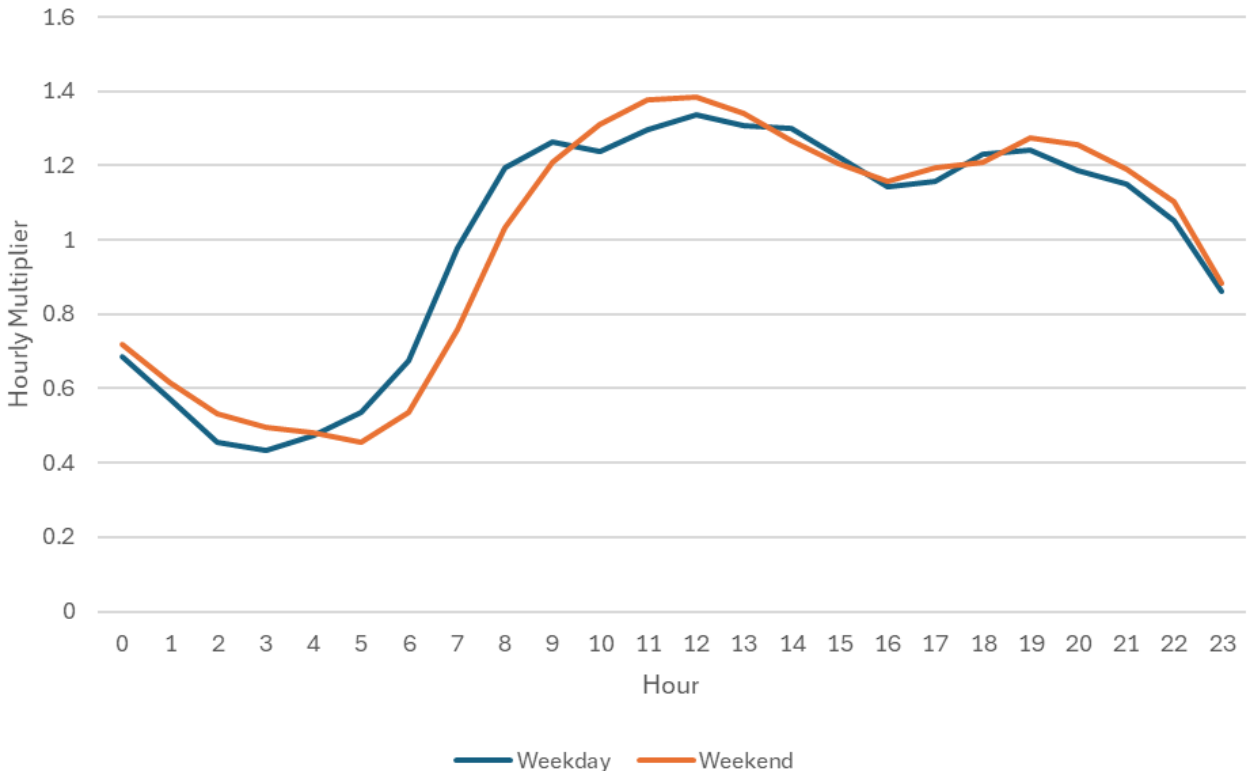


Figure 15 Example of Diurnal Pattern (Meter 8-1-2)

9.2.2 Dry Weather Calibration Discussion

Table 7 provides a summary of the DWF calibration using the average and daily peak flow results for both weekday and weekend conditions. As shown on Table 7, the model-simulated average and peak flows for both weekday and weekend DWF were all within 10 percent. In general, the percent difference between the overall modeled and measured DWF ranged between -2.2 and +7.7 percent, with most differences being less than 8 percent.

Attachment E contains a detailed DWF calibration summary sheet for each of the seven metering sites. Each calibration sheet provides plots that compare the model-simulated and field-measured flow data for both weekday and weekend conditions. An example of the dry weather calibration for Meter 8-1-2 is shown in Figure 16.

There is good overall correlation of the field-measured data to the model output results. All meters meet criteria for both level and velocity, indicating a well calibrated model for DWFs. Losses in the modeled manholes were minimized throughout the system to allow for minimal head loss and decrease in modeled levels to better match the measured data.

Table 7 DWF Calibration Results

Flow Meter ID	Weekday Average Flow Percent Error (%)	Weekday Peak Flow Percent Error (%)	Weekday Max Level Difference (inches)	Weekend Average Flow Percent Error (%)	Weekend Peak Flow Percent Error (%)	Weekday Max Level Difference (inches)	Percent Different (%)
Meter 4-1-3	-2.6%	0.7%	2.07	-1.1%	-0.4%	2.01	-2.2%
Meter 5-1-2	1.3%	-1.9%	1.35	0.9%	0.9%	1.32	1.2%
Meter 5-2-1	0.4%	-7.8%	0.21	-3.9%	3.0%	0.32	-0.9%
Meter 8-1-2	0.4%	-1.7%	0.37	4.1%	2.0%	0.30	1.4%
STEP/WWTF	2.2%	-0.4%		1.0%	-1.2%		1.8%
Leadbetter Road	10.0%	0.7%		-1.3%	-5.6%		6.5%
Goodwin Road	4.0%	2.8%		-3.3%	-4.2%		1.8%

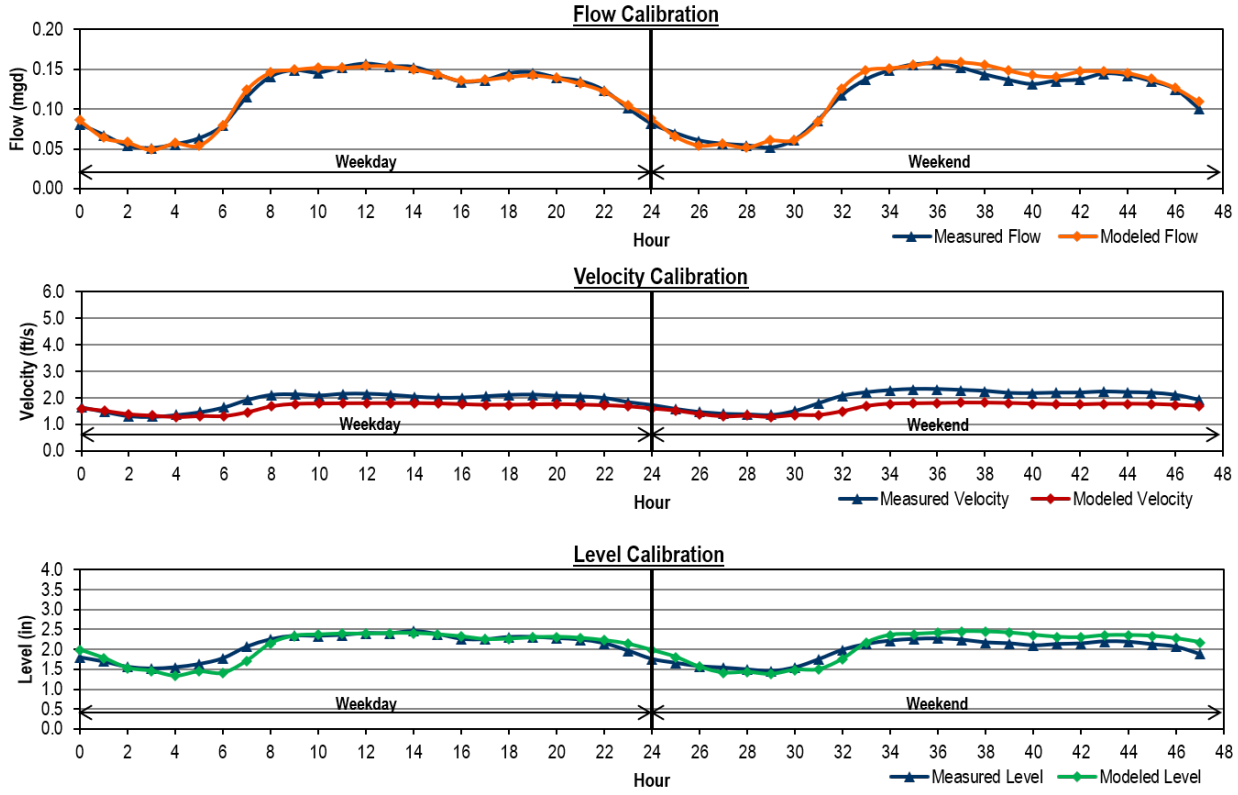


Figure 16 Example of DWF Calibration (Meter 8-1-2)

9.3 Wet Weather Flow Calibration

9.3.1 Wet Weather Flow Calibration Process

The WWF calibration enables the hydraulic model to accurately simulate RDII entering the collection system during storms. The WWF calibration process consists of running model simulations of historic

rainfall events based on data collected as part of a system flow monitoring program. The goal of any WWF monitoring program is to capture and characterize a system's response to a significant rainfall event, preferably during wet antecedent moisture conditions. As outlined below, the WWF calibration process consists of several elements:

- **Identify calibration rainfall events**. The WWF calibration process consists of running model simulations of historic rainfall events based on data collected as part of the flow monitoring program. The goal of any wet weather flow monitoring program is to capture and characterize a system's response to a significant rainfall event, preferably during wet antecedent moisture conditions.

  The selection of a particular calibration storm or group of storms is based on a review of the flow and rainfall data. There is a good range of different event types available for the different meters. Major rainfall events were identified as part of Section 4.2.2. For WWF calibration, the model was run from March 9 to April 13, 2025, because the rain events that occurred on these dates have shown the most response to the collection system. To run a model simulation for the period of these storms, minute rainfall data were input into the model for these events. Table 3 summarizes the three storms picked for calibration for each of the five sites. Figure 9 illustrates the storms used in the model calibration process.
- **Define RDII tributary areas**. For the WWF calibration, RDII flows are added on top of the DWF. The model calculates two types of response: a slow response corresponding mainly to infiltration, or slow response curve (SRC), and a fast response corresponding mainly to direct inflow, or fast response curve (FRC). Impervious area, which is the fraction of the catchment considered to contribute to FRC runoff, and RDI Area, which is the fraction of the total catchment area that contributes to the SRC RDI runoff component are two major model-specific data in the model calculation of WWFs. These values were initially set based on engineering judgment, as well as the previously used values, and then adjusted until the model-simulated flows (both peak flows and total volume) matched closely with the field-measured flows.
- **Create RDII parameter database and modify to match field-measured flows**. The main step in the WWF calibration process involves adjusting both Model A and RDI parameters for each flow monitoring tributary area. The most important parameters were described in Section 8.4 and Attachment D summarizes all calibrated parameters by flow monitoring site, for current conditions. As with the dry weather calibration, the wet weather calibration process compared the meter data with the model output. Comparisons were made of average and peak flows as well as the temporal distribution of flow until flows returned to their baseline levels. According to the CIWEM UDG, a hydraulic model is generally considered calibrated to WWF conditions if the modeled peak flows are within +25 percent to -15 percent of the field-measured data, and if the average modeled volumes are within +20 percent to -10 percent of the field-measured data. Calibration was performed for the depth of flow as well, this is considered calibrated when peak depths are with ± 4-inches when unsurcharged, and +20-inches to -4 inches when surcharged.
- **Adjust model variables to match field-measured velocity and flow depths**. Once the model-simulated flows matched the field-measured flows within the acceptable limits, the model-simulated velocity and flow depth were compared to the field-measured velocity and flow depth. Adjustments were made to various model parameters until the modeled and measured velocity and depth closely matched one another. The primary varied parameters for this process are node outlet head losses and pipeline roughness (Manning's n), although other parameters can also be

adjusted as calibration results are generated. Sediment buildup and movement in the pipe will also influence the level and depth, but these are very difficult to quantify and can change frequently, therefore they are not included in the calibration.

Manning's roughness coefficients, or n values, have industry accepted ranges based on a number of variables. Roughness coefficients increase over time depending on the construction methods, installation quality, system maintenance, and other environmental factors. There can be certain factors within the City's collection system that can result in roughness coefficients that differ from the typical range. These could include joint misalignment, cracks, and debris (e.g., root intrusion, etc.) that lead to increased turbulence in a pipe and an increase in the apparent Manning's n factor.

If the model is unable to reasonably match the field-measured flow depth and velocity using Manning's roughness coefficients within the range of 0.011 to 0.013, further investigation should be conducted to help determine the cause of the discrepancy. Some issues that could cause such a discrepancy can include errors in the slope or diameter of a pipeline, downstream blockages, pipeline sags, and, in some cases, influences from downstream pump station operations.

9.3.2 Wet Weather Calibration Results

Attachment F contains a detailed WWF calibration summary sheet for each of the seven-meter sites. The modeled outputs at each flow meter were compared to the data from three storms recorded during the flow monitoring period for calibration. Each calibration sheet provides plots that compare the model-simulated and field-measured flow, velocity, and level data for the calibration storms. An example of the wet weather calibration for Meter 5-1-2 is shown on Figure 17.

Table 8 provides a summary of the WWF calibration using the total volume and peak flow results. Of the seven meters, all had two or more storm event responses within calibration standards for volume and peak flows. As shown on Table 8, the model-simulated average and peak flows at all meter sites were within the acceptable tolerances for the calibration storms, and therefore the model was considered calibrated and ready to use for capacity analysis purposes.

As discussed in Section 9.1, it is critical that the hydraulic model is not only calibration to volume and peak flow, but also level data. This will ensure accuracy and trust in modeled results when evaluating capacity deficiencies, which are based on a hydraulic grade line criteria in the collection system.

Modeled data at all meters closely matched the recorded level information. Of the seven meters with level data, all seven met the level calibration standard with a maximum difference of 3.5 inches.

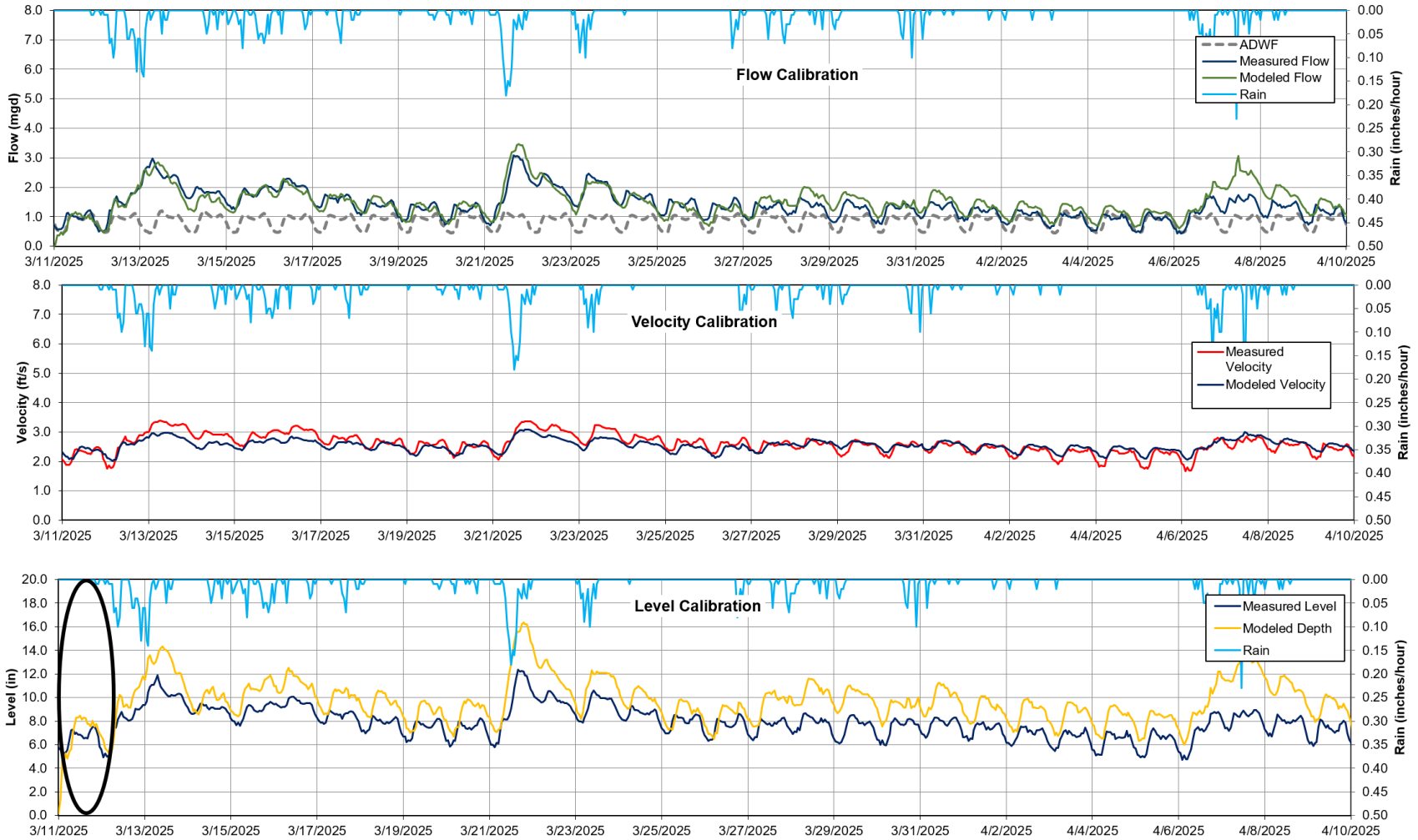


Figure 17 Example WWF Calibration (Meter 5-1-2)

Table 8 WWF Calibration Results

Flow Meter ID	Storm 1 Total Volume Percent Error (%)	Storm 1 Peak Flow Percent Error (%)	Storm 1 Max Level Difference (inches)	Storm 2 Total Volume Percent Error (%)	Storm 2 Peak Flow Percent Error (%)	Storm 2 Max Level Difference (inches)	Storm 3 Total Volume Percent Error (%)	Storm 3 Peak Flow Percent Error (%)	Storm 3 Max Level Difference (inches)
Meter 4-1-3	8.0%	13.0%	2.5	6.1%	12.0%	2.5	28.2%	81.1%	3.7
Meter 5-1-2	-4.2%	-4.6%	2.4	6.0%	12.8%	4.0	33.7%	74.8%	6.1
Meter 5-2-1	-18.9%	-49.3%	-0.3	-9.4%	-11.7%	1.3	1.9%	3.1%	1.1
Meter 8-1-2	6.5%	-1.8%	0.2	6.8%	3.3%	0.1	11.5%	13.4%	0.1
STEP	5.2%	0.8%		19.6%	13.0%		39.8%	53.5%	
Leadbetter Road	-8.2%	-28.3%		4.1%	-10.1%		6.2%	-4.6%	
Goodwin Road	-6.4%	-9.1%		3.2%	20.8%		7.1%	38.3%	

9.4 Hydraulic Model Calibration Summary

Calibration of the City's hydraulic model was a multi-step process that involved comparing model-simulated flow to the actual field-measured data for both dry and wet weather conditions. The model met all UDG standards for ADWF. Results showed the model met UDG standards for calculation of flows during peak wet weather flow. The UDG level standards were met at seven of the seven sites used for model calibration. These calibration results provide a high level of confidence in the model's accuracy such that the model can be considered calibrated and ready to use for subsequent capacity analysis.

ATTACHMENT A

CAMAS FLOW MONITORING REPORT 2025

Camas Flow Monitoring 2025

Final Report Submitted to **Carollo Engineers** May 28, 2025



ADS ENVIRONMENTAL SERVICES

846 Industry Dr.
Tukwila, WA 98188

800-633-7246
www.adsenv.com

May 28, 2025

Max Mozer

Carollo Engineers

1200 5th Avenue Suite 900

Seattle, WA 98101

SUBJECT: Camas Flow Monitoring 2025

Dear Mr. Mozer,

ADS is pleased to submit the report for the project referenced above completed on behalf of Carollo Engineers. The metering was conducted at four (4) flow monitoring locations and one (1) rain monitoring location. The study was conducted during the period of Wednesday, 15 January 2025 to Tuesday, 29 April 2025.

The report contains depth, velocity, and quantity hydrographs as well as daily long tables for the metering period. An Excel file containing depth, quantity, and velocity entities for the monitoring location in 15-minute format was provided previously.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, you may contact the Project Manager, Cody Mahaffey at (425) 620-6412.

It has been our pleasure to be of service to you in the performance of this project. Thank you for choosing ADS products and services to meet your flow monitoring needs.

Sincerely,
ADS ENVIRONMENTAL SERVICES

Justin Hatch
Hydraulic Data Analyst

Camas Flow Monitoring 2025

Prepared For:

Max Mozer
Carollo Engineers
1200 5th Avenue Suite 900
Seattle, WA 98101

Prepared By:

ADS, LLC
846 Industry Dr.
Tukwila, WA 98188

Scope and Methodology

Introduction

Carollo Engineers entered into an agreement with ADS Environmental Services to conduct flow monitoring at (4) four flow locations and (1) one rainfall gauging location in Camas, Washington. The study was scheduled for a period of (105) one-hundred and five days. Once in place, the flow monitoring equipment was to be used to measure depth, velocity, and to quantify flows. Data obtained from the study will be used for inflow and infiltration analysis.

Project Scope

The scope of this study involved using a flow monitor to quantify wastewater flow at the designated locations for the study period. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring site for adequate hydraulic conditions
- Flow monitor installation
- Flow monitor confirmations and data collections
- Flow data analysis

Additionally, temporary rain gauge monitors were used to measure and record rainfall at the designated locations. Specifically, the study involved the following key components.

- Investigate the proposed rain gauge sites for sufficient exposure and security
- Rain Gauge installations
- Manually confirming rain gauge tipping bucket operation and date collections
- Rain data analysis

Equipment installation was completed on January 14, 2025. The monitoring period began on January 15, 2025 and was completed on April 29, 2025. Upon completion of the study, equipment was removed from the system.

Flow Monitoring Equipment



The ***ADS Triton+*** monitor was selected for this project. This flow monitor is an area velocity flow monitor that uses both the Continuity and Manning's equations to measure flow.

The ADS Triton+ monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings. The monitor was programmed to acquire and store depth of flow and velocity readings at 5-minute intervals.

The Triton+ monitor features cross-checking using multiple technologies in each sensor for continuous running of comparisons and tolerances. The Triton+ monitor can support two (2) sets of sensors. The sensor option used for this project was:

The Peak Combo Sensor installed at the bottom of the pipe includes three types of data acquisition technologies

The ***up looking ultrasonic depth*** uses sound waves from two independent transceivers to measure the distance from the sensor upward toward the flow surface; applying the speed of sound in the water and the temperature measured by sensor to calculate depth.

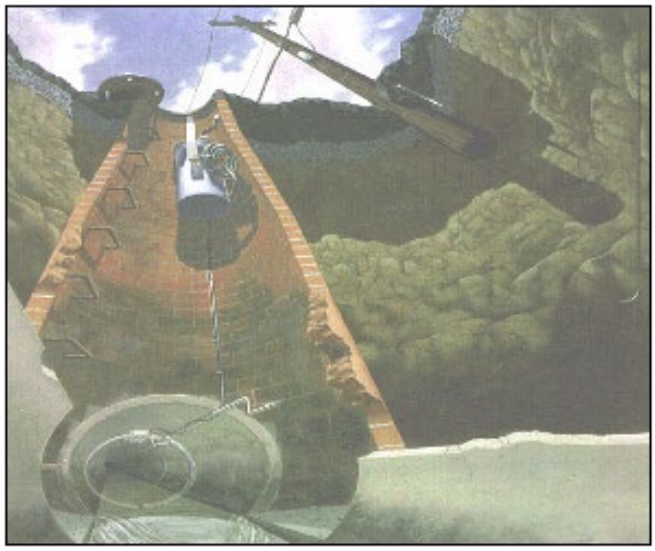
The ***pressure depth*** is calculated by using a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube.

To obtain ***peak velocity*****,** the sensor sends an ultrasonic signal at an angle upward through the widest cross-section of the oncoming flow. The signal is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity.

Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed.

In pipes up to 42 inches in diameter, the sensors were mounted on expandable stainless-steel rings, inserted at least a foot upstream into influent pipes and tightened against the inside walls of the pipes. Influent pipe installations reduce the influences of turbulence and backwater often caused by changes in channel geometry in manholes.





Data Collection, Confirmation, and Quality Assurance

Data collects were done remotely via wireless connect on a weekly basis. As needed, during the monitoring period, field crews visit each monitoring location to verify proper monitor operation and document field conditions. The following quality assurance steps are taken to assure the integrity of the collected data:

Measure power supplies: monitors were powered by dry cell battery packs. Voltages were recorded and battery packs replaced, as necessary. Separate batteries provided back-up power to memory allowing primary batteries to be replaced without loss of data.

Clock synchronization: Field crews synchronized monitor clocks to master clocks.

Confirm depth and velocity readings: Field crews descended into meter manholes to manually measure depths and velocities and compare the meter readings to confirm that they agreed. The site met the criteria for confirmation for depth and velocity unless noted otherwise in the site commentary section. They also measured silt levels, if any, in the inverts of the pipes. Silt areas were subtracted from flow areas to compute true areas of flow.

Confirm average velocities through cross-sectional velocity profiles: Since ADS velocity sensors measure peak velocity, field crews collected cross-sectional velocity profiles in order to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.

Upload and Review Data: Data collected from the monitors were uploaded and reviewed by a Data Analyst for completeness, outliers and deviations in the flow patterns, which indicate system anomalies or equipment failure.

Rainfall Logging Equipment



The ***ADS RainAlert III*** monitor was selected for this project. This monitor provides rainfall data acquisition and intelligent alarming to support wastewater capital improvement.

The ADS RainAlert III monitor measures rainfall using a tipping bucket containing a funnel and a small tipping mechanism that can collect a specific amount of rainfall. Once the tipping mechanism is full it empties and records that a tip has occurred. Typically, each tip is equivalent to 0.01 inches (or 0.2mm) of rainfall. The monitor records the number of tips that occur over each 5-minute interval to calculate discrete rainfall amounts for each of those 5-minute intervals.

Installation

Installation of rainfall logging equipment typically proceeds in five steps. First, investigating and selecting the appropriate location to install the tipping bucket and monitor. Second, installing the Sun Shield involves properly placing the sun shield and securing it to an appropriate structure or surface, or mounting it to a pole, as applicable. Third, involves mounting the tipping bucket on the sun shield at the designated rainfall collection location and connecting the wires from the monitor to the tipping bucket. Fourth, involves testing and adjusting the tipping bucket and internal tipping mechanism to ensure it accurately measures rainfall amounts. The final step involves installing the monitor at the appropriate location.

Flow Quantification Methods

There are two main equations used to measure open channel flow: the ***Continuity Equation*** and the ***Manning Equation.*** The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in most sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the ultrasonic depth, (2) the peak velocity and (3) the pressure depth. The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data.

Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Occasionally the velocity sensor's performance may be compromised resulting in invalid readings sporadically during the monitoring period. This is generally caused by excessive debris (silt) blocking the sensor's crystals, shallow flows (~< 1") that may drop below the top of the sensor or very clear flows lacking the particles needed to measure rate. In order to use the Continuity equation to quantify the flow during these periods, a Data Analyst and/or Engineer will use the site's historical pipe curve (depth vs. velocity) data along with valid field confirmations to reconstitute and replace the false velocity recordings with expected velocity readings for a given historical depth along the curve.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hydrographs.
Hydrographs are based on 15-minute data. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums, the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the flow data table and hydrograph.

DFINAL - Final calculated depth measurement (in inches)

QFINAL - Final calculated flow rate (in MGD)

VFINAL - Final calculated flow velocity (in feet per second)

RAIN – Final calculated rainfall (in inches)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)

CAM_100290

Site Commentary

SITE INFORMATION

Pipe	Elliptical (19 in H x 19.5 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located upstream of site CAM_51123. A review of flow balancing indicated no problems

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	3.24	2.00	0.326
Minimum	1.34	1.05	0.049
Maximum	9.57	3.56	1.941
Min Time	04/29/2025 02:10:00	04/23/2025 00:55:00	04/29/2025 02:10:00
Max Time	02/23/2025 16:40:00	01/31/2025 09:25:00	02/23/2025 15:50:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

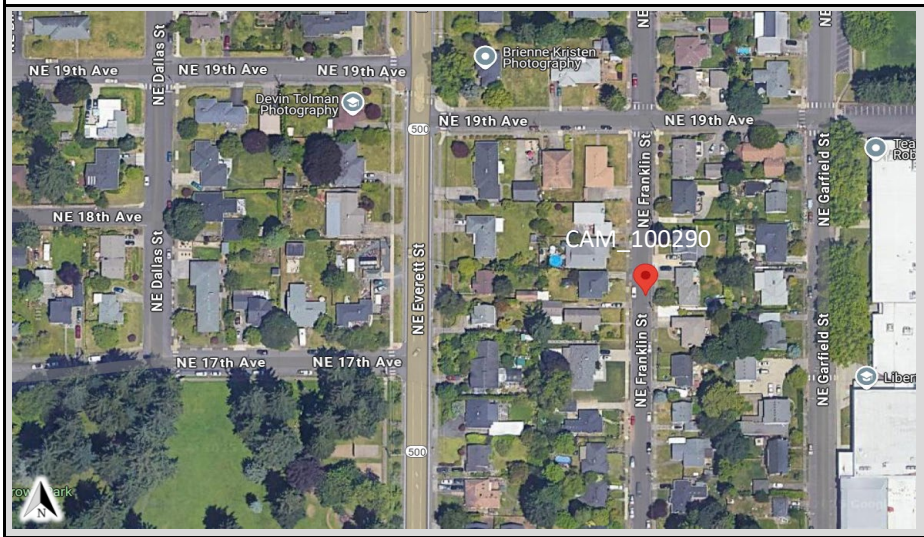
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report		CAM_100290

Site Address /Location:	1724 NE Franklin St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5919803	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4042885	19.00 x 19.50	Circular



Manhole #	System Characteristics
100290	Residential
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Special Installation
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
12:14:00 PM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.23	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

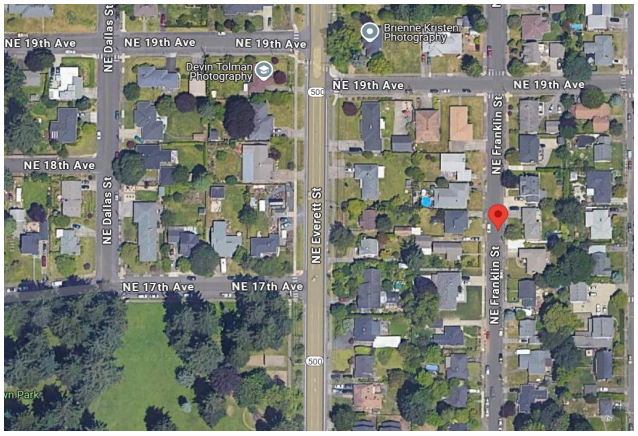
Manhole Depth (Approx. FT):	Manhole Configuration
13'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
PVC	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

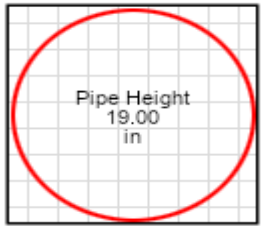
Monitoring Point Inlet	Outlet	
		
Top Down	Location	Map
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_100290

Flow Monitor

CAM_100290



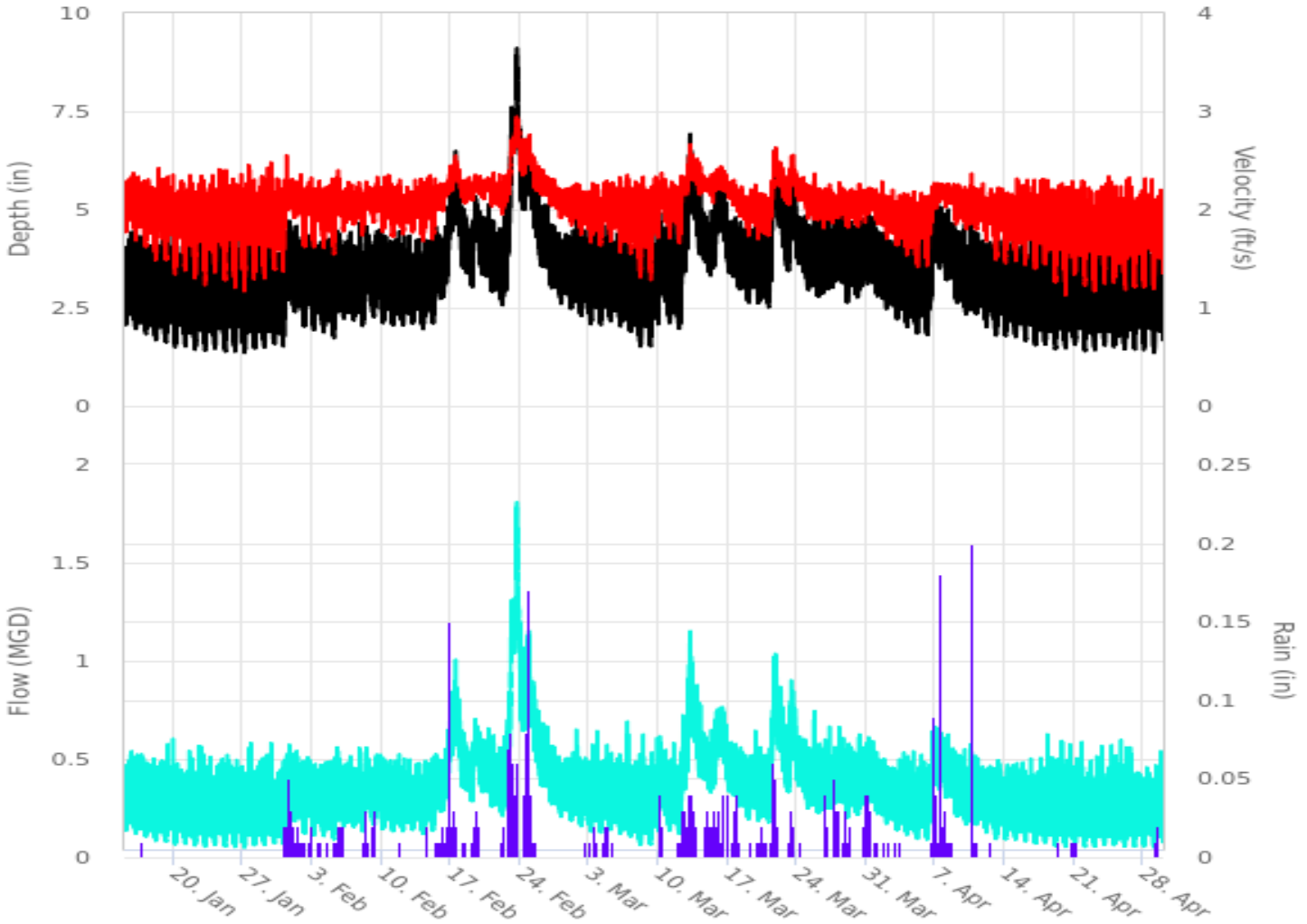
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

ADS ENVIRONMENTAL SERVICES



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Tukwila, WA 98188

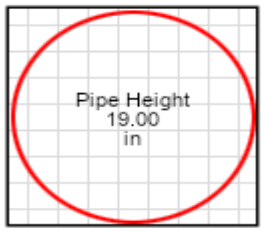
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Scattergraph Report

CAM_100290

Flow Monitor

CAM_100290



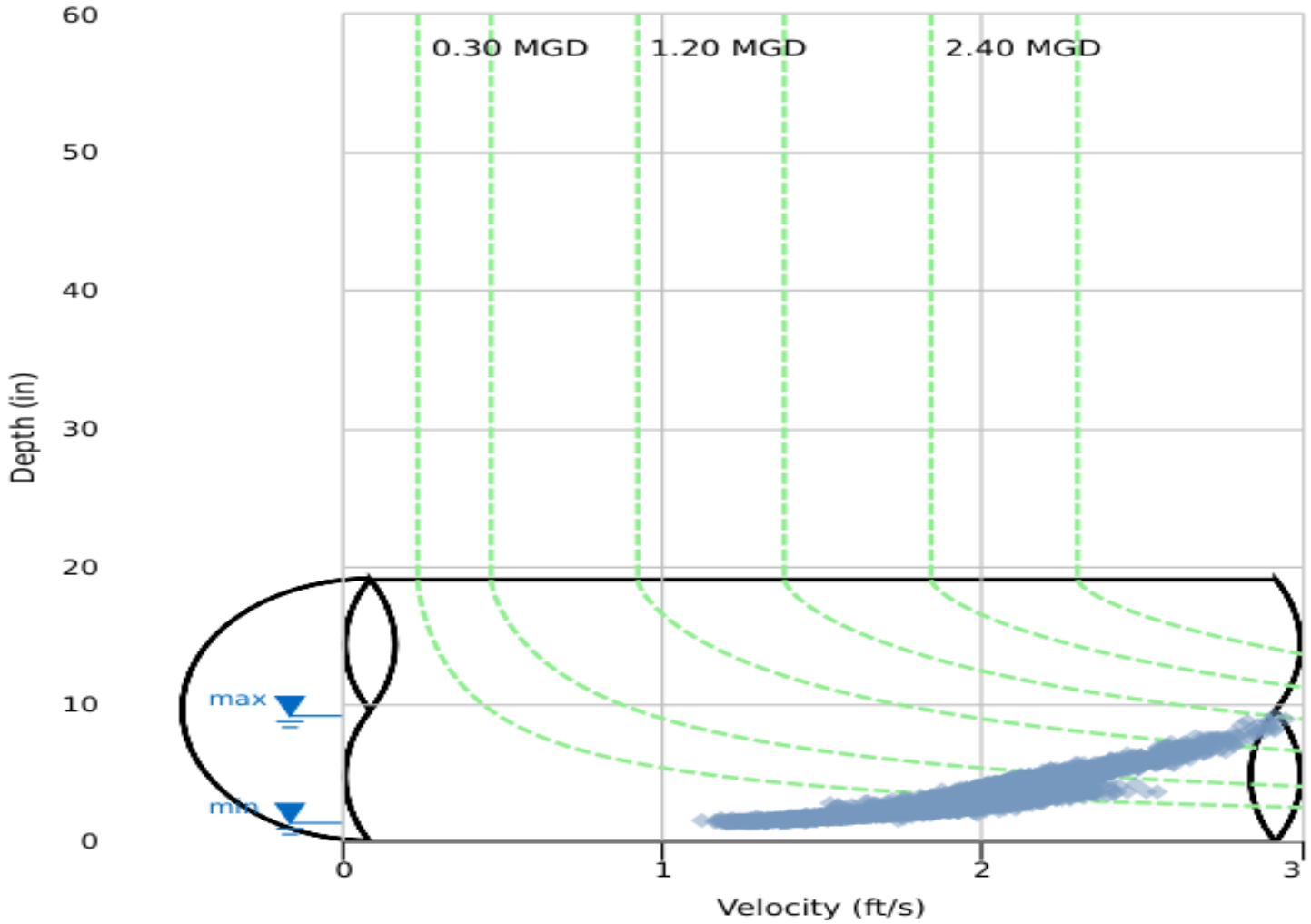
Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth





846 Industry Dr.
Tukwila, WA 98188

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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_100290 Pipe: Elliptical (19 in H x 19.5 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:00	2.05	17:35	5.79	2.91	04:00	1.72	12:50	2.64	2.05	04:00	0.131	17:35	0.777	0.274	0.274	-
01/16/2025	03:45	1.95	17:20	5.64	2.78	03:30	1.67	14:35	2.65	2.01	03:30	0.118	17:20	0.766	0.256	0.256	0.01
01/17/2025	04:50	1.82	08:55	5.72	2.66	03:50	1.60	09:35	2.65	1.94	03:50	0.104	08:55	0.823	0.235	0.235	-
01/18/2025	03:35	1.66	15:10	5.61	2.61	04:05	1.38	21:50	2.67	1.90	04:05	0.078	15:10	0.752	0.228	0.228	-
01/19/2025	05:50	1.61	21:45	5.69	2.60	03:00	1.46	10:10	2.67	1.88	05:50	0.080	21:45	0.792	0.226	0.226	-
01/20/2025	03:10	1.48	08:50	5.26	2.58	03:00	1.32	19:10	2.65	1.87	03:10	0.063	15:55	0.700	0.222	0.222	-
01/21/2025	04:10	1.50	07:40	5.55	2.49	02:40	1.34	14:05	2.65	1.83	04:10	0.067	07:40	0.757	0.208	0.208	-
01/22/2025	03:15	1.42	10:40	5.50	2.46	05:05	1.28	19:00	2.61	1.81	03:30	0.058	17:15	0.705	0.203	0.203	-
01/23/2025	03:10	1.40	11:55	5.55	2.41	03:15	1.20	21:45	2.60	1.80	03:15	0.052	11:55	0.717	0.197	0.197	-
01/24/2025	03:40	1.44	21:35	5.46	2.48	03:05	1.33	13:30	2.67	1.83	03:50	0.062	21:35	0.802	0.207	0.207	-
01/25/2025	05:10	1.37	09:30	5.59	2.47	04:50	1.25	06:30	2.75	1.80	04:50	0.053	09:30	0.746	0.207	0.207	-
01/26/2025	04:05	1.37	18:40	5.56	2.48	04:05	1.18	16:35	2.58	1.79	04:05	0.050	18:40	0.741	0.207	0.207	-
01/27/2025	03:05	1.34	10:10	5.32	2.44	02:35	1.15	10:15	2.88	1.81	03:10	0.049	09:25	0.712	0.203	0.203	-
01/28/2025	05:20	1.45	13:35	5.60	2.48	02:40	1.17	20:45	2.80	1.81	02:40	0.055	20:45	0.790	0.206	0.206	-
01/29/2025	04:05	1.49	08:25	5.63	2.50	03:55	1.25	19:20	2.99	1.82	03:55	0.060	19:20	0.884	0.211	0.211	-
01/30/2025	05:00	1.56	20:55	5.05	2.46	05:15	1.37	10:00	2.95	1.83	05:15	0.070	10:00	0.682	0.202	0.202	-
01/31/2025	02:00	1.50	16:35	5.68	3.25	00:45	1.34	09:25	3.56	2.05	01:50	0.065	09:25	1.079	0.328	0.328	0.60
02/01/2025	06:40	2.37	10:00	5.76	3.09	03:45	1.90	20:15	2.55	2.08	06:40	0.180	10:00	0.736	0.296	0.296	0.12
02/02/2025	03:50	2.02	20:45	5.43	2.96	03:35	1.56	15:20	2.60	1.98	03:35	0.117	15:20	0.791	0.273	0.273	0.07
02/03/2025	03:05	1.91	07:20	5.57	2.82	04:25	1.60	18:10	2.66	1.97	04:25	0.111	07:20	0.704	0.253	0.253	0.02
02/04/2025	03:45	1.86	07:55	5.46	2.75	04:30	1.60	14:20	2.57	1.96	04:30	0.107	07:55	0.718	0.245	0.245	0.01
02/05/2025	04:30	1.71	12:15	5.74	2.93	04:10	1.52	12:10	2.55	1.99	04:10	0.090	12:15	0.824	0.273	0.273	0.19
02/06/2025	04:30	2.21	21:30	5.44	3.02	03:40	1.70	15:20	2.55	2.03	03:40	0.150	20:30	0.679	0.282	0.282	-
02/07/2025	04:55	2.16	07:10	5.58	2.89	04:55	1.80	00:35	2.51	2.01	04:55	0.148	07:10	0.722	0.264	0.264	-
02/08/2025	01:55	2.02	11:05	5.93	3.17	01:45	1.73	11:05	2.33	2.06	01:55	0.129	11:05	0.812	0.309	0.309	0.25
02/09/2025	04:40	2.25	20:30	5.60	3.14	17:30	1.83	14:20	2.45	2.07	04:25	0.162	20:30	0.709	0.303	0.303	0.05
02/10/2025	03:10	2.10	07:40	5.61	2.98	02:50	1.76	07:35	2.71	2.04	04:00	0.141	07:40	0.778	0.279	0.279	-
02/11/2025	05:00	2.04	07:40	5.65	2.90	02:40	1.70	15:20	2.57	2.00	04:35	0.131	07:40	0.738	0.265	0.265	0.01
02/12/2025	03:55	2.05	07:05	5.48	2.90	00:20	1.69	13:50	2.52	2.00	03:30	0.131	07:05	0.690	0.264	0.264	-
02/13/2025	03:50	2.09	06:40	5.37	2.95	03:20	1.74	15:05	2.49	2.02	03:20	0.137	06:40	0.678	0.272	0.272	-
02/14/2025	05:10	1.95	08:55	5.54	2.87	05:00	1.66	08:50	2.56	1.98	05:00	0.117	08:55	0.770	0.261	0.261	0.07
02/15/2025	06:10	2.10	11:30	5.53	3.08	03:35	1.65	00:25	2.58	2.02	03:35	0.130	08:40	0.734	0.291	0.291	0.09
02/16/2025	01:45	2.76	21:35	6.26	3.77	04:55	1.90	20:30	2.43	2.18	04:55	0.229	21:35	0.902	0.412	0.412	0.77
02/17/2025	23:35	3.96	11:45	6.94	5.05	02:20	2.17	12:20	2.65	2.34	23:35	0.429	11:45	1.090	0.657	0.657	0.39
02/18/2025	23:30	3.21	06:40	6.08	4.00	14:05	2.02	20:45	2.42	2.20	23:30	0.309	06:40	0.852	0.445	0.445	0.02
02/19/2025	05:00	3.01	08:55	6.23	4.25	07:05	2.06	08:55	2.43	2.23	05:00	0.281	08:55	0.904	0.495	0.495	0.40
02/20/2025	23:55	3.15	02:50	5.75	3.82	07:55	2.08	18:05	2.40	2.21	23:55	0.307	09:40	0.788	0.420	0.420	-
02/21/2025	23:15	2.78	23:20	5.80	3.45	16:05	2.01	08:05	2.54	2.16	23:15	0.245	08:10	0.793	0.357	0.357	0.04
02/22/2025	05:40	2.55	23:30	6.71	3.69	06:45	1.91	23:00	2.49	2.16	06:45	0.207	23:30	0.988	0.402	0.402	0.84
02/23/2025	00:00	5.10	16:40	9.57	7.24	00:00	2.35	15:55	3.00	2.71	00:00	0.663	15:50	1.941	1.246	1.246	1.07
02/24/2025	10:35	4.91	23:25	7.52	5.85	05:45	2.34	15:35	2.86	2.54	10:35	0.633	19:35	1.324	0.874	0.874	0.87
02/25/2025	23:40	3.80	00:40	6.97	5.08	11:05	2.14	00:00	2.77	2.40	23:40	0.409	00:40	1.145	0.682	0.682	0.03
02/26/2025	23:55	3.25	06:45	6.02	3.98	15:30	2.11	06:45	2.49	2.22	23:55	0.314	06:45	0.886	0.448	0.448	-
02/27/2025	23:55	2.81	19:55	5.67	3.54	16:45	1.97	06:20	2.46	2.14	23:55	0.240	19:55	0.766	0.367	0.367	-
02/28/2025	03:25	2.59	14:55	5.80	3.32	13:50	1.88	14:55	2.37	2.05	03:20	0.202	14:55	0.799	0.323	0.323	-
03/01/2025	03:20	2.45	19:55	5.73	3.23	04:15	1.82	23:00	2.35	2.02	04:15	0.185	14:25	0.770	0.310	0.310	-
03/02/2025	06:20	2.29	14:00	5.53	3.17	04:00	1.73	08:25	2.29	1.97	04:00	0.155	20:10	0.709	0.295	0.295	0.05
03/03/2025	03:55	2.07	19:00	5.90	3.04	04:05	1.66	21:10	2.30	1.93	04:00	0.128	19:00	0.793	0.277	0.277	0.07
03/04/2025	04:20	2.05	16:25	5.79	3.09	03:20	1.62	16:20	2.39	1.97	03:55	0.124	16:25	0.801	0.290	0.290	0.12
03/05/2025	04:10	2.14	20:15	5.47	3.03	03:30	1.65	22:25	2.42	1.97	03:35	0.137	20:50	0.701	0.279	0.279	0.01
03/06/2025	03:20	2.02	22:15	5.72	2.85	02:55	1.55	13:25	2.50	1.90	03:15	0.116	22:15	0.785	0.250	0.250	-
03/07/2025	23:55	1.85	16:35	5.47	2.68	03:40	1.51	21:30	2.45	1.87	03:40	0.101	16:35	0.729	0.230	0.230	-
03/08/2025	04:20	1.50	17:25	5.66	2.60	04:05	1.29	10:35	2.41	1.81	04:05	0.062	17:25	0.767	0.220	0.220	-
03/09/2025	04:20	1.51	07:45	5.47	2.73	05:00	1.27	15:00	2.49	1.85	05:05	0.062	07:45	0.742	0.240	0.240	0.20
03/10/2025	23:05	2.29	06:20	5.91	3.41	00:00	1.81	07:35	2.58	2.11	00:00	0.164	06:20	0.811	0.344	0.344	0.22
03/11/2025	23:30	2.06	06:40	5.64	2.92	01:55	1.62	19:10	2.53	2.01	01:55	0.133	16:25	0.766	0.270	0.270	0.02
03/12/2025	03:25	1.96	23:15	6.33	3.68	02:15	1.64	23:15	2.41	2.10	03:10	0.117	23:15	0.917	0.398	0.398	0.83
03/13/2025	23:50	4.25	03:05	7.64	5.44	22:35	2.20	05:00	2.73	2.40	23:50	0.484	05:00	1.283	0.749	0.749	0.49
03/14/2025	23:40	3.51	01:00	6.11	4.27	04:20	2.15	01:00	2.55	2.26	23:40	0.369	01:00	0.924	0.502	0.502	0.16
03/15/2025	06:25	3.30	20:15	6.13	4.13	13:15	2.04	20:15	2.46	2.25	06:20	0.327	20:15	0.895	0.479	0.479	0.60
03/16/2025	23:35	3.62	04:50	6.35	4.73	21:10	2.11	07:10	2.60	2.28	23:35	0.378	07:10	0.995	0.584	0.584	0.16
03/17/2025	23:40	3.11	02:55	5.79	3.87	14:45	2.01	15:20	2.60	2.18	23:40	0.284	02:55	0.808	0.421	0.421	0.19
03/18/2025	23:05	2.71	06:40	5.83	3.51	23:55	1.77	12:40	2.35	2.04	23:55	0.203	06:40	0.776	0.348	0.348	0.02
03/19/2025	04:25	2.60	20:55	5.97	3.47	04:40	1.68	18:45	2.39	1.97	01:45	0.190	18:45	0.832	0.334	0.334	0.07
03/20/2025	03:25	2.60	06:45	5.86	3.38	01:30	1.67	03:50	2.27	1.93	01:30	0.182	06:45	0.774	0.316	0.316	0.11
03/21/2025	03:20	2.49	15:25	7.29	4.60	02:45	1.73	15:55	2.76	2.19	03:20	0.176	15:25	1.249	0.577	0.577	1.12
03/22/2025	23:00	3.51	05:40	6.54	4.75	23:00	2.07	04:10	2.62	2.28	23:00	0.344	05:40	1.031	0.590	0.590	-
03/23/2025	02:40	3.42	09:50	6.72	4.53	03:15	2.03	09:50	2.74	2.26	04:05	0.329	09:50	1.132	0.551	0.551	0.44
03/24/2025	23:55	3.16	06:10	6.03	3.99	23:10	2.00	15:55	2.44	2.17	23:55	0.288	15:55	0.855	0.439	0.439	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	04:25	2.94	20:10	5.99	3.58	16:25	1.85	18:45	2.42	2.07	02:40	0.241	18:45	0.851	0.363	0.363	-
03/26/2025	04:25	2.76	06:25	5.96	3.53	17:00	1.77	06:25	2.38	2.05	04:20	0.224	06:25	0.834	0.354	0.354	0.20
03/27/2025	03:50	2.95	06:45	5.94	3.62	01:45	1.76	06:45	2.33	2.01	01:45	0.238	06:45	0.812	0.357	0.357	0.24
03/28/2025	23:55	2.79	03:25	6.14	3.78	23:10	1.87	06:30	2.37	2.06	23:55	0.225	06:30	0.862	0.388	0.388	0.17
03/29/2025	01:45	2.62	15:55	5.90	3.59	03:25	1.78	06:05	2.36	2.01	01:30	0.198	06:05	0.797	0.355	0.355	0.12
03/30/2025	02:00	2.74	08:55	5.83	3.57	04:05	1.81	09:30	2.34	2.02	04:05	0.216	09:30	0.793	0.354	0.354	0.23
03/31/2025	23:50	2.91	12:40	6.05	3.74	23:50	1.87	12:40	2.38	2.07	23:50	0.237	12:40	0.852	0.384	0.384	0.10
04/01/2025	23:55	2.49	01:35	5.59	3.34	23:55	1.72	14:00	2.39	1.99	23:55	0.174	01:35	0.751	0.318	0.318	0.03
04/02/2025	23:25	2.33	16:55	5.70	3.15	23:05	1.60	00:25	2.32	1.92	23:25	0.152	16:55	0.749	0.283	0.283	0.05
04/03/2025	23:25	2.18	00:55	5.66	2.98	23:25	1.55	19:15	2.26	1.86	23:25	0.129	19:15	0.726	0.259	0.259	0.02
04/04/2025	02:40	2.00	14:05	5.65	2.85	04:20	1.51	23:25	2.30	1.83	02:10	0.112	14:05	0.741	0.241	0.241	-
04/05/2025	03:15	1.84	14:15	5.67	2.75	05:10	1.40	22:20	2.38	1.80	05:10	0.092	14:15	0.748	0.229	0.229	-
04/06/2025	04:35	1.80	22:35	6.10	3.29	03:10	1.39	12:10	2.36	1.91	04:40	0.091	21:00	0.840	0.319	0.319	0.71
04/07/2025	23:45	3.31	00:40	6.20	4.18	01:25	1.92	23:50	2.32	2.15	10:35	0.314	00:40	0.850	0.464	0.464	0.37
04/08/2025	23:50	2.80	06:45	6.01	3.74	00:20	1.94	07:20	2.39	2.13	23:50	0.233	06:45	0.819	0.394	0.394	0.07
04/09/2025	23:10	2.49	15:20	5.69	3.30	15:10	1.79	07:40	2.46	2.04	23:10	0.187	07:40	0.759	0.319	0.319	-
04/10/2025	02:15	2.32	06:10	5.60	3.18	04:10	1.73	05:05	2.45	2.04	02:25	0.164	06:10	0.699	0.305	0.305	0.27
04/11/2025	23:10	2.28	06:05	5.51	3.07	23:55	1.76	19:15	2.34	2.00	23:55	0.157	06:05	0.732	0.284	0.284	0.01
04/12/2025	23:55	1.94	06:05	5.40	2.95	23:50	1.59	06:05	2.34	1.93	23:50	0.113	06:05	0.716	0.266	0.266	0.01
04/13/2025	03:05	1.78	08:30	5.37	2.89	04:40	1.47	08:30	2.53	1.90	02:50	0.092	08:30	0.769	0.258	0.258	-
04/14/2025	03:15	1.77	06:40	5.62	2.77	02:20	1.40	06:40	2.42	1.87	02:20	0.088	06:40	0.782	0.240	0.240	-
04/15/2025	02:50	1.74	18:50	5.27	2.73	02:30	1.47	05:45	2.43	1.86	02:25	0.088	18:50	0.669	0.233	0.233	-
04/16/2025	23:55	1.63	15:15	5.54	2.60	01:35	1.43	07:00	2.45	1.84	23:55	0.079	15:15	0.719	0.217	0.217	-
04/17/2025	01:40	1.53	06:20	5.34	2.59	01:35	1.33	00:00	2.67	1.83	01:35	0.067	06:20	0.679	0.218	0.218	-
04/18/2025	02:45	1.56	15:10	5.61	2.53	03:00	1.42	00:10	2.45	1.80	02:25	0.073	12:50	0.764	0.209	0.209	-
04/19/2025	02:55	1.43	15:10	5.55	2.51	00:35	1.24	16:10	2.46	1.76	02:55	0.056	13:10	0.726	0.206	0.206	0.01
04/20/2025	03:50	1.46	10:55	5.52	2.59	03:30	1.09	10:50	2.49	1.76	03:30	0.051	10:55	0.765	0.215	0.215	0.05
04/21/2025	03:00	1.54	17:10	5.56	2.56	00:15	1.33	20:30	2.53	1.80	02:25	0.068	10:45	0.718	0.212	0.212	0.02
04/22/2025	02:45	1.38	19:10	5.57	2.49	02:55	1.21	14:35	2.34	1.75	02:55	0.052	19:10	0.740	0.202	0.202	-
04/23/2025	03:35	1.41	07:00	5.56	2.52	00:55	1.05	09:30	2.33	1.76	00:55	0.050	07:00	0.705	0.206	0.206	-
04/24/2025	03:35	1.53	19:30	5.64	2.49	03:00	1.22	12:30	2.62	1.77	03:00	0.063	19:30	0.756	0.201	0.201	-
04/25/2025	01:30	1.46	15:20	5.44	2.49	00:55	1.24	15:20	2.35	1.73	01:30	0.057	15:20	0.724	0.200	0.200	-
04/26/2025	02:30	1.42	14:20	5.51	2.50	05:25	1.17	18:25	2.54	1.75	02:30	0.055	14:20	0.747	0.205	0.205	-
04/27/2025	04:00	1.42	07:20	5.24	2.58	02:55	1.18	20:20	2.47	1.75	04:00	0.053	07:20	0.667	0.212	0.212	-
04/28/2025	01:40	1.41	08:35	5.40	2.51	01:50	1.19	12:40	2.56	1.76	01:40	0.052	08:35	0.688	0.204	0.204	-
04/29/2025	02:10	1.34	10:55	5.61	2.52	02:00	1.19	21:10	2.47	1.74	02:10	0.049	10:55	0.759	0.205	0.205	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			34.250	13.62
Average	3.24	2.00	0.326	

CAM_51123

Site Commentary

SITE INFORMATION

Pipe	Elliptical (20 in H x 20.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

This site was located downstream of site CAM_100290. A review of flow balancing indicated no problems.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	7.07	2.37	1.132
Minimum	3.27	1.07	0.162
Maximum	19.05	3.74	5.203
Min Time	04/28/2025 03:45:00	04/28/2025 03:45:00	04/28/2025 03:45:00
Max Time	02/23/2025 16:05:00	02/23/2025 15:45:00	02/23/2025 16:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

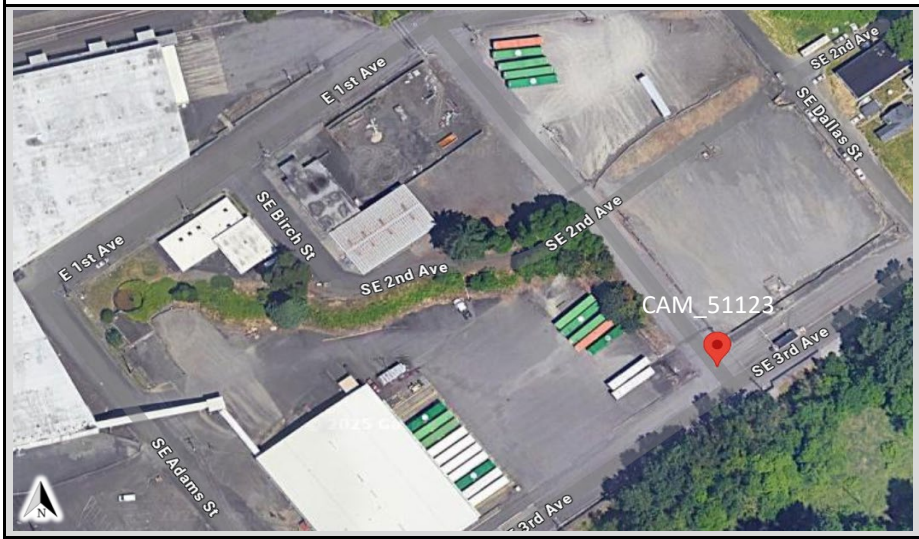
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	99.653
VFINAL (ft/s)	99.653
QFINAL (MGD - Total MG)	99.653

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report		CAM_51123

Site Address /Location:	SE Cedar St and SE 3rd Ave, Camas, WA 98607			Monitor Series: TRITON+	Location Type: Temporary
Site Access Details:	On Road	Latitude:	45.5829094	Pipe Size (H x W): 20.00 X 20.13	Pipe Shape: Circular
		Longitude:	-122.4010296		



Manhole #	System Characteristics
51123	Industrial
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Wednesday, January 15, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
8:23:00 AM	
Depth of Flow (Wet DOF) (in)	
7.75	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.38"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.77	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

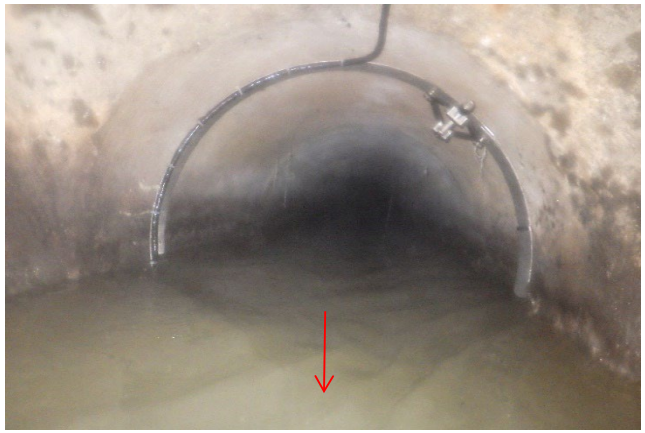
Manhole Depth (Approx. FT):	Manhole Configuration
16'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

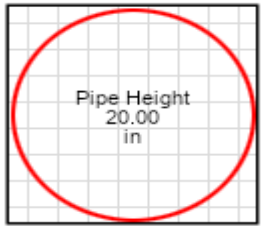
Monitoring Point Inlet	Outlet	
		
Top Down	Location	Map
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_51123

Flow Monitor

CAM_51123



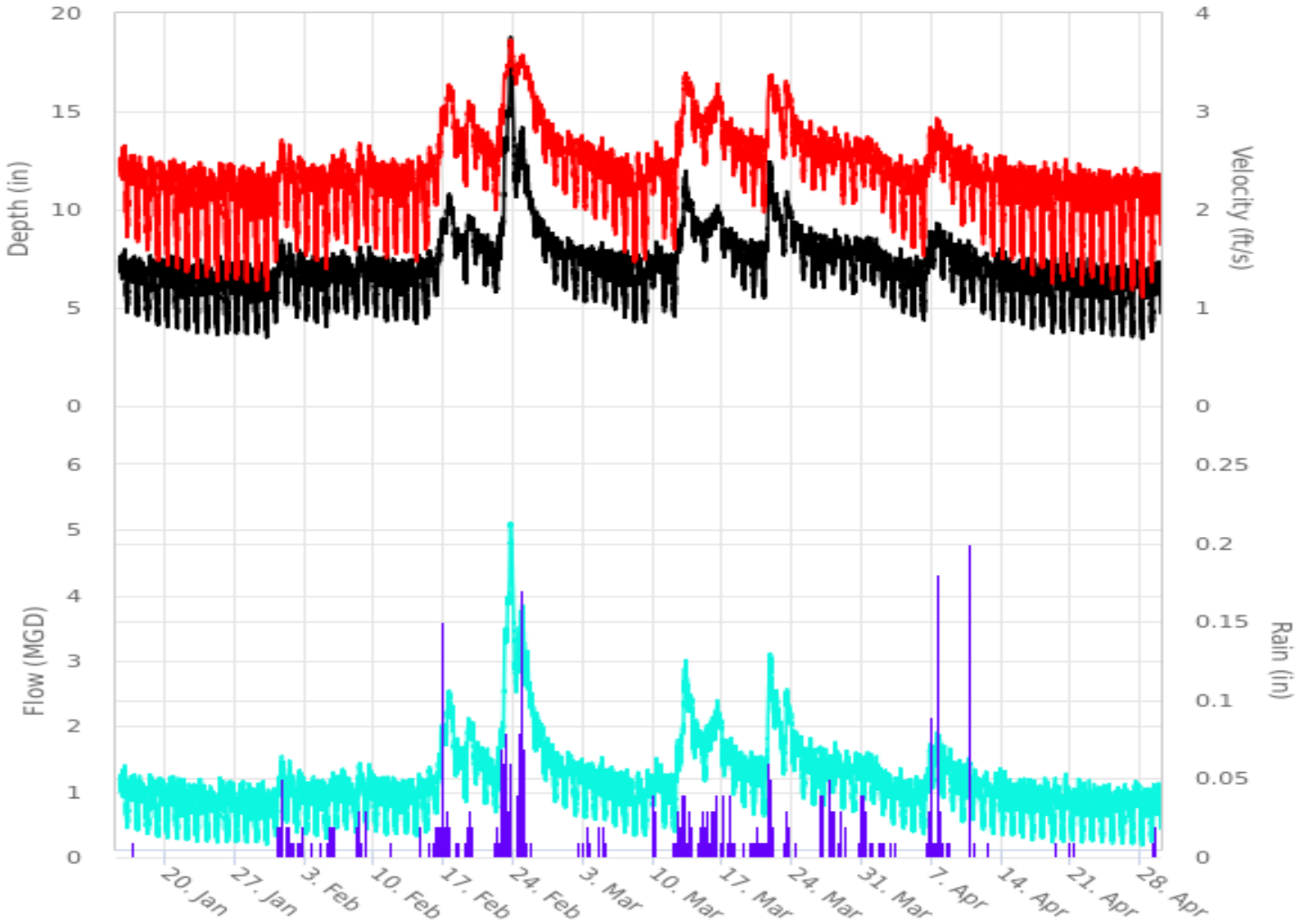
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL





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Tukwila, WA 98188

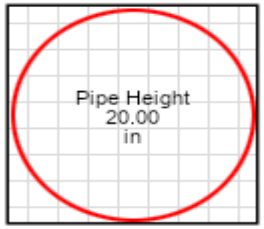
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Scattergraph Report

CAM_51123

Flow Monitor

CAM_51123

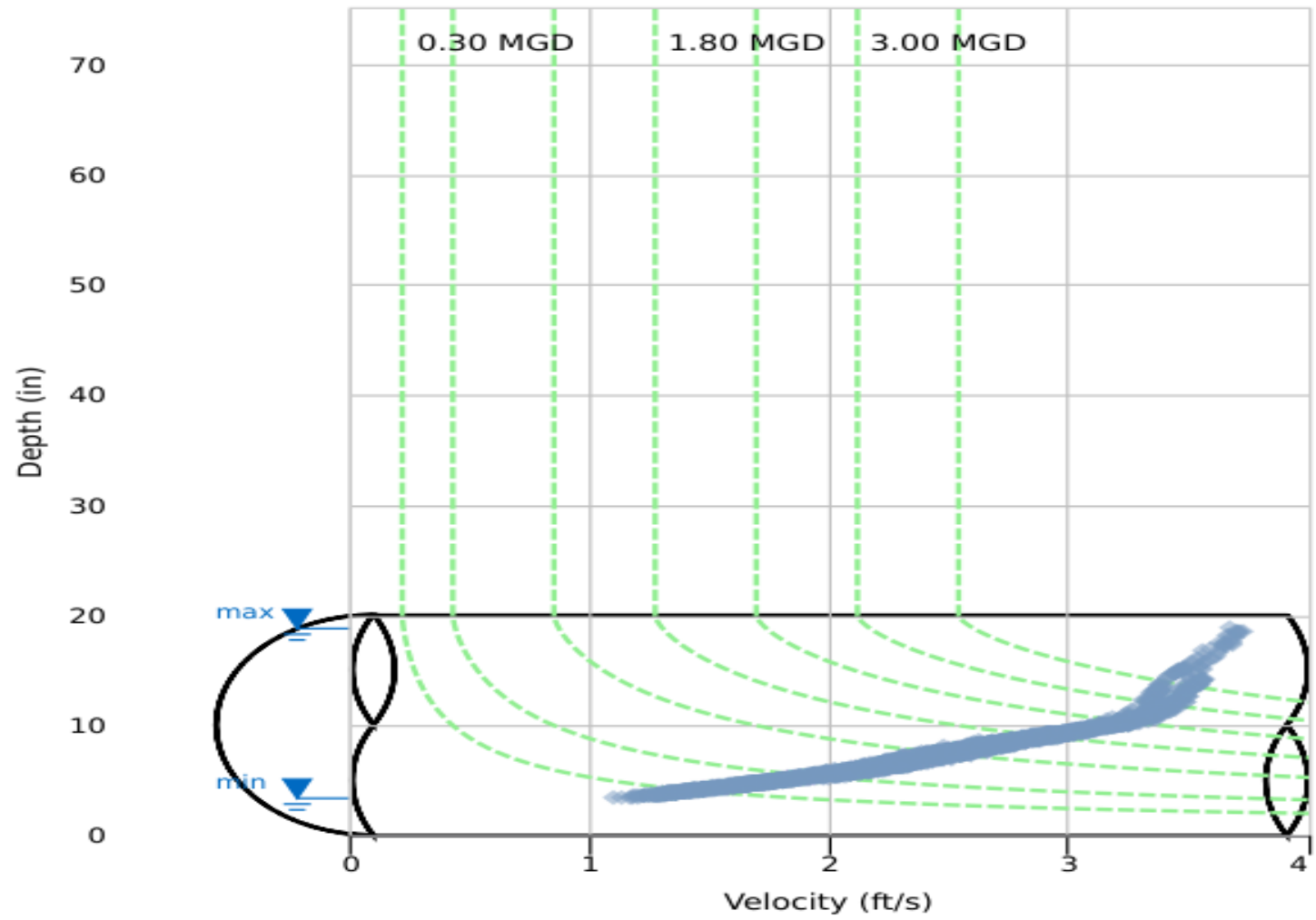


Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_51123 Pipe: Elliptical (20 in H x 20.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	23:50	5.80	21:30	8.39	7.16	23:50	2.17	21:30	2.69	2.45	23:50	0.742	21:30	1.522	1.123	0.710	-
01/16/2025	03:30	4.69	17:40	8.36	6.47	03:30	1.70	17:40	2.60	2.26	03:30	0.431	17:40	1.464	0.914	0.914	0.01
01/17/2025	04:30	4.46	09:15	7.96	6.27	04:30	1.62	09:15	2.59	2.21	04:30	0.383	09:15	1.367	0.858	0.858	-
01/18/2025	03:35	4.21	09:55	7.89	6.14	03:35	1.52	19:00	2.59	2.16	03:35	0.330	19:00	1.330	0.825	0.825	-
01/19/2025	05:05	4.01	10:00	7.93	6.07	05:05	1.44	10:00	2.57	2.12	05:05	0.292	10:00	1.348	0.802	0.802	-
01/20/2025	04:35	3.95	17:50	8.08	6.12	04:35	1.41	19:35	2.57	2.13	04:35	0.280	10:00	1.363	0.812	0.812	-
01/21/2025	05:25	3.91	20:45	8.03	5.89	05:25	1.39	20:45	2.54	2.07	05:25	0.271	20:45	1.352	0.749	0.749	-
01/22/2025	04:00	3.72	08:15	7.89	5.84	03:10	1.31	20:55	2.51	2.05	04:00	0.240	20:55	1.285	0.738	0.738	-
01/23/2025	04:05	3.64	21:00	7.78	5.80	04:05	1.27	12:20	2.50	2.05	04:05	0.224	21:00	1.257	0.728	0.728	-
01/24/2025	04:10	3.64	11:05	7.86	5.75	04:10	1.28	11:05	2.52	2.04	04:10	0.226	11:05	1.303	0.715	0.715	-
01/25/2025	04:35	3.55	09:50	8.22	5.72	03:45	1.24	11:10	2.56	2.02	04:35	0.211	09:50	1.396	0.712	0.712	-
01/26/2025	05:00	3.58	10:40	7.91	5.81	05:00	1.24	11:15	2.57	2.04	05:00	0.214	10:40	1.323	0.739	0.739	-
01/27/2025	02:40	3.65	18:55	8.00	5.77	02:40	1.26	18:55	2.56	2.03	02:40	0.223	18:55	1.359	0.719	0.719	-
01/28/2025	02:45	3.53	08:45	7.64	5.62	02:45	1.24	08:50	2.45	1.98	02:45	0.209	08:45	1.215	0.679	0.679	-
01/29/2025	04:00	3.61	19:45	7.87	5.65	02:30	1.23	19:45	2.54	1.98	02:30	0.216	19:45	1.321	0.681	0.681	-
01/30/2025	03:40	3.44	09:10	7.52	5.58	03:35	1.17	08:10	2.44	1.96	03:40	0.191	09:10	1.175	0.665	0.665	-
01/31/2025	00:55	4.02	18:35	8.72	6.76	00:55	1.39	16:20	2.74	2.29	00:55	0.283	18:35	1.618	1.008	1.008	0.60
02/01/2025	04:10	5.01	10:20	8.59	6.63	04:05	1.79	10:20	2.74	2.28	04:05	0.499	10:20	1.599	0.952	0.952	0.12
02/02/2025	05:45	4.47	12:50	8.36	6.47	05:45	1.55	10:45	2.61	2.20	05:45	0.367	12:50	1.442	0.906	0.906	0.07
02/03/2025	03:15	4.30	19:40	8.08	6.25	04:15	1.50	21:30	2.64	2.15	04:15	0.338	19:40	1.372	0.838	0.838	0.02
02/04/2025	04:40	4.08	08:20	8.08	6.03	03:55	1.43	08:20	2.54	2.09	04:40	0.298	08:20	1.361	0.779	0.779	0.01
02/05/2025	03:55	3.97	20:15	7.96	6.28	04:55	1.38	20:45	2.58	2.15	03:55	0.278	20:15	1.356	0.857	0.857	0.19
02/06/2025	04:05	4.70	19:15	8.20	6.49	04:50	1.67	19:55	2.71	2.24	04:50	0.426	19:15	1.436	0.912	0.912	-
02/07/2025	04:20	4.62	18:05	8.12	6.18	03:30	1.64	18:05	2.56	2.17	04:20	0.408	18:05	1.382	0.825	0.825	-
02/08/2025	03:25	4.41	10:25	8.28	6.59	03:25	1.54	11:25	2.70	2.26	03:25	0.358	10:25	1.482	0.955	0.955	0.25
02/09/2025	04:10	4.62	11:35	8.31	6.60	04:10	1.63	11:00	2.69	2.27	04:10	0.405	11:05	1.478	0.953	0.953	0.05
02/10/2025	03:45	4.52	22:30	8.01	6.33	04:10	1.59	19:40	2.51	2.18	03:40	0.385	22:30	1.329	0.861	0.861	-
02/11/2025	04:25	4.23	19:40	7.90	6.18	04:25	1.48	20:45	2.56	2.14	04:25	0.323	19:40	1.333	0.822	0.822	0.01
02/12/2025	04:10	4.27	07:30	7.92	6.12	04:55	1.50	07:25	2.58	2.13	04:10	0.338	07:25	1.350	0.806	0.806	-
02/13/2025	04:20	4.32	19:55	7.86	6.20	04:20	1.52	09:20	2.54	2.16	04:20	0.342	19:55	1.303	0.835	0.835	-
02/14/2025	05:15	4.09	10:10	8.06	6.15	05:15	1.43	11:05	2.58	2.14	05:15	0.297	11:05	1.310	0.825	0.825	0.07
02/15/2025	04:15	4.40	10:50	8.30	6.46	04:15	1.58	12:00	2.69	2.24	04:15	0.366	12:00	1.485	0.921	0.921	0.09
02/16/2025	03:30	5.49	20:45	9.65	7.62	05:25	2.00	19:50	3.09	2.56	03:30	0.637	20:45	2.066	1.317	1.317	0.77
02/17/2025	23:15	8.39	10:25	11.12	9.70	23:15	2.79	16:55	3.31	3.09	23:15	1.578	10:25	2.661	2.116	2.116	0.39
02/18/2025	23:40	7.27	08:10	9.37	8.28	23:50	2.46	08:40	2.94	2.71	23:40	1.152	08:10	1.918	1.507	1.507	0.02
02/19/2025	04:45	6.10	09:45	9.95	8.58	04:45	2.21	10:20	3.14	2.80	04:45	0.810	09:45	2.192	1.658	1.658	0.40
02/20/2025	03:55	7.11	08:20	9.14	8.13	12:45	2.32	19:05	2.91	2.65	03:55	1.089	08:20	1.821	1.442	1.442	-
02/21/2025	05:15	6.03	08:30	9.07	7.41	05:15	2.17	08:30	2.84	2.49	05:15	0.783	08:30	1.779	1.199	1.199	0.04
02/22/2025	04:00	5.59	23:55	11.23	7.72	03:45	1.99	23:50	3.26	2.59	04:00	0.646	23:50	2.678	1.351	1.351	0.84
02/23/2025	00:05	10.43	16:05	19.05	15.02	00:05	3.26	15:45	3.74	3.50	00:05	2.439	16:30	5.203	3.978	3.978	1.07
02/24/2025	04:05	10.51	19:25	14.53	12.43	05:20	3.25	19:50	3.59	3.44	05:20	2.464	19:25	3.923	3.191	3.191	0.87
02/25/2025	23:55	9.12	00:20	12.77	10.78	23:40	2.97	00:30	3.50	3.33	23:40	1.874	00:20	3.349	2.601	2.601	0.03
02/26/2025	23:55	7.91	03:10	10.25	9.11	23:20	2.66	03:15	3.21	2.96	23:55	1.400	03:10	2.346	1.864	1.864	-
02/27/2025	04:25	6.91	08:10	9.35	8.19	04:25	2.39	08:40	2.95	2.70	04:25	1.041	08:10	1.914	1.481	1.481	-
02/28/2025	02:40	5.95	08:10	9.19	7.57	03:35	2.20	08:10	2.85	2.55	02:40	0.786	08:10	1.812	1.266	1.266	-
03/01/2025	04:20	5.79	09:20	8.95	7.36	05:25	2.14	11:30	2.83	2.51	03:15	0.733	09:20	1.729	1.206	1.206	-
03/02/2025	04:10	5.27	20:00	8.28	7.13	05:25	1.95	19:35	2.78	2.47	05:25	0.584	19:35	1.538	1.137	1.137	0.05
03/03/2025	03:25	5.12	19:25	8.40	6.91	03:25	1.95	08:10	2.75	2.41	03:25	0.559	19:25	1.547	1.066	1.066	0.07
03/04/2025	03:55	5.13	19:45	8.46	6.94	04:40	1.88	19:45	2.76	2.38	03:55	0.541	19:45	1.574	1.059	1.059	0.12
03/05/2025	04:30	5.15	20:05	8.27	6.77	04:30	1.87	20:10	2.66	2.34	04:30	0.540	20:05	1.470	1.004	1.004	0.01
03/06/2025	03:55	4.82	20:55	8.32	6.57	03:55	1.72	20:55	2.61	2.25	03:55	0.452	20:55	1.460	0.931	0.931	-
03/07/2025	03:30	4.38	08:30	8.15	6.34	03:30	1.53	08:35	2.58	2.17	03:30	0.351	08:30	1.402	0.857	0.857	-
03/08/2025	04:00	4.11	17:45	7.86	6.17	04:00	1.39	11:30	2.59	2.14	04:00	0.291	11:30	1.335	0.822	0.822	-
03/09/2025	04:15	3.93	11:05	8.22	6.30	04:15	1.37	11:05	2.64	2.18	04:15	0.269	11:05	1.451	0.869	0.869	0.20
03/10/2025	23:55	5.43	09:00	8.53	7.24	23:55	1.98	07:20	2.72	2.44	23:55	0.617	07:20	1.563	1.138	1.138	0.22
03/11/2025	02:55	4.69	16:45	8.03	6.51	03:00	1.68	20:40	2.59	2.24	03:00	0.425	20:40	1.369	0.915	0.915	0.02
03/12/2025	03:50	4.50	23:00	9.76	7.62	03:50	1.57	23:00	3.08	2.51	03:50	0.376	23:00	2.116	1.312	1.312	0.83
03/13/2025	23:25	8.95	07:05	12.07	10.44	23:25	2.91	07:10	3.40	3.24	23:25	1.788	07:05	3.041	2.437	2.437	0.49
03/14/2025	23:40	7.92	07:40	9.77	9.01	23:40	2.58	07:20	3.16	2.89	23:40	1.352	07:20	2.169	1.795	1.795	0.16
03/15/2025	04:40	7.19	22:05	10.06	8.76	03:25	2.39	22:10	3.15	2.81	04:40	1.113	22:05	2.245	1.695	1.695	0.60
03/16/2025	23:55	7.87	09:40	10.53	9.47	23:55	2.58	10:35	3.32	3.04	23:55	1.336	10:35	2.505	2.018	2.018	0.16
03/17/2025	23:35	7.19	07:15	9.24	8.40	04:05	2.46	18:50	2.96	2.75	23:35	1.131	07:15	1.878	1.560	1.560	0.19
03/18/2025	23:50	6.16	07:10	8.86	7.77	23:50	2.22	07:10	2.84	2.61	23:50	0.825	07:10	1.725	1.335	1.335	0.02
03/19/2025	02:40	5.74	19:05	8.73	7.39	01:45	2.15	19:45	2.84	2.54	02:40	0.725	19:05	1.677	1.221	1.221	0.07
03/20/2025	03:30	5.47	19:45	8.61	7.24	02:20	2.01	18:45	2.78	2.47	02:20	0.635	19:45	1.622	1.161	1.161	0.11
03/21/2025	03:05	5.41	15:45	12.74	9.27	03:05	1.95	19:10	3.38	2.86	03:05	0.602	15:40	3.207	1.943	1.943	1.12
03/22/2025	23:55	8.30	09:00	11.00	9.75	23:55	2.69	11:10	3.29	3.07	23:55	1.498	09:00	2.618	2.112	2.112	-
03/23/2025	02:30	7.45	10:05	11.31	9.37	02:55	2.50	08:30	3.36	2.96	02:30	1.203	10:05	2.708	1.955	1.955	0.44
03/24/2025	23:20	7.24	07:40	9.54	8.59	23:55	2.46	07:40	2.99	2.75	23:20	1.142	07:40	1.995	1.606	1.606	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	23:40	6.19	18:00	9.34	7.88	01:05	2.22	19:10	2.95	2.60	23:40	0.850	18:00	1.900	1.362	1.362	-
03/26/2025	02:45	5.80	06:45	9.16	7.56	00:35	2.14	20:30	2.88	2.55	02:45	0.730	20:25	1.776	1.266	1.266	0.20
03/27/2025	03:25	5.93	07:05	9.04	7.56	03:25	2.17	07:05	2.86	2.54	03:25	0.765	07:05	1.781	1.256	1.256	0.24
03/28/2025	23:55	6.20	06:50	9.39	7.83	23:55	2.26	06:50	2.92	2.59	23:55	0.848	06:50	1.909	1.340	1.340	0.17
03/29/2025	01:25	5.73	09:45	8.88	7.46	02:10	2.05	09:45	2.83	2.49	01:25	0.699	09:45	1.724	1.220	1.220	0.12
03/30/2025	02:25	5.57	17:20	8.76	7.39	04:10	2.02	17:25	2.77	2.47	02:25	0.654	17:20	1.649	1.195	1.195	0.23
03/31/2025	03:00	6.05	13:00	8.93	7.68	03:55	2.19	13:00	2.80	2.54	03:00	0.795	13:00	1.720	1.283	1.283	0.10
04/01/2025	23:55	5.76	10:30	8.75	7.25	23:30	2.07	10:35	2.71	2.43	23:55	0.705	10:35	1.614	1.137	1.137	0.03
04/02/2025	01:35	5.43	08:25	8.27	6.87	01:30	1.88	07:50	2.59	2.34	01:30	0.588	08:30	1.422	1.019	1.019	0.05
04/03/2025	02:55	4.97	19:35	8.09	6.56	02:50	1.76	19:35	2.60	2.26	02:55	0.484	19:35	1.399	0.925	0.925	0.02
04/04/2025	04:05	4.69	18:35	8.36	6.32	04:05	1.69	10:20	2.49	2.19	04:05	0.428	18:35	1.371	0.858	0.858	-
04/05/2025	03:45	4.41	08:10	8.43	6.22	03:45	1.54	08:15	2.61	2.15	03:45	0.356	08:10	1.479	0.833	0.833	-
04/06/2025	05:00	4.27	19:20	9.00	6.97	02:25	1.48	19:25	2.88	2.33	02:30	0.331	19:25	1.780	1.081	1.081	0.71
04/07/2025	03:35	6.81	11:15	9.59	8.28	03:35	2.37	11:15	2.99	2.67	03:35	1.010	11:15	2.010	1.488	1.488	0.37
04/08/2025	23:55	6.16	07:05	9.12	7.75	23:55	2.20	07:05	2.84	2.53	23:55	0.817	07:05	1.793	1.293	1.293	0.07
04/09/2025	02:30	5.66	17:30	8.69	7.15	23:15	2.01	19:50	2.67	2.39	23:15	0.666	17:35	1.539	1.101	1.101	-
04/10/2025	02:30	5.06	06:30	8.55	7.01	01:40	1.81	20:15	2.69	2.35	02:30	0.516	19:40	1.528	1.061	1.061	0.27
04/11/2025	02:30	5.10	07:05	8.11	6.76	02:30	1.82	07:40	2.57	2.29	02:30	0.519	07:05	1.370	0.978	0.978	0.01
04/12/2025	04:00	4.62	09:40	8.21	6.51	04:00	1.63	09:55	2.65	2.22	04:00	0.403	09:40	1.409	0.912	0.912	0.01
04/13/2025	03:30	4.34	20:15	8.25	6.44	03:30	1.50	19:20	2.61	2.20	03:30	0.341	19:20	1.428	0.898	0.898	-
04/14/2025	03:15	4.26	07:50	8.82	6.25	03:15	1.46	07:50	2.74	2.15	03:15	0.323	07:50	1.654	0.839	0.839	-
04/15/2025	02:30	4.12	06:10	7.98	6.10	02:30	1.44	19:45	2.52	2.11	02:30	0.303	06:10	1.293	0.796	0.796	-
04/16/2025	02:20	4.01	18:40	7.96	6.06	03:10	1.36	06:55	2.50	2.10	02:20	0.279	18:40	1.293	0.786	0.786	-
04/17/2025	03:50	3.81	06:45	7.84	5.98	03:45	1.31	06:45	2.46	2.07	03:45	0.248	06:45	1.271	0.764	0.764	-
04/18/2025	02:00	3.84	07:40	8.08	5.88	02:00	1.31	09:40	2.57	2.05	02:00	0.250	07:45	1.368	0.737	0.737	-
04/19/2025	02:50	3.60	11:25	7.81	5.85	02:50	1.21	09:50	2.49	2.03	02:50	0.210	11:25	1.253	0.733	0.733	0.01
04/20/2025	04:50	3.71	11:20	7.89	5.96	04:50	1.27	11:25	2.53	2.06	04:50	0.230	11:20	1.316	0.769	0.769	0.05
04/21/2025	03:00	3.64	17:30	7.90	5.82	03:00	1.24	17:30	2.50	2.03	03:00	0.219	17:30	1.301	0.724	0.724	0.02
04/22/2025	02:55	3.56	10:55	7.73	5.75	02:55	1.18	20:45	2.45	2.01	02:55	0.202	10:55	1.241	0.707	0.707	-
04/23/2025	02:15	3.58	19:55	7.83	5.71	02:15	1.21	20:00	2.49	1.99	02:15	0.208	20:00	1.279	0.693	0.693	-
04/24/2025	02:15	3.44	19:50	7.87	5.69	02:15	1.15	19:50	2.47	1.99	02:15	0.186	19:50	1.279	0.690	0.690	-
04/25/2025	03:25	3.51	18:25	7.41	5.68	03:25	1.16	07:45	2.41	1.99	03:25	0.195	17:05	1.137	0.686	0.686	-
04/26/2025	02:40	3.49	08:05	7.89	5.72	02:40	1.16	10:00	2.44	1.99	02:40	0.193	08:10	1.240	0.701	0.701	-
04/27/2025	03:40	3.41	11:00	7.70	5.83	03:40	1.13	09:35	2.47	2.01	03:40	0.182	11:00	1.230	0.732	0.732	-
04/28/2025	03:45	3.27	08:55	7.48	5.68	03:45	1.07	08:55	2.38	1.97	03:45	0.162	08:55	1.156	0.686	0.686	-
04/29/2025	01:50	3.54	18:50	8.02	5.78	01:50	1.17	18:55	2.49	2.00	01:50	0.199	18:55	1.314	0.706	0.706	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			118.475	13.62
Average	7.07	2.37	1.132	

CAM_52167

Site Commentary

SITE INFORMATION

Pipe	Elliptical (18.13 in H x 18.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were maintained throughout the study.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	1.63	3.33	0.221
Minimum	0.54	0.43	0.006
Maximum	5.26	5.50	1.536
Min Time	01/22/2025 04:45:00	04/22/2025 03:30:00	01/22/2025 04:45:00
Max Time	02/18/2025 09:55:00	02/18/2025 09:55:00	02/18/2025 09:55:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_52167

Site Address /Location:	SE Dallas St and SE 3rd Ave, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.5833078	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.4001589	18.13 X 18.13	Circular



Manhole #	System Characteristics
52167	Industrial
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4), Smart Depth (CS5)	0 - 5 psi

Installation Confirmation:

Time	
2:43:00 PM	
Depth of Flow (Wet DOF) (in)	
1.25	
CS58 Physical Offset (in)	Measurement Confidence (in)
1.38	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.82	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

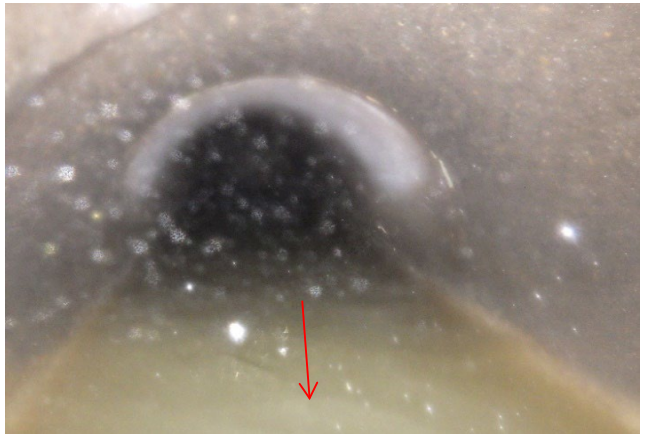
Manhole Depth (Approx. FT):	Manhole Configuration
17.5'	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
No	Normal
Pipe Material	Pipe Condition:
Hollow Tile	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

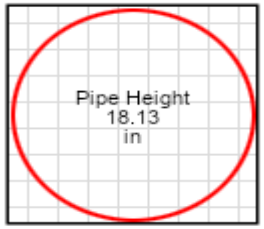
Monitoring Point Inlet	Outlet	NW inlet connection
		
Top Down	**Location**	**Map**
		
	KEY	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_52167

Flow Monitor

CAM_52167



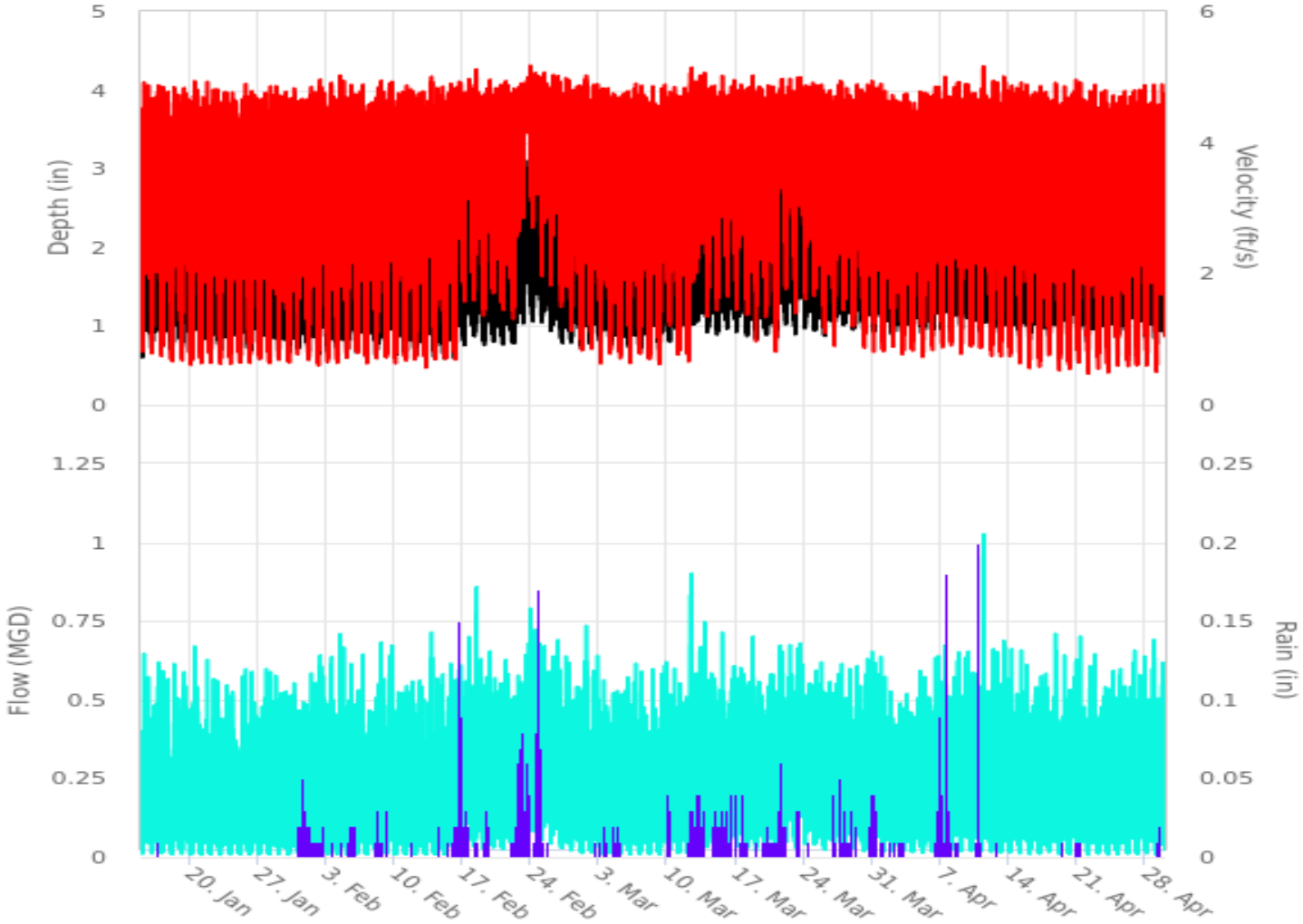
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

ADS ENVIRONMENTAL SERVICES



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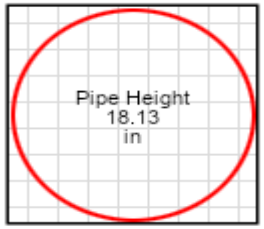
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Scattergraph Report

CAM_52167

Flow Monitor

CAM_52167

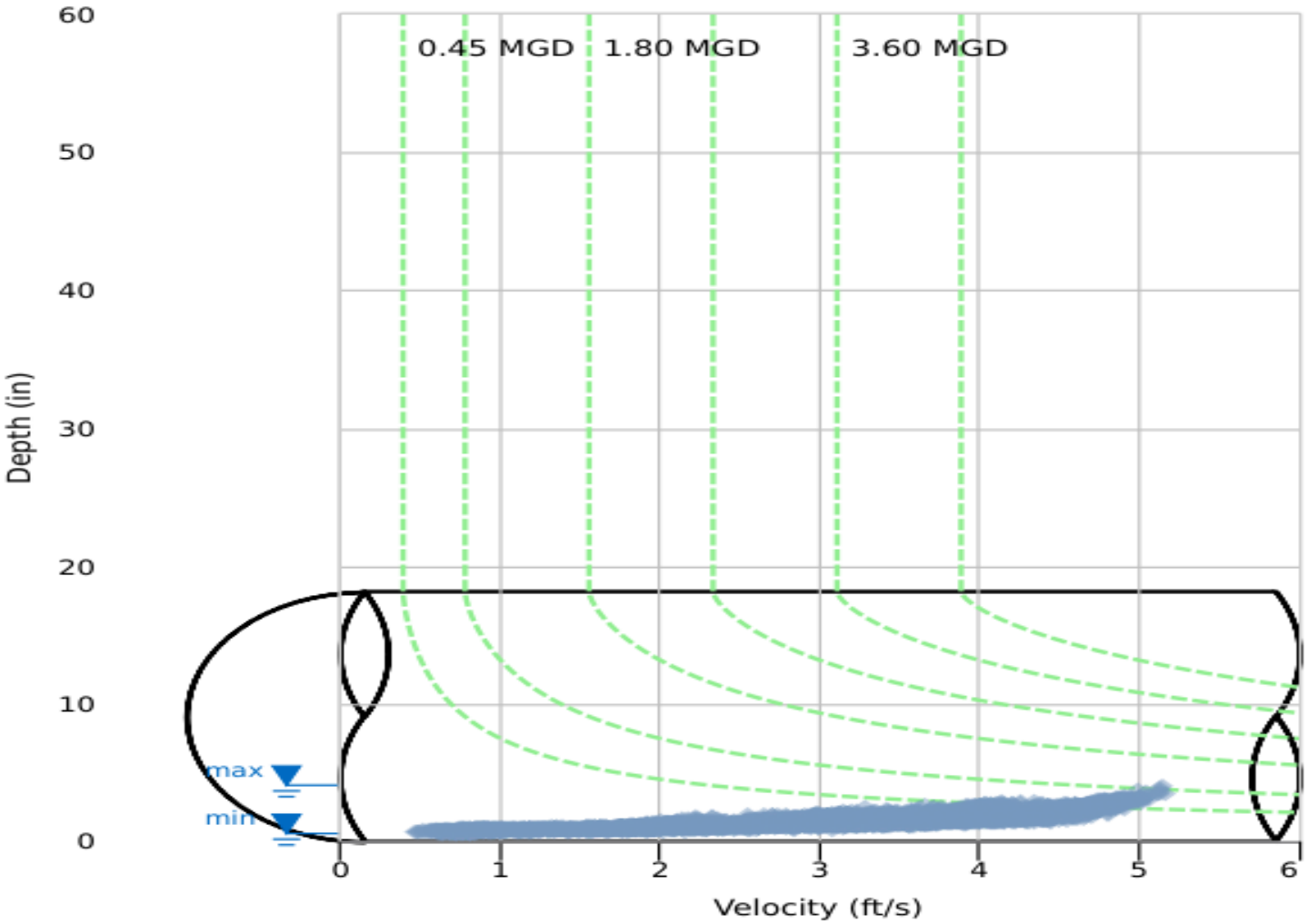


Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_52167 Pipe: Elliptical (18.13 in H x 18.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	0.55	08:30	3.97	1.60	05:45	0.66	08:30	5.21	3.36	04:55	0.008	08:30	0.981	0.214	0.214	-
01/16/2025	03:55	0.63	08:05	4.32	1.59	04:50	0.74	20:00	5.28	3.33	03:55	0.009	08:05	1.118	0.213	0.213	0.01
01/17/2025	06:00	0.68	20:05	4.16	1.51	03:45	0.73	20:05	5.28	3.15	06:00	0.011	20:05	1.057	0.189	0.189	-
01/18/2025	04:30	0.65	10:15	4.26	1.53	06:50	0.63	10:15	5.28	3.13	04:30	0.009	10:15	1.096	0.197	0.197	-
01/19/2025	04:15	0.70	09:25	4.17	1.56	06:40	0.64	16:40	5.26	3.20	04:15	0.010	11:30	1.046	0.203	0.203	-
01/20/2025	03:55	0.59	13:00	4.22	1.53	04:00	0.58	13:00	5.30	3.15	03:55	0.007	13:00	1.084	0.198	0.198	-
01/21/2025	02:50	0.54	18:10	4.14	1.47	05:25	0.61	18:10	5.24	3.09	05:25	0.007	18:10	1.044	0.182	0.182	-
01/22/2025	04:45	0.54	23:35	3.98	1.48	04:45	0.58	12:00	5.15	3.13	04:45	0.006	23:35	0.965	0.186	0.186	-
01/23/2025	05:00	0.55	21:25	4.33	1.45	05:00	0.59	21:25	5.31	3.04	05:00	0.006	21:25	1.129	0.179	0.179	-
01/24/2025	03:45	0.61	08:55	3.95	1.45	05:30	0.60	08:55	5.10	3.09	05:30	0.008	08:55	0.951	0.179	0.179	-
01/25/2025	05:45	0.66	10:20	4.19	1.48	03:30	0.62	10:20	5.31	3.08	04:55	0.009	10:20	1.076	0.189	0.189	-
01/26/2025	05:05	0.63	14:25	4.18	1.46	03:45	0.60	10:35	5.29	3.09	05:15	0.008	14:25	1.064	0.184	0.184	-
01/27/2025	01:25	0.65	21:20	4.06	1.49	04:40	0.66	21:20	5.33	3.08	01:30	0.010	21:20	1.033	0.191	0.191	-
01/28/2025	02:00	0.65	08:00	4.06	1.44	05:35	0.63	08:00	5.26	2.96	03:25	0.009	08:00	1.018	0.178	0.178	-
01/29/2025	04:15	0.65	10:05	4.15	1.41	04:00	0.66	10:05	5.26	2.92	04:10	0.009	10:05	1.051	0.171	0.171	-
01/30/2025	03:55	0.57	20:25	3.97	1.41	05:40	0.57	20:25	5.19	2.94	04:00	0.007	20:25	0.976	0.171	0.171	-
01/31/2025	01:35	0.68	19:40	4.05	1.52	02:40	0.76	19:40	5.22	3.25	02:40	0.013	19:40	1.010	0.197	0.197	0.60
02/01/2025	06:45	0.68	21:45	3.97	1.49	05:45	0.63	19:35	5.18	3.04	05:45	0.010	21:45	0.971	0.187	0.187	0.12
02/02/2025	02:55	0.61	12:05	3.95	1.57	05:45	0.55	10:00	5.25	3.18	05:45	0.007	10:00	0.972	0.211	0.211	0.07
02/03/2025	05:30	0.62	13:20	4.03	1.46	04:00	0.59	13:20	5.14	3.03	04:00	0.008	13:20	0.988	0.181	0.181	0.02
02/04/2025	03:55	0.67	19:30	4.00	1.51	03:55	0.61	19:30	5.20	3.09	03:55	0.008	19:30	0.988	0.194	0.194	0.01
02/05/2025	04:50	0.60	14:05	3.61	1.48	04:35	0.69	17:55	5.09	3.09	05:00	0.008	14:05	0.831	0.188	0.188	0.19
02/06/2025	04:35	0.62	17:25	3.99	1.51	04:35	0.72	19:35	5.16	3.15	04:35	0.009	19:35	0.972	0.194	0.194	-
02/07/2025	03:25	0.59	12:25	3.81	1.44	04:55	0.60	09:55	5.13	2.99	04:55	0.008	12:25	0.906	0.175	0.175	-
02/08/2025	02:10	0.62	22:45	4.02	1.49	05:05	0.68	16:20	5.18	3.07	05:15	0.010	22:45	0.986	0.192	0.192	0.25
02/09/2025	02:30	0.66	18:15	4.05	1.58	05:20	0.62	18:15	5.29	3.27	05:20	0.009	18:15	1.023	0.210	0.210	0.05
02/10/2025	05:50	0.61	16:10	3.93	1.50	03:05	0.62	16:10	5.26	3.17	03:05	0.008	16:10	0.974	0.193	0.193	-
02/11/2025	02:20	0.62	19:55	3.94	1.48	05:10	0.65	19:55	5.20	3.13	02:45	0.009	19:55	0.964	0.188	0.188	0.01
02/12/2025	05:45	0.61	19:05	4.18	1.45	02:50	0.67	19:05	5.29	3.06	02:50	0.009	19:05	1.068	0.184	0.184	-
02/13/2025	06:00	0.64	19:50	4.14	1.48	05:50	0.55	19:50	5.29	3.17	06:00	0.007	19:50	1.054	0.191	0.191	-
02/14/2025	02:00	0.59	19:55	4.18	1.41	04:55	0.64	19:55	5.26	3.00	04:55	0.008	19:55	1.063	0.180	0.180	0.07
02/15/2025	03:25	0.58	19:55	4.17	1.41	05:05	0.56	19:55	5.28	3.11	05:05	0.007	19:55	1.064	0.178	0.178	0.09
02/16/2025	03:40	0.58	20:15	4.10	1.55	06:45	0.66	18:25	5.27	3.39	06:45	0.008	20:15	1.009	0.219	0.219	0.77
02/17/2025	04:40	0.70	07:50	4.25	1.74	04:00	1.03	07:50	5.35	3.80	04:00	0.016	07:50	1.108	0.262	0.262	0.39
02/18/2025	03:35	0.79	09:55	5.26	1.80	04:45	1.22	09:55	5.50	3.78	04:45	0.022	09:55	1.536	0.281	0.281	0.02
02/19/2025	05:25	0.70	19:45	4.44	1.75	04:10	0.93	19:45	5.40	3.84	05:25	0.015	19:45	1.190	0.271	0.271	0.40
02/20/2025	03:30	0.70	16:55	4.22	1.69	04:45	1.02	08:05	5.36	3.72	04:45	0.016	16:55	1.073	0.252	0.252	-
02/21/2025	05:15	0.69	08:40	4.15	1.65	04:35	0.91	15:35	5.36	3.59	04:35	0.013	08:40	1.017	0.239	0.239	0.04
02/22/2025	04:20	0.65	16:55	3.98	1.66	05:05	0.78	19:35	5.13	3.65	05:05	0.011	16:55	0.956	0.241	0.241	0.84
02/23/2025	05:25	0.92	15:55	4.46	2.16	02:35	1.93	10:50	5.39	4.46	04:55	0.047	15:55	1.157	0.385	0.385	1.07
02/24/2025	06:05	0.90	19:45	4.29	2.03	05:40	1.71	08:35	5.42	4.30	05:40	0.039	08:35	1.122	0.344	0.344	0.87
02/25/2025	03:45	0.90	13:10	4.31	1.91	03:45	1.64	13:10	5.44	4.17	03:45	0.035	13:10	1.146	0.304	0.304	0.03
02/26/2025	05:45	0.80	21:05	4.18	1.82	00:55	1.61	06:55	5.25	3.95	00:55	0.031	21:05	1.041	0.282	0.282	-
02/27/2025	05:45	0.70	23:15	3.98	1.69	03:50	0.85	22:00	5.23	3.69	03:50	0.014	22:00	0.977	0.244	0.244	-
02/28/2025	04:05	0.70	15:40	3.43	1.62	03:25	0.86	15:40	5.07	3.61	03:25	0.014	15:40	0.773	0.222	0.222	-
03/01/2025	05:40	0.69	11:25	4.47	1.60	05:40	0.73	11:25	5.37	3.52	05:40	0.010	11:25	1.191	0.221	0.221	-
03/02/2025	05:40	0.71	19:45	4.32	1.64	04:50	0.70	11:00	5.22	3.50	04:50	0.011	19:45	1.098	0.230	0.230	0.05
03/03/2025	04:00	0.67	11:45	4.11	1.59	03:55	0.57	11:45	5.24	3.46	03:55	0.008	11:45	1.035	0.213	0.213	0.07
03/04/2025	05:20	0.68	21:05	4.23	1.55	02:15	0.70	21:05	5.30	3.35	02:15	0.011	21:05	1.088	0.207	0.207	0.12
03/05/2025	03:55	0.65	08:10	4.05	1.54	03:55	0.67	19:50	5.31	3.29	03:55	0.009	08:10	1.019	0.207	0.207	0.01
03/06/2025	04:25	0.62	22:10	4.19	1.52	04:20	0.63	18:15	5.28	3.23	04:25	0.008	22:10	1.067	0.201	0.201	-
03/07/2025	04:00	0.64	08:30	4.09	1.47	01:50	0.69	08:30	5.20	3.10	01:50	0.009	08:30	1.020	0.185	0.185	-
03/08/2025	04:10	0.64	12:00	3.85	1.48	03:00	0.62	09:10	5.21	3.12	03:00	0.009	12:00	0.920	0.185	0.185	-
03/09/2025	04:25	0.65	18:00	4.24	1.58	03:00	0.59	20:35	5.34	3.20	03:00	0.008	10:50	1.090	0.211	0.211	0.20
03/10/2025	05:15	0.79	17:15	4.14	1.59	06:10	1.01	17:15	5.26	3.29	06:10	0.018	17:15	1.046	0.209	0.209	0.22
03/11/2025	02:10	0.71	07:10	3.79	1.54	02:10	0.75	20:45	5.14	3.22	02:10	0.011	19:20	0.877	0.196	0.196	0.02
03/12/2025	03:55	0.70	09:45	4.33	1.82	03:55	0.65	09:45	5.43	3.58	03:55	0.010	09:45	1.154	0.281	0.281	0.83
03/13/2025	04:50	0.92	14:35	4.42	1.83	04:45	1.41	14:35	5.41	3.83	04:50	0.032	14:35	1.183	0.279	0.279	0.49
03/14/2025	01:20	0.80	21:05	4.19	1.80	01:20	0.90	21:05	5.33	3.71	01:20	0.016	21:05	1.080	0.270	0.270	0.16
03/15/2025	04:45	0.85	15:50	4.19	1.78	04:45	0.86	15:50	5.27	3.70	04:45	0.017	15:50	1.070	0.264	0.264	0.60
03/16/2025	06:20	0.81	18:35	4.35	1.85	04:05	0.98	18:35	5.37	3.79	04:05	0.018	18:35	1.148	0.284	0.284	0.16
03/17/2025	02:00	0.83	19:20	4.36	1.77	02:00	0.99	19:20	5.33	3.67	02:00	0.019	19:20	1.144	0.261	0.261	0.19
03/18/2025	03:40	0.77	18:30	4.20	1.72	03:05	0.90	18:30	5.28	3.58	03:40	0.017	18:30	1.074	0.246	0.246	0.02
03/19/2025	03:20	0.79	13:10	4.17	1.67	01:55	0.82	13:10	5.37	3.50	01:55	0.016	13:10	1.083	0.232	0.232	0.07
03/20/2025	02:50	0.79	19:15	4.12	1.65	02:50	0.70	13:20	5.32	3.47	02:50	0.012	19:15	1.029	0.228	0.228	0.11
03/21/2025	02:15	0.78	15:45	4.33	1.82	04:05	0.77	15:45	5.35	3.76	04:05	0.014	15:45	1.137	0.277	0.277	1.12
03/22/2025	23:20	0.94	13:30	4.22	1.89	03:40	1.44	20:55	5.32	3.92	03:40	0.035	13:30	1.072	0.295	0.295	-
03/23/2025	02:10	0.83	15:15	4.36	1.88	02:10	0.96	15:15	5.39	3.92	02:10	0.018	15:15	1.156	0.295	0.295	0.44
03/24/2025	00:40	0.89	13:50	4.13	1.80	01:45	1.32	04:30	5.18	3.77	01:45	0.029	13:50	1.010	0.268	0.268	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:55	0.86	19:00	4.30	1.76	23:50	1.09	19:00	5.26	3.67	23:50	0.023	19:00	1.105	0.254	0.254	-
03/26/2025	01:10	0.83	06:55	4.34	1.73	03:10	0.80	10:05	5.28	3.58	03:10	0.016	06:55	1.111	0.245	0.245	0.20
03/27/2025	00:30	0.85	23:40	3.85	1.73	01:55	0.79	06:35	5.27	3.54	01:55	0.016	12:15	0.929	0.242	0.242	0.24
03/28/2025	03:05	0.91	12:25	4.30	1.74	01:40	1.09	15:10	5.34	3.55	05:05	0.025	12:25	1.117	0.247	0.247	0.17
03/29/2025	01:45	0.89	19:25	4.06	1.74	01:45	0.87	19:25	5.18	3.50	01:45	0.018	19:25	1.003	0.243	0.243	0.12
03/30/2025	01:00	0.88	11:45	4.29	1.73	02:30	0.76	11:45	5.26	3.43	02:30	0.016	11:45	1.104	0.240	0.240	0.23
03/31/2025	04:30	0.87	07:15	4.01	1.71	04:30	0.75	07:15	5.24	3.35	04:30	0.015	07:15	0.997	0.231	0.231	0.10
04/01/2025	04:35	0.87	21:05	4.20	1.63	03:40	0.79	21:05	5.20	3.25	01:10	0.016	21:05	1.056	0.212	0.212	0.03
04/02/2025	03:45	0.85	20:50	4.04	1.59	03:45	0.84	20:50	5.15	3.17	03:45	0.017	20:50	0.991	0.199	0.199	0.05
04/03/2025	03:00	0.82	13:05	3.65	1.58	05:00	0.71	18:15	5.02	3.09	01:55	0.014	13:05	0.831	0.194	0.194	0.02
04/04/2025	03:35	0.75	21:30	4.15	1.55	03:35	0.68	23:10	5.20	3.07	03:35	0.011	21:30	1.041	0.189	0.189	-
04/05/2025	04:35	0.79	16:25	4.20	1.58	04:35	0.67	16:25	5.24	3.09	04:35	0.012	16:25	1.066	0.196	0.196	-
04/06/2025	03:15	0.85	10:45	4.21	1.73	04:15	0.82	16:20	5.30	3.44	03:15	0.016	16:20	1.079	0.238	0.238	0.71
04/07/2025	04:25	0.88	06:35	4.34	1.78	03:30	0.77	06:35	5.32	3.47	03:30	0.017	06:35	1.131	0.249	0.249	0.37
04/08/2025	05:00	0.91	16:40	4.40	1.74	03:30	0.76	16:40	5.36	3.44	03:30	0.017	16:40	1.163	0.241	0.241	0.07
04/09/2025	02:25	0.92	06:35	4.02	1.76	02:20	0.72	14:00	5.23	3.39	02:25	0.017	14:00	0.997	0.242	0.242	-
04/10/2025	01:35	0.87	12:00	4.13	1.71	04:05	0.72	12:00	5.24	3.35	03:15	0.016	12:00	1.039	0.228	0.228	0.27
04/11/2025	05:10	0.88	09:35	5.07	1.82	02:45	0.73	09:35	5.34	3.41	02:45	0.015	09:35	1.416	0.266	0.266	0.01
04/12/2025	03:40	0.85	08:05	4.30	1.67	05:40	0.73	18:45	5.31	3.33	02:45	0.015	08:05	1.109	0.224	0.224	0.01
04/13/2025	04:30	0.78	19:05	4.31	1.66	04:30	0.64	19:05	5.31	3.28	04:30	0.011	19:05	1.122	0.227	0.227	-
04/14/2025	02:25	0.78	19:10	4.26	1.63	02:25	0.71	19:10	5.27	3.28	02:25	0.012	19:10	1.093	0.217	0.217	-
04/15/2025	03:00	0.73	09:20	4.06	1.64	03:00	0.52	09:20	5.20	3.18	03:00	0.008	09:20	1.009	0.216	0.216	-
04/16/2025	02:55	0.72	18:45	3.92	1.58	02:55	0.55	18:45	5.10	3.08	02:55	0.008	18:45	0.942	0.196	0.196	-
04/17/2025	03:10	0.75	18:45	4.03	1.59	03:10	0.54	18:45	5.22	3.00	03:10	0.009	18:45	1.003	0.201	0.201	-
04/18/2025	04:55	0.87	21:45	4.25	1.61	01:50	0.75	21:45	5.29	3.03	01:50	0.015	21:45	1.093	0.199	0.199	-
04/19/2025	04:10	0.79	16:30	4.10	1.60	04:10	0.52	16:30	5.19	2.92	04:10	0.009	16:30	1.019	0.196	0.196	0.01
04/20/2025	05:10	0.73	21:20	4.29	1.65	05:10	0.53	21:20	5.27	3.07	05:10	0.008	21:20	1.102	0.214	0.214	0.05
04/21/2025	02:35	0.73	07:30	4.17	1.58	02:35	0.58	07:30	5.29	2.94	02:35	0.009	07:30	1.064	0.196	0.196	0.02
04/22/2025	03:30	0.68	20:20	4.40	1.60	03:30	0.43	20:20	5.26	2.99	03:30	0.006	20:20	1.141	0.201	0.201	-
04/23/2025	03:55	0.76	20:55	4.05	1.57	03:55	0.53	20:55	5.18	2.92	03:55	0.009	20:55	1.001	0.187	0.187	-
04/24/2025	03:35	0.65	06:20	4.10	1.61	03:35	0.47	06:20	5.18	2.93	03:35	0.006	06:20	1.017	0.200	0.200	-
04/25/2025	03:40	0.67	10:50	4.33	1.57	03:40	0.58	10:50	5.27	2.88	03:40	0.008	10:50	1.121	0.189	0.189	-
04/26/2025	05:10	0.78	21:15	4.33	1.62	05:10	0.57	21:15	5.27	2.98	05:10	0.010	21:15	1.120	0.202	0.202	-
04/27/2025	05:15	0.71	18:10	3.91	1.63	05:15	0.58	18:10	5.22	2.97	05:15	0.009	18:10	0.958	0.210	0.210	-
04/28/2025	03:05	0.75	20:15	4.35	1.57	03:05	0.55	20:15	5.31	2.97	03:05	0.009	20:15	1.136	0.194	0.194	-
04/29/2025	02:50	0.67	15:10	3.95	1.55	02:25	0.49	15:10	5.20	2.95	02:50	0.007	15:10	0.968	0.190	0.190	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			23.166	13.62
Average	1.63	3.33	0.221	

CAM_81189

Site Commentary

SITE INFORMATION

Pipe	Elliptical (12.13 in H x 12.13 in W)
Silt	0.00 (in)

OBSERVATIONS

Surcharge conditions were not experienced. Review of the scattergraph shows that free-flow conditions were experienced during the study. Backwater conditions were observed.

Average flow depth, velocity, and quantity data observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025**, along with observed minimum and maximum data, are provided in the following table.

Observed Flow Conditions			
Item	**DFINAL (in)**	**VFINAL (ft/s)**	**QFINAL (MGD - Total MG)**
Average	2.07	1.91	0.117
Minimum	0.98	0.37	0.017
Maximum	4.16	2.85	0.295
Min Time	04/11/2025 02:50:00	02/21/2025 04:30:00	04/22/2025 02:20:00
Max Time	04/23/2025 08:25:00	04/01/2025 10:45:00	02/06/2025 15:30:00

Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Values in the graphical reports are based on the fifteen minutes average and values in the Observed Flow Conditions and tabular report are based on the five-minute average.

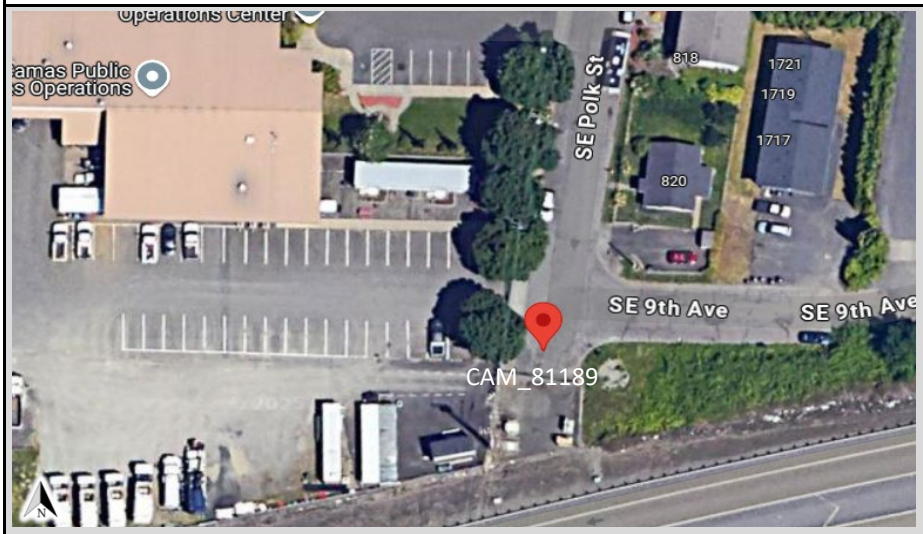
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
DFINAL (in)	100
VFINAL (ft/s)	100
QFINAL (MGD - Total MG)	100

Camas.Carollo.TFM.WA24		Site Name
Flow Monitoring Site Report	ADS ENVIRONMENTAL SERVICES®	CAM_81189

Site Address /Location:	820 SE Polk St, Camas, WA 98607			Monitor Series	Location Type
				TRITON+	Temporary
Site Access Details:	On Road	Latitude:	45.580146	Pipe Size (H x W)	Pipe Shape
		Longitude:	-122.39157	12.13 x 12.13	Circular



Manhole #	System Characteristics
81189	Residential
Access	Traffic
Drive	None







ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23116.11.325

Installation Information

Installation Date:	Installation Type:
Tuesday, January 14, 2025	Doppler Standard Ring and Crank
Monitoring Location (Sensors):	Monitor Location:
Upstream 0-5 FT	Manhole
Sensors / Devices:	Pressure Sensor Range (psi)
Peak Combo (CS4)	0 - 5 psi

Installation Confirmation:

Time	
10:17:00 AM	
Depth of Flow (Wet DOF) (in)	
2.50	
CS58 Physical Offset (in)	Measurement Confidence (in)
N/A	0.25"
Peak Velocity (fps)	Velocity Sensor Offset (in)
2.57	N/A
Silt (in)	Silt Type
0	

Manhole / Pipe Information:

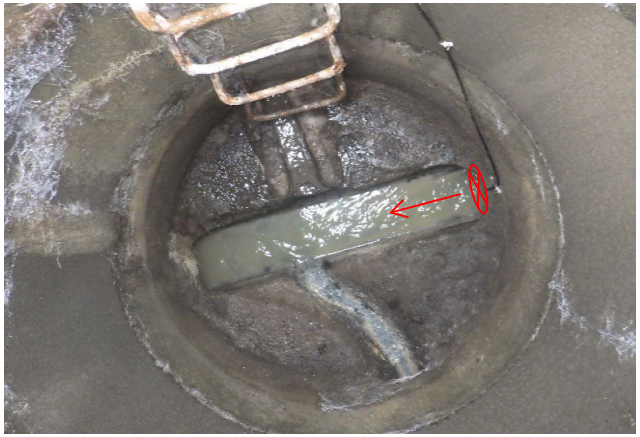
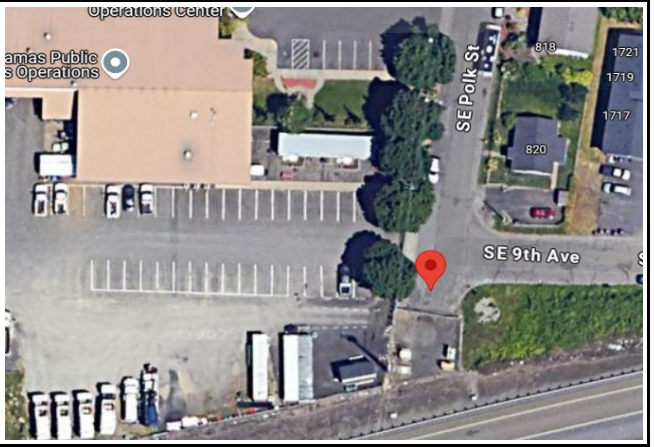
Manhole Depth (Approx. FT):	Manhole Configuration
7.5	Single
Manhole Material:	Manhole Condition:
Concrete	Good
Manhole Opening Diameter (in)	Manhole Diameter (Approx.):
24	26
Manhole Cover	Manhole Frame
Steel	Normal
Active Connections	Air Quality:
Yes, Inside	Normal
Pipe Material	Pipe Condition:
Concrete	Good

Communication Information:

Communication Type	Antenna Location
Wireless	Manhole Pick / Vent Hole

Additional Site Info. / Comments:

Additional Photos

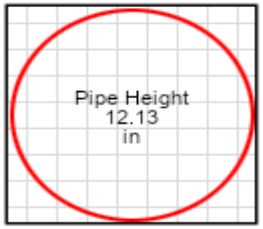
Monitoring Point Inlet	Outlet	West connection
		
Top Down	**Location**	**Map**
		
East Connection	**KEY**	
	Flow Direction Monitoring Point	

Hydrograph Report

CAM_81189

Flow Monitor

CAM_81189



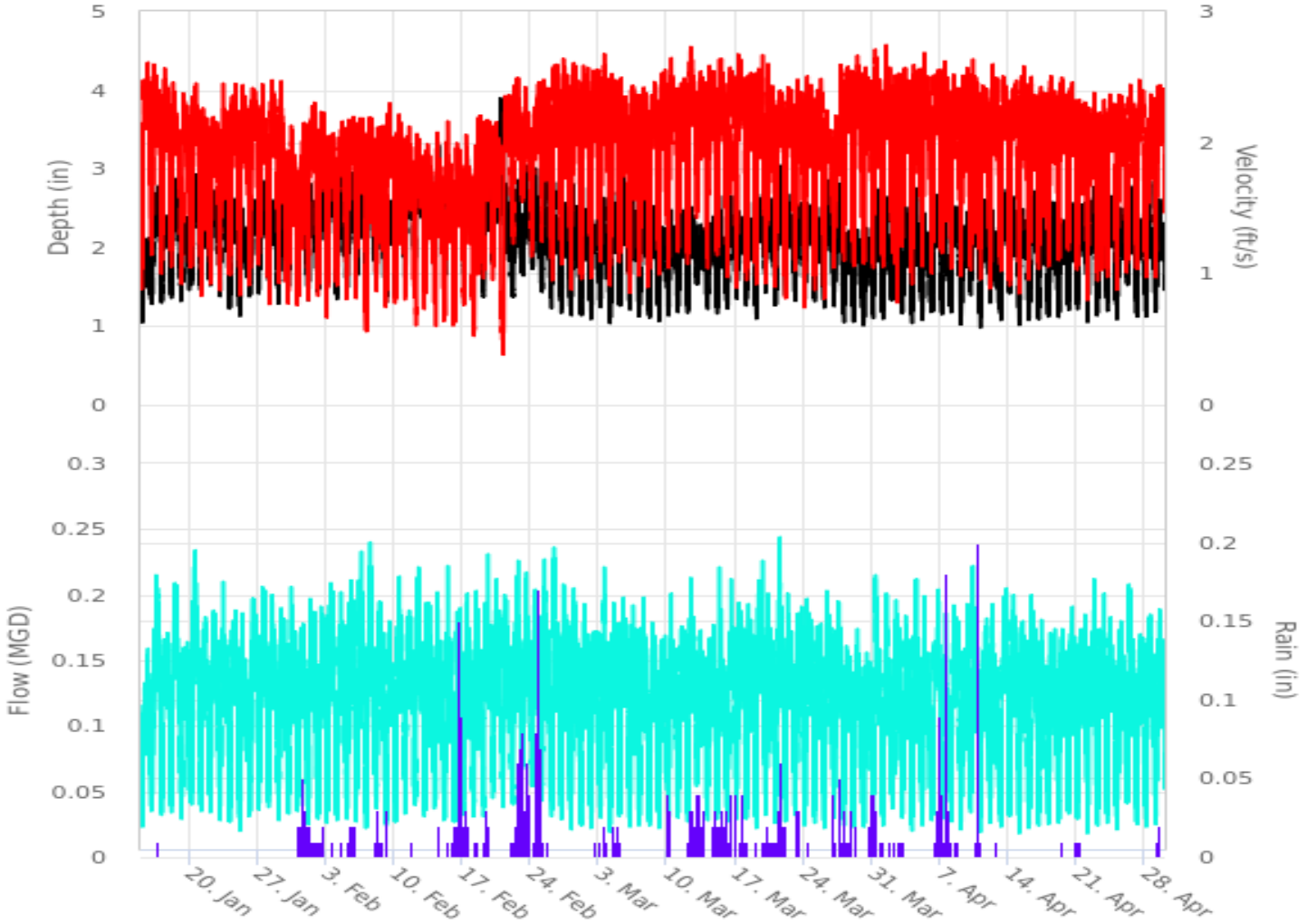
Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL

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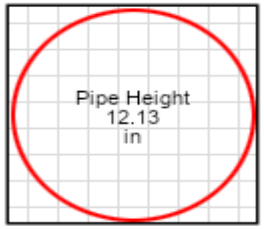
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Scattergraph Report

CAM_81189

Flow Monitor

CAM_81189

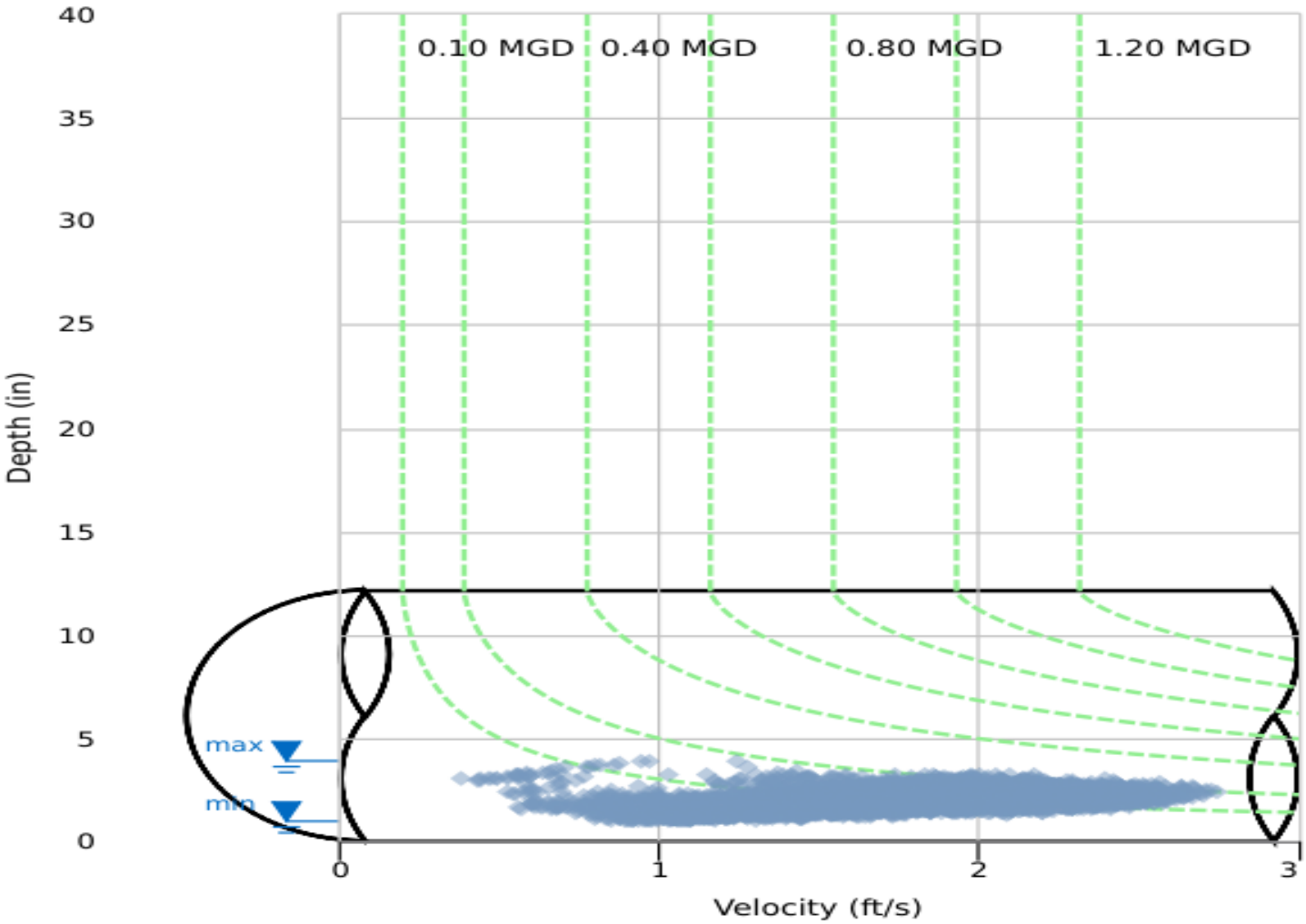


Report Period

01/15/2025
To
04/29/2025

Legend

- DFINAL - VFINAL
- Iso-Q™
- Min-Max Depth



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_81189 Pipe: Elliptical (12.13 in H x 12.13 in W), Silt0.00 in

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
01/15/2025	04:55	1.03	09:30	2.34	1.63	02:55	0.86	15:35	2.71	2.08	04:55	0.022	15:35	0.168	0.090	0.090	-
01/16/2025	04:20	1.26	18:25	2.91	2.11	04:35	0.89	09:15	2.65	2.09	04:35	0.026	14:20	0.217	0.133	0.133	0.01
01/17/2025	05:05	1.26	13:55	2.70	1.97	03:45	0.95	11:30	2.66	2.03	05:05	0.030	12:20	0.203	0.115	0.115	-
01/18/2025	04:20	1.31	12:00	2.93	2.19	04:20	1.03	04:25	2.50	1.92	04:20	0.031	12:00	0.226	0.129	0.129	-
01/19/2025	03:05	1.30	16:40	2.70	1.92	06:20	0.87	16:40	2.60	1.82	05:15	0.028	16:40	0.224	0.101	0.101	-
01/20/2025	04:15	1.49	13:45	3.00	2.27	06:15	0.92	11:35	2.63	1.94	06:15	0.037	11:35	0.253	0.137	0.137	-
01/21/2025	03:50	1.41	14:55	2.97	2.09	06:00	0.77	08:20	2.35	1.82	04:25	0.031	15:30	0.196	0.112	0.112	-
01/22/2025	03:55	1.48	15:05	3.08	2.22	05:15	0.74	11:25	2.30	1.78	03:55	0.032	12:05	0.203	0.121	0.121	-
01/23/2025	03:20	1.37	12:55	3.26	2.17	04:15	0.86	11:30	2.60	1.84	04:15	0.028	11:30	0.234	0.121	0.121	-
01/24/2025	02:50	1.22	14:20	2.77	2.05	04:40	0.90	14:15	2.61	1.91	04:40	0.025	14:15	0.222	0.118	0.118	-
01/25/2025	04:45	1.09	11:05	2.53	1.85	04:45	0.80	18:05	2.50	1.91	04:45	0.019	11:05	0.194	0.101	0.101	-
01/26/2025	05:10	1.37	19:55	2.69	2.10	02:30	0.90	08:10	2.51	1.94	02:45	0.030	13:50	0.205	0.123	0.123	-
01/27/2025	03:25	1.39	20:20	2.89	2.21	03:25	1.02	11:30	2.51	1.86	03:25	0.034	11:35	0.224	0.125	0.125	-
01/28/2025	06:25	1.52	18:20	2.94	2.10	05:35	0.63	11:45	2.50	1.91	03:25	0.037	11:50	0.206	0.117	0.117	-
01/29/2025	03:05	1.22	20:50	3.16	2.18	22:25	0.80	10:10	2.52	1.72	03:05	0.024	10:10	0.204	0.113	0.113	-
01/30/2025	05:10	1.47	09:25	3.13	2.34	03:15	0.73	06:10	2.19	1.55	05:10	0.029	10:45	0.209	0.114	0.114	-
01/31/2025	02:20	1.72	15:20	3.07	2.38	04:30	0.70	19:55	2.30	1.57	02:20	0.034	15:55	0.207	0.116	0.116	0.60
02/01/2025	05:00	1.30	09:50	2.89	2.13	05:05	0.78	14:05	2.39	1.80	05:05	0.024	14:05	0.206	0.116	0.116	0.12
02/02/2025	03:55	1.42	19:10	2.99	2.18	05:15	0.79	18:55	2.60	1.74	05:20	0.028	12:00	0.215	0.117	0.117	0.07
02/03/2025	03:45	1.50	16:05	3.30	2.41	02:40	0.64	18:55	2.27	1.66	02:40	0.024	14:35	0.236	0.128	0.128	0.02
02/04/2025	03:45	1.31	13:10	3.19	2.15	01:20	0.88	17:25	2.59	1.73	03:40	0.028	13:15	0.249	0.114	0.114	0.01
02/05/2025	04:10	1.39	15:35	3.41	2.24	02:55	0.75	20:00	2.27	1.77	02:55	0.028	15:35	0.233	0.124	0.124	0.19
02/06/2025	02:55	1.38	15:30	3.78	2.30	02:55	0.78	19:40	2.33	1.76	02:55	0.025	15:30	0.295	0.127	0.127	-
02/07/2025	05:45	1.49	15:10	3.53	2.40	05:05	0.55	08:05	2.44	1.60	02:30	0.022	13:25	0.252	0.125	0.125	-
02/08/2025	02:05	1.55	17:45	3.26	2.44	04:55	0.74	20:10	2.33	1.58	04:55	0.033	20:10	0.228	0.121	0.121	0.25
02/09/2025	05:00	1.27	23:05	2.81	2.02	03:20	0.71	09:20	2.51	1.70	05:00	0.021	13:25	0.196	0.104	0.104	0.05
02/10/2025	02:50	1.36	15:20	3.24	2.32	02:15	0.77	12:10	2.27	1.71	04:00	0.025	10:45	0.229	0.126	0.126	-
02/11/2025	02:45	1.57	18:20	2.95	2.38	04:45	0.72	13:05	2.24	1.61	04:45	0.029	13:10	0.207	0.121	0.121	0.01
02/12/2025	03:05	1.75	12:40	3.28	2.55	05:55	0.60	07:00	2.15	1.55	03:05	0.034	12:00	0.230	0.129	0.129	-
02/13/2025	04:10	1.58	13:40	3.20	2.43	02:40	0.72	07:45	2.01	1.50	02:40	0.030	07:45	0.207	0.116	0.116	-
02/14/2025	04:30	1.61	13:35	3.65	2.38	06:55	0.55	10:30	2.11	1.48	02:50	0.028	10:25	0.207	0.111	0.111	0.07
02/15/2025	06:20	1.62	12:05	3.12	2.38	02:05	0.61	12:05	2.20	1.45	06:20	0.026	12:05	0.232	0.109	0.109	0.09
02/16/2025	03:00	1.60	15:45	3.32	2.40	01:30	0.54	10:30	2.12	1.45	06:10	0.025	10:30	0.207	0.113	0.113	0.77
02/17/2025	03:25	1.62	12:30	3.15	2.46	03:25	0.70	09:05	2.20	1.46	03:25	0.029	09:05	0.215	0.116	0.116	0.39
02/18/2025	23:15	1.81	14:20	3.31	2.40	04:50	0.48	16:10	2.29	1.53	03:35	0.028	10:35	0.219	0.112	0.112	0.02
02/19/2025	04:05	1.35	15:15	3.34	2.22	04:05	0.82	17:45	2.27	1.75	04:05	0.026	15:20	0.238	0.121	0.121	0.40
02/20/2025	04:35	1.74	21:45	3.99	2.55	22:55	0.63	09:15	2.25	1.60	05:50	0.040	12:05	0.221	0.127	0.127	-
02/21/2025	23:40	1.63	00:00	3.38	2.45	04:30	0.37	10:00	2.53	1.64	04:30	0.036	12:45	0.224	0.112	0.112	0.04
02/22/2025	04:45	1.33	19:35	3.08	2.08	05:25	1.15	08:25	2.56	1.99	04:45	0.036	17:15	0.235	0.124	0.124	0.84
02/23/2025	06:20	1.59	14:00	3.11	2.25	23:15	1.35	11:10	2.43	1.94	06:20	0.057	11:40	0.226	0.131	0.131	1.07
02/24/2025	04:50	1.66	12:45	3.09	2.19	05:30	1.06	20:25	2.52	1.95	04:50	0.046	12:40	0.215	0.128	0.128	0.87
02/25/2025	04:20	1.39	11:55	3.24	2.08	23:05	1.11	08:25	2.55	2.00	04:20	0.037	11:55	0.251	0.124	0.124	0.03
02/26/2025	03:50	1.21	10:05	2.96	2.08	04:55	0.91	17:50	2.72	2.11	03:50	0.030	10:05	0.264	0.132	0.132	-
02/27/2025	03:25	1.14	12:40	2.87	2.01	04:35	0.98	08:30	2.68	2.10	03:25	0.026	11:05	0.225	0.125	0.125	-
02/28/2025	05:00	1.11	09:35	3.31	1.96	03:30	0.86	10:10	2.71	2.04	05:00	0.021	11:25	0.215	0.118	0.118	-
03/01/2025	03:55	1.12	22:00	2.89	1.91	05:15	0.83	09:35	2.67	2.07	05:15	0.020	12:00	0.202	0.115	0.115	-
03/02/2025	04:30	1.08	19:50	2.40	1.88	04:30	0.93	11:10	2.65	2.08	04:30	0.021	12:15	0.185	0.114	0.114	0.05
03/03/2025	04:30	1.21	13:50	2.77	1.95	01:50	1.03	13:05	2.73	2.13	04:30	0.028	13:50	0.237	0.121	0.121	0.07
03/04/2025	03:50	1.02	08:45	3.19	1.95	03:40	0.89	13:20	2.70	2.02	03:40	0.019	21:55	0.214	0.115	0.115	0.12
03/05/2025	02:25	1.25	12:25	3.34	2.09	02:15	1.05	07:15	2.65	1.94	02:15	0.031	12:50	0.219	0.121	0.121	0.01
03/06/2025	04:40	1.20	12:15	2.75	2.07	04:35	0.85	10:45	2.53	1.90	04:35	0.023	12:10	0.198	0.117	0.117	-
03/07/2025	02:35	1.10	14:55	2.65	1.96	23:30	0.71	11:50	2.57	1.91	02:35	0.023	14:35	0.203	0.110	0.110	-
03/08/2025	05:00	1.09	13:15	2.72	1.89	04:45	0.86	13:40	2.53	1.99	04:45	0.021	13:10	0.198	0.109	0.109	-
03/09/2025	04:20	1.06	12:25	2.40	1.83	04:20	0.98	12:25	2.59	2.05	04:20	0.022	12:25	0.188	0.107	0.107	0.20
03/10/2025	03:45	1.12	10:15	2.52	1.91	03:40	0.99	10:15	2.71	2.09	03:40	0.024	10:15	0.211	0.115	0.115	0.22
03/11/2025	01:45	1.16	14:05	2.55	1.95	01:45	1.00	09:50	2.62	2.08	01:45	0.025	10:20	0.189	0.117	0.117	0.02
03/12/2025	02:40	1.16	10:00	2.63	1.94	02:35	1.07	09:50	2.80	2.15	02:35	0.027	10:00	0.230	0.122	0.122	0.83
03/13/2025	23:50	1.30	18:15	2.34	1.89	23:50	1.25	19:20	2.62	2.12	23:50	0.037	10:50	0.180	0.112	0.112	0.49
03/14/2025	04:05	1.20	11:00	2.52	1.89	04:05	0.98	08:05	2.76	2.04	04:05	0.026	18:15	0.203	0.111	0.111	0.16
03/15/2025	03:20	1.16	08:35	2.68	1.89	00:45	1.08	11:15	2.71	2.12	03:25	0.028	08:30	0.225	0.116	0.116	0.60
03/16/2025	04:20	1.21	13:15	2.88	1.93	04:45	0.89	15:20	2.63	2.06	04:45	0.025	13:15	0.238	0.116	0.116	0.16
03/17/2025	03:30	1.33	08:25	2.63	2.00	02:00	0.80	13:40	2.79	2.12	03:30	0.026	13:45	0.206	0.124	0.124	0.19
03/18/2025	02:30	1.25	08:20	2.61	1.95	03:30	0.91	10:10	2.79	2.05	02:30	0.028	08:20	0.199	0.116	0.116	0.02
03/19/2025	03:40	1.09	08:20	2.76	2.06	03:20	0.85	18:45	2.79	2.02	03:20	0.021	18:45	0.236	0.126	0.126	0.07
03/20/2025	02:15	1.40	12:30	2.67	2.04	02:00	0.90	08:15	2.71	1.96	02:00	0.030	08:15	0.214	0.117	0.117	0.11
03/21/2025	01:25	1.24	13:50	3.12	2.15	02:35	0.81	12:20	2.52	1.93	02:35	0.024	13:45	0.256	0.127	0.127	1.12
03/22/2025	02:40	1.38	08:40	2.72	2.09	03:35	0.69	09:30	2.53	1.93	03:35	0.024	08:35	0.205	0.121	0.121	-
03/23/2025	02:20	1.28	11:15	2.61	2.07	02:20	0.97	09:10	2.49	1.96	02:20	0.028	11:15	0.197	0.121	0.121	0.44
03/24/2025	03:35	1.31	16:15	2.64	2.10	02:00	0.71	09:00	2.60	1.96	03:35	0.022	18:10	0.202	0.124	0.124	0.01

	DFINAL (in)					VFINAL (ft/s)					QFINAL (MGD - Total MG)						RAIN FINAL (in)
Date	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
03/25/2025	03:15	1.30	08:15	2.67	1.98	03:35	0.84	09:05	2.65	1.98	03:35	0.025	10:40	0.205	0.115	0.115	-
03/26/2025	02:40	1.22	07:40	3.02	2.15	02:35	0.77	07:40	2.37	1.81	02:35	0.021	07:40	0.239	0.120	0.120	0.20
03/27/2025	01:50	1.22	12:05	2.90	2.08	01:50	1.00	18:55	2.65	1.89	01:50	0.027	12:10	0.209	0.117	0.117	0.24
03/28/2025	03:35	1.03	19:55	2.55	1.78	03:35	1.04	13:05	2.71	2.11	03:35	0.022	09:00	0.169	0.105	0.105	0.17
03/29/2025	02:10	1.04	11:00	2.38	1.75	03:30	1.04	09:55	2.70	2.14	03:30	0.023	12:25	0.178	0.105	0.105	0.12
03/30/2025	02:55	0.99	11:00	2.42	1.65	04:35	1.01	18:30	2.66	2.08	04:35	0.021	11:00	0.181	0.093	0.093	0.23
03/31/2025	03:40	1.09	13:30	2.79	1.91	02:05	0.99	07:50	2.77	2.10	03:45	0.023	08:50	0.218	0.116	0.116	0.10
04/01/2025	03:25	1.08	13:50	2.88	1.80	03:25	1.02	10:45	2.85	2.06	03:25	0.023	10:45	0.225	0.105	0.105	0.03
04/02/2025	02:50	1.29	14:05	3.92	2.03	14:20	0.69	16:20	2.72	1.99	02:50	0.035	11:15	0.211	0.115	0.115	0.05
04/03/2025	03:55	1.14	10:45	2.65	1.87	02:25	1.18	17:25	2.65	2.08	02:25	0.030	08:05	0.200	0.110	0.110	0.02
04/04/2025	02:55	1.02	10:20	2.89	1.91	02:55	0.91	23:00	2.71	2.02	02:55	0.019	10:20	0.235	0.113	0.113	-
04/05/2025	03:55	1.06	09:05	2.49	1.77	02:45	1.00	08:45	2.73	2.09	03:55	0.023	09:05	0.207	0.103	0.103	-
04/06/2025	01:05	1.13	19:10	2.83	1.95	03:35	0.94	19:45	2.64	2.10	03:35	0.024	19:45	0.219	0.120	0.120	0.71
04/07/2025	04:15	1.15	14:00	2.99	1.73	13:30	0.91	11:15	2.65	2.10	04:25	0.024	13:55	0.199	0.098	0.098	0.37
04/08/2025	03:45	1.17	14:55	2.57	2.02	02:35	0.97	04:25	2.61	2.03	02:35	0.025	09:20	0.199	0.122	0.122	0.07
04/09/2025	02:45	1.01	18:15	2.50	1.86	02:15	0.96	18:15	2.68	2.03	02:50	0.021	18:15	0.206	0.108	0.108	-
04/10/2025	03:25	1.38	09:25	2.89	2.11	03:25	1.02	11:45	2.77	2.06	03:25	0.033	08:30	0.236	0.130	0.130	0.27
04/11/2025	02:50	0.98	13:55	2.71	1.96	02:45	0.95	06:30	2.47	1.97	02:50	0.019	17:50	0.193	0.114	0.114	0.01
04/12/2025	23:55	1.19	09:05	2.52	1.83	02:10	0.88	09:00	2.66	2.02	02:25	0.026	09:00	0.207	0.104	0.104	0.01
04/13/2025	05:40	1.07	20:05	2.79	2.06	05:20	0.99	10:20	2.58	1.99	05:20	0.023	20:00	0.215	0.124	0.124	-
04/14/2025	01:50	1.38	12:55	2.68	2.02	03:30	0.86	19:25	2.58	2.01	03:30	0.029	14:15	0.207	0.119	0.119	-
04/15/2025	02:35	1.01	10:50	2.55	1.87	02:35	0.83	13:30	2.70	1.98	02:35	0.017	10:50	0.195	0.108	0.108	-
04/16/2025	01:55	1.05	14:05	2.85	1.99	01:55	0.90	08:30	2.56	1.98	01:55	0.020	08:30	0.206	0.116	0.116	-
04/17/2025	02:50	1.04	14:00	2.61	1.88	02:45	0.96	07:45	2.57	1.98	02:50	0.021	09:00	0.188	0.106	0.106	-
04/18/2025	02:20	1.10	13:45	2.79	1.88	02:15	0.92	06:40	2.68	2.04	02:15	0.021	13:40	0.193	0.110	0.110	-
04/19/2025	03:40	1.10	15:15	2.41	1.91	05:35	1.08	10:55	2.59	2.05	02:20	0.026	10:55	0.180	0.113	0.113	0.01
04/20/2025	04:25	1.16	13:05	2.74	2.00	02:35	0.94	07:10	2.50	2.01	02:35	0.026	13:05	0.211	0.118	0.118	0.05
04/21/2025	02:15	1.16	07:20	2.90	2.08	01:05	0.99	06:55	2.44	1.94	02:15	0.025	10:40	0.197	0.120	0.120	0.02
04/22/2025	02:35	1.05	18:35	2.87	2.07	02:20	0.73	11:05	2.45	1.88	02:20	0.017	18:35	0.226	0.117	0.117	-
04/23/2025	00:40	1.13	08:25	4.16	2.16	12:25	0.65	19:30	2.35	1.78	03:40	0.019	19:35	0.210	0.117	0.117	-
04/24/2025	03:30	1.18	08:55	2.97	2.01	01:30	0.93	09:55	2.57	1.91	03:30	0.025	08:55	0.210	0.113	0.113	-
04/25/2025	02:45	1.08	11:15	2.58	1.98	02:40	0.82	08:20	2.50	1.92	02:40	0.019	08:25	0.191	0.112	0.112	-
04/26/2025	04:05	1.40	10:35	3.07	2.16	02:40	0.87	11:20	2.53	1.95	04:05	0.031	10:35	0.231	0.126	0.126	-
04/27/2025	02:15	1.11	20:15	2.51	1.92	02:20	0.88	09:30	2.51	2.00	02:20	0.021	12:30	0.182	0.112	0.112	-
04/28/2025	01:30	1.07	10:55	2.93	2.03	03:15	0.92	12:50	2.50	1.92	01:30	0.021	12:50	0.216	0.116	0.116	-
04/29/2025	01:00	1.15	11:35	2.83	2.00	02:25	0.96	10:45	2.50	2.04	02:25	0.025	11:35	0.218	0.119	0.119	0.13

01/15/2025 00:00 - 04/29/2025 23:59

	DFINAL (in)	VFINAL (ft/s)	QFINAL (MGD - Total MG)	RAIN FINAL (in)
Total			12.250	13.62
Average	2.07	1.91	0.117	

CAM_RG

Site Commentary

SITE INFORMATION

Rain Collector Dimensions	8”

OBSERVATIONS

A review of the hydrograph indicates CAM_RG functioned under normal conditions during the study.

The total rainfall recorded during the monitoring period was 13.62 inches.

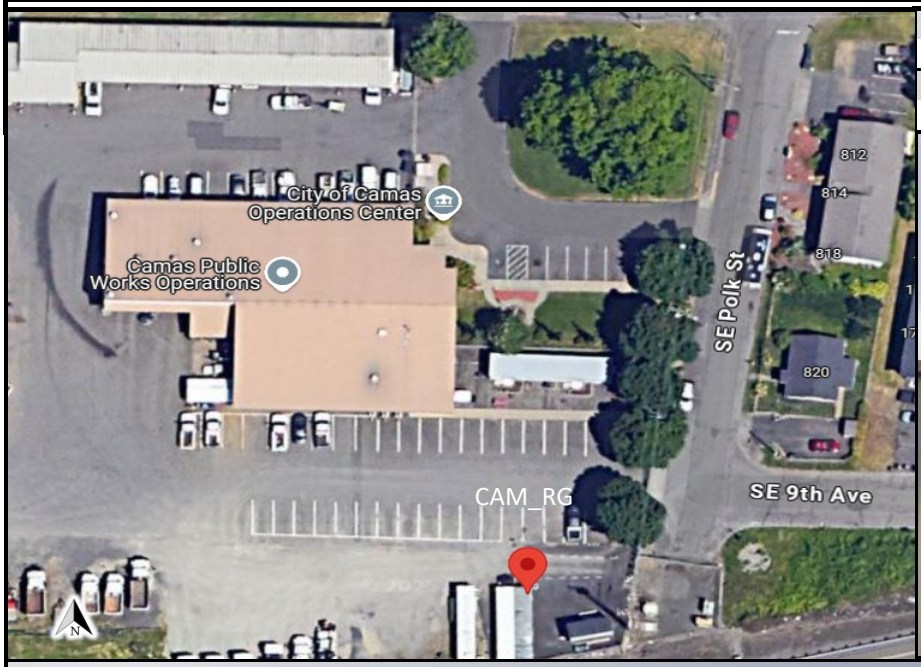
DATA UPTIME

Data uptime observed during **Wednesday, 15 January 2025 to Tuesday, 29 April 2025** is provided in the following table:

Percent Uptime	
Rain	100

Camas.Carollo.TFM.WA24		Site Name
Rainfall Monitoring Site Report		CAM_RG

Site Address /Location:	1620 SE 8th Ave, Camas, WA 98607			Monitor Series	Location Type
				Rain Alert III	Temporary
Site Access Details:	On Roof	Latitude:	45.5800529	Installation Date	
		Longitude:	-122.3918594	1.14.2025	



Location	
On Roof	
Access	Traffic
Drive	None





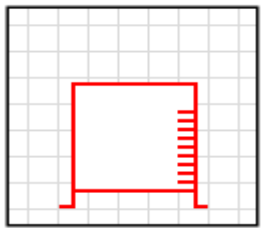
ADS Project Name:	Camas.Carollo.TFM.WA24
ADS Project Number:	23081.11.325

Hydrograph Report

CAM_RG

Rain Gauge

CAM_RG

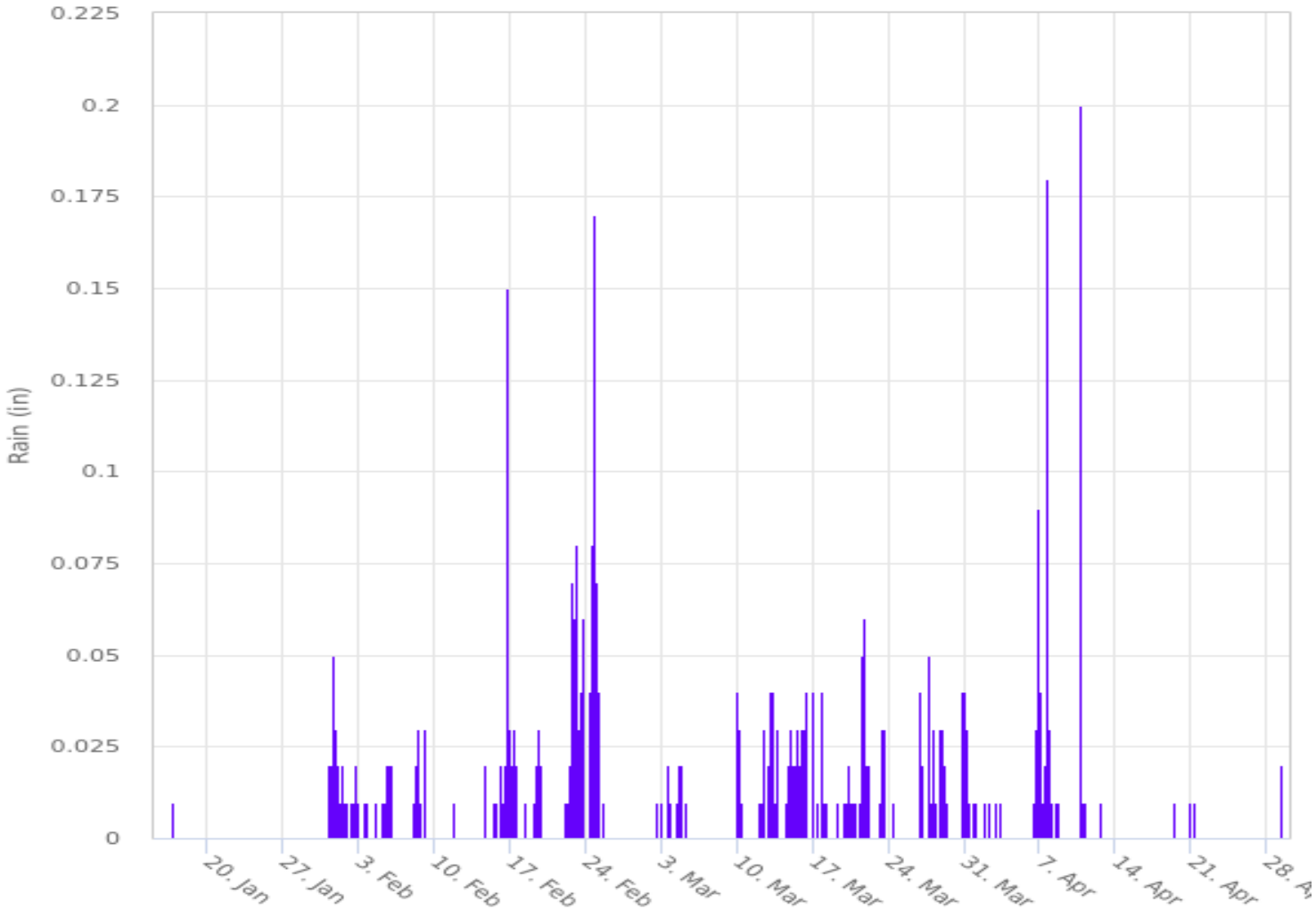


Report Period

01/15/2025
To
04/29/2025

Legend

DFINAL
VFINAL
QFINAL
RAIN FINAL



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Daily Tabular Report

01/15/2025 00:00 - 04/29/2025 23:59
CAM_RG

Date	RAIN FINAL (in) Total
01/15/2025	-
01/16/2025	0.01
01/17/2025	-
01/18/2025	-
01/19/2025	-
01/20/2025	-
01/21/2025	-
01/22/2025	-
01/23/2025	-
01/24/2025	-
01/25/2025	-
01/26/2025	-
01/27/2025	-
01/28/2025	-
01/29/2025	-
01/30/2025	-
01/31/2025	0.60
02/01/2025	0.12
02/02/2025	0.07
02/03/2025	0.02
02/04/2025	0.01
02/05/2025	0.19
02/06/2025	-
02/07/2025	-
02/08/2025	0.25
02/09/2025	0.05
02/10/2025	-
02/11/2025	0.01
02/12/2025	-
02/13/2025	-
02/14/2025	0.07
02/15/2025	0.09
02/16/2025	0.77
02/17/2025	0.39
02/18/2025	0.02
02/19/2025	0.40
02/20/2025	-
02/21/2025	0.04
02/22/2025	0.84
02/23/2025	1.07
02/24/2025	0.87
02/25/2025	0.03
02/26/2025	-
02/27/2025	-
02/28/2025	-
03/01/2025	-
03/02/2025	0.05
03/03/2025	0.07
03/04/2025	0.12
03/05/2025	0.01
03/06/2025	-
03/07/2025	-
03/08/2025	-
03/09/2025	0.20
03/10/2025	0.22
03/11/2025	0.02
03/12/2025	0.83
03/13/2025	0.49
03/14/2025	0.16
03/15/2025	0.60
03/16/2025	0.16
03/17/2025	0.19
03/18/2025	0.02
03/19/2025	0.07
03/20/2025	0.11
03/21/2025	1.12
03/22/2025	-
03/23/2025	0.44
03/24/2025	0.01
03/25/2025	-

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01/15/2025 00:00 - 04/29/2025 23:59

	RAIN FINAL (in)
Date	Total
03/26/2025	0.20
03/27/2025	0.24
03/28/2025	0.17
03/29/2025	0.12
03/30/2025	0.23
03/31/2025	0.10
04/01/2025	0.03
04/02/2025	0.05
04/03/2025	0.02
04/04/2025	-
04/05/2025	-
04/06/2025	0.71
04/07/2025	0.37
04/08/2025	0.07
04/09/2025	-
04/10/2025	0.27
04/11/2025	0.01
04/12/2025	0.01
04/13/2025	-
04/14/2025	-
04/15/2025	-
04/16/2025	-
04/17/2025	-
04/18/2025	-
04/19/2025	0.01
04/20/2025	0.05
04/21/2025	0.02
04/22/2025	-
04/23/2025	-
04/24/2025	-
04/25/2025	-
04/26/2025	-
04/27/2025	-
04/28/2025	-
04/29/2025	0.13

	RAIN FINAL (in)
Total	13.62
Average	

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TECHNICAL MEMORANDUM

Subject: Camas, WA Flow Monitoring Wet Weather Analysis

Prepared For: Carollo

Prepared By: Paul Mitchell, Regional Engineer

Date: May 23, 2025

Background

In addition to sewer flow monitoring and data delivery conducted as part of this temporary deployment of 4 flow monitors, ADS also conducted a wet weather analysis which also takes into account rain data collected from the single deployed temporary rain gauge. This wet weather analysis was conducted to assess Rainfall Dependent Infiltration and Inflow (RDII) attributed to each of the 4 monitored tributaries which could then be used to assist in relative prioritization of those tributary areas (or basins) based on computed and normalized RDII volume per inch rain per acre (converted to % rainfall ingress).

Methodology

The methodology used for this evaluation includes the following primary tasks:

- Evaluate the available data using ADS' Sliicer™ application for evaluating RDII. This includes determination of typical net average dry day flow (ADF).
- Determine RDII for each storm event meeting minimum criteria discussed herein and compute RDII volume associated with each rain event.
- Generate an RDII volume vs. rainfall volume chart (called a Q-vs-i chart) from each storm event data point for each evaluated site/basin and fit a regression line through the data on the Q-vs-i chart.
- Normalize the RDII using the Q-vs-i chart by dividing the slope of the regression line (Gallons RDII per inch rain) by acreage to generate values of % ingress attributed to each site/basin. Use this result to rank relative RDII performance of the site/basins.

Wet Weather Analysis

This section describes an evaluation of wet weather impacts on system flows, defined as Rainfall Dependent Infiltration and Inflow (RDII). This evaluation was based on available flow data provided during the approximate 3 month duration of the flow study. This is done by evaluating excess flow volumes from the studied sewer shed areas (basins) associated with each flow monitoring site during rain events that occurred during the available data periods at each of the 4 locations. This section also describes an evaluation of dry weather flow data for purposes of determining base wastewater flows (to compare wet weather flows against).

Each flow monitoring site represents a defined tributary area (or basin) and each was identified with a simple alpha-numeric ID – CAM_100290, CAM_51123, etc. The Sliicer™ application recognizes basins as having the same name as the monitors used to determine tributary flows (i.e. sites and basins have the same ID). One of the flow sites, CAM_51123, relied upon subtracting flow from a flow monitor upstream (CAM_100290) to define net flow for basin CAM_51123. Table 1 provides a summary of site/basins, site schematic defining each evaluated basin, and size of each basin (acres).

Dry Weather Flow

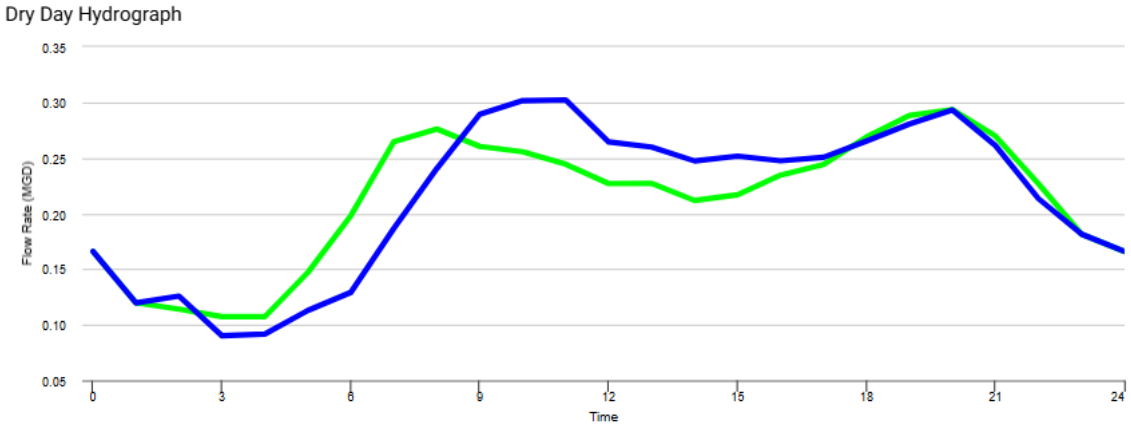
Prior to conducting a wet weather analysis, dry weather flow patterns must first be determined by reviewing data obtained during dry weather conditions at each location. For this analysis, a *dry day* is defined as any day in which there was less than 0.10 in. of rain in the previous day, less than 0.50 in. of rain in the previous three days, and less than 1.00 in. of rain in the previous five days. This process automatically eliminates the selection of most wet weather events and the periods associated with recovery from these events. Once the initial dry days are selected, they are compared to one another to make sure that the flow pattern for each day is repeatable. Any days that have an inconsistent flow pattern are removed from consideration. The resulting dry days are then averaged to establish an average diurnal flow pattern from the site, called an Average Dry day (ADF) pattern. The dry weather analysis evaluates the weekday pattern separate from the weekend pattern to account for differences often observed.

Dry weather flows were evaluated for each flow monitor location from the available data provided. Recorded flow rates from the sanitary sewer monitoring location for each dry day are overlaid on a hydrograph, enabling a hydrograph of the Average Dry day Flow (ADF) to be determined for Weekdays (green curve) and Weekends (blue curve) as depicted in Figure 1 for site/basin CAM_100290. ADF hydrographs for each site are included in Appendix A. Table 1 summarizes the ADF values (weekdays) for each site/basin.

Table 1
Basin Summary Data

Site/ Basin	Pipe Diameter (in)	Added or Upstream Subtracted FM Sites to Determine Net Basin Flow	Basin Size (Acres)	Gross ADDF Weekday (mgd)	Net ADDF Weekday (mgd)
CAM_100290	19	+(CAM_100290)	476	0.22	0.22
CAM_51123	20	+(CAM_51123) - (CAM_100290)	1159	0.77	0.55
CAM_52167	18	+(CAM_52167)	299	0.19	0.19
CAM_81189	12	+(CAM_81189)	136	0.12	0.12
		Total	2071		1.08

Figure 1
Average Dry Day Flow (ADF) Hydrograph – Site/Basin CAM_100290



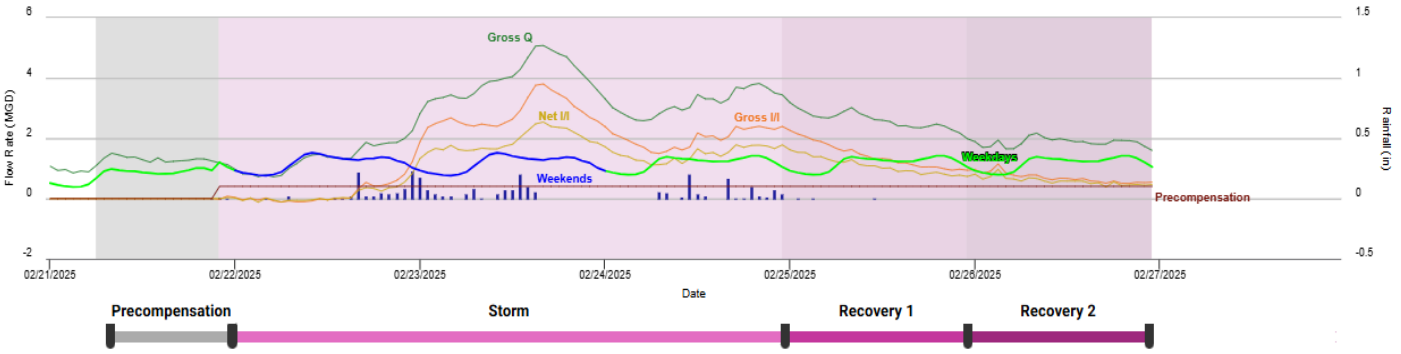
Wet Weather RDII Analysis

A wet weather RDII analysis is performed by comparing specific wet weather events to average dry weather flows (ADF). Based on criteria for a “storm” as being a rain event with at least 0.8 inch of rain with no rain interruption of more than 12 hours, there were 5 rain “storm” events captured during the flow study period. Captured storm volumes ranged from 1.15 inches (April 6, 2025) to 2.84 inches (February 21, 2025). Based on the concurrent periods of flow and rain “storm” data available at each site, an RDII analysis was conducted to characterize the impact of wet weather on flow measured in the basins.

Recorded flow rates for a specific storm event are plotted against average dry weather conditions. The difference observed represents the rain-dependent inflow and infiltration

(RDII or I/I) entering the sanitary sewer system upstream from each monitoring location and is called a storm hydrograph. Figure 2 depicts a storm hydrograph for site/basin CAM_51123 during the largest captured storm event period (from February 21 to 26, 2025).

Figure 2
Storm Hydrograph – Site/Basin CAM_51123



RDII calculations are made for each storm event (the ~5 day period depicted by purple colored bands above for the storm event starting February 21). The first period (shown as a 3 day duration in Figure 2) following the onset of rain is referred to as the Storm Period. The darker purple period following the Storm Period is referred to as Recovery 1, and the next period is referred to as Recovery 2. For purposes of this evaluation, the entire "Event" was used for this analysis which covers the Storm and both Recovery periods. Figure 2 also depicts precompensation which is an upward adjustment made to the ADF pattern so that pattern and the actual flow on storm onset were the same. This effectively compensates for flow that is already elevated leading into a given storm event; enabling a more accurate RDII response to be quantified only from the indicated storm under evaluation.

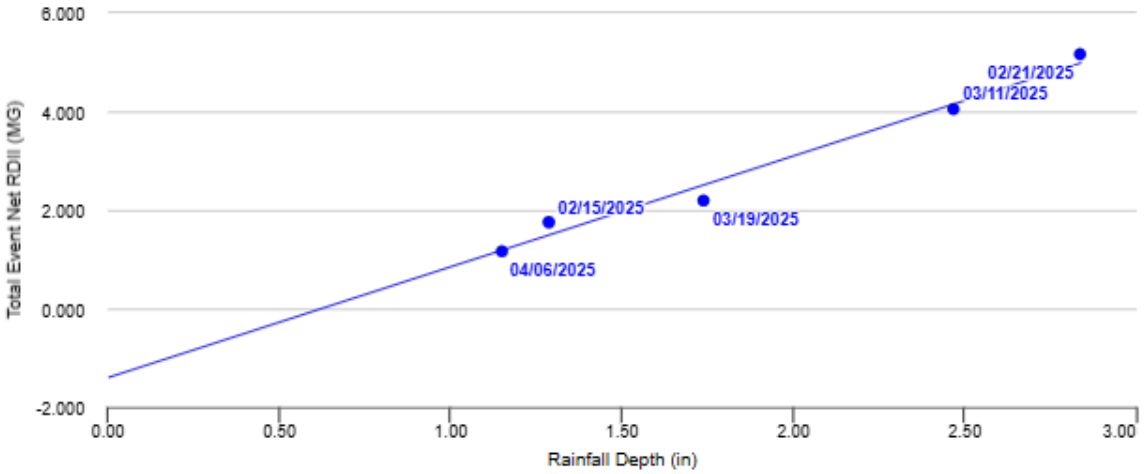
The storm hydrographs for this location showed excess flow responses (shown as "Gross I/I" in the above hydrograph) follow closely with a slight delay to the rainfall pattern. The Gross I/I is the difference between the actual recorded flow (shown as "Gross Q") minus the ADF weekend and weekday pattern. For cases where the net RDII for a basin is determined by subtraction of an upstream flow site (see Table 1), the hydrographs also show a "Net I/I" component as is the case for site/basin CAM_51123 above.

Also, in the case of CAM_51123, the delayed and significant yet muted or delayed response to rainfall may be indicative of predominantly indirect storm drainage pathways (i.e., the infiltration component of RDII). Storm hydrographs of the 5 selected storms for all locations are included in Appendix A.

Once the calculations were complete for each storm event, excess wet weather flow volumes were plotted as a function of rainfall volume on graphs commonly referred to as

Q-vs-i graphs; each with best fit regression lines drawn. The rain volume vs. excess flow volume Q-vs-i chart is shown in Figure 3 for site/basin CAM_51123. These charts for all other locations are included in Appendix A.

Figure 3
Q-vs-i graph for CAM_51123



These volume-based Q-vs-i graphs for the basins generally show a good visual (regression line) correlation between excess wastewater volume and rainfall. The Q-vs-i graph for CAM_51123 projects about 2 million gallons of I/I would be generated from about 1.5 inches of rain. However, there is an apparent threshold (X-intercept) of about 0.5 or 0.6 inches of rain in the above Q-vs-i graph; below which there is little to no RDII response. This means projected RDII vs rainfall volumes based on regression line slope will be greater than individual storm values. These graphs are included for all the site/basins in Appendix A. Caution is warranted in attempting to extrapolate higher rainfall responses from these Q-vs-i graphs since the linear extrapolation may not remain fully intact during significantly stronger storm events. A summary of individual RDII response data points (MG/inch) per storm is provided in Table 2.

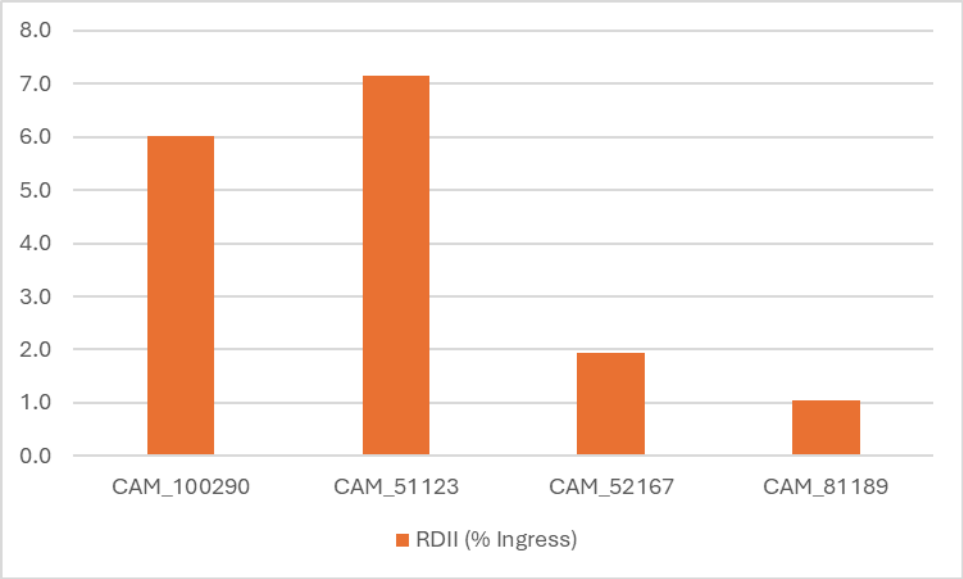
Table 2
Basin RDII Storm Response Summary

	Storm RDII (MG/inch)				
Site/ Basin	2/15/2025 (1.29")	2/21/2025 (2.84")	3/11/2025 (2.47")	3/19/2025 (1.74")	4/6/2025 (1.15")
CAM_100290	0.57	0.68	0.64	0.48	0.52
CAM_51123	1.36	1.82	1.64	1.26	1.01
CAM_52167	0.16	0.14	0.20	0.12	0.17
CAM_81189	0.01	0.03	0.01	0.03	0.00

To properly characterize relative I/I performance among the sites/basins evaluated, the wet weather I/I responses must also be normalized according to basin size. This is done by taking the slope of the Q-vs-i responses described above (gallons RDII / inch rain) and dividing by basin area (acres – see Table 1) to yield normalized values of RDII response in terms of projected % rainfall ingress. These rain and size normalized % ingress values based on Q-vs-i projected slopes are summarized in Figure 4.

As a general rule, basins may be considered to yield excessive RDII if such normalized values are much greater than 5. Two of the 4 site/basins evaluated slightly exceeded this value.

Figure 4
Projected RDII (% Rainfall Ingress)



The computed values for ADF and rain & area normalized projected RDII volumes (including % Ingress) are summarized in Table 3. Hydrographs of the flow monitoring period, dry day hydrographs, storm hydrographs, and volume-based Q vs i graphs are included in Appendix A.

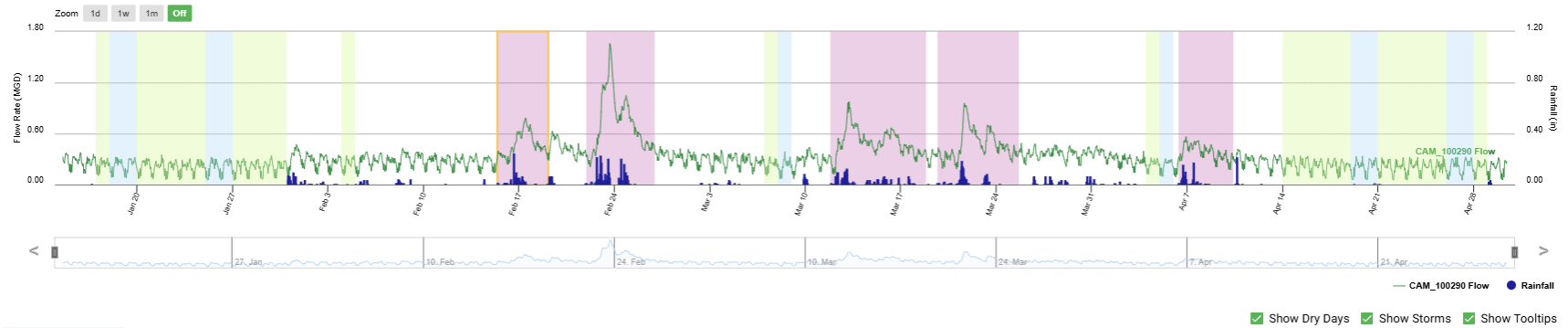
Table 3
Basin Dry and Wet Weather Performance Summary

Site/ Basin	Pipe Diameter (in)	Basin Size (Acres)	Net ADDF Weekday (mgd)	Projected Net RDII (MG/in)	Projected Net RDII (%rain ingress)
CAM_100290	19	476	0.22	0.78	6.0
CAM_51123	20	1159	0.55	2.25	7.1
CAM_52167	18	299	0.19	0.16	1.9
CAM_81189	12	136	0.12	0.04	1.0

Appendix A

Study period Hydrographs, ADF hydrographs, Storm hydrographs, and Q vs i graphs

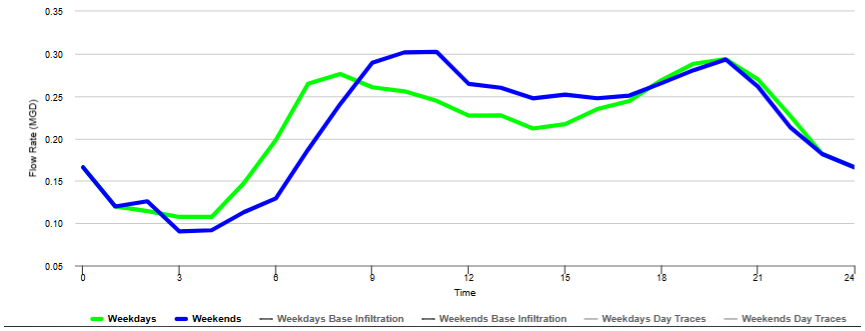
Hydrograph with Basin Rainfall: 01/14/2025 - 04/30/2025 | Basin CAM_100290 | Edit Dry Days

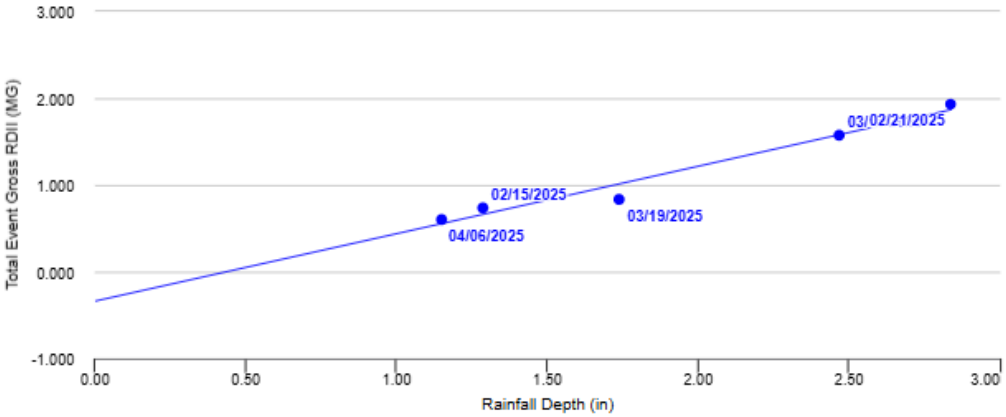


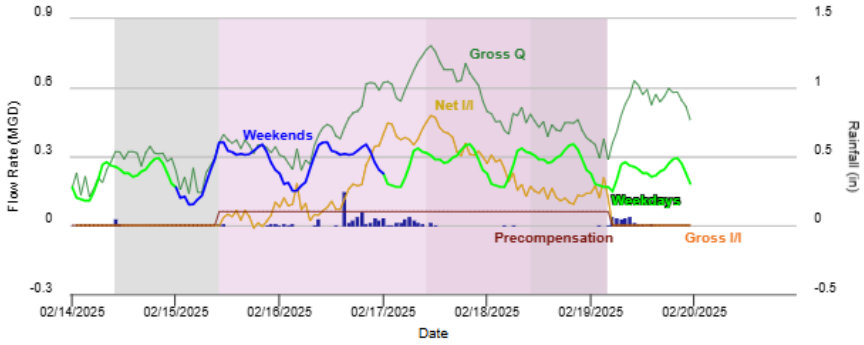
Show Dry Days | Show Storms | Show Tooltips

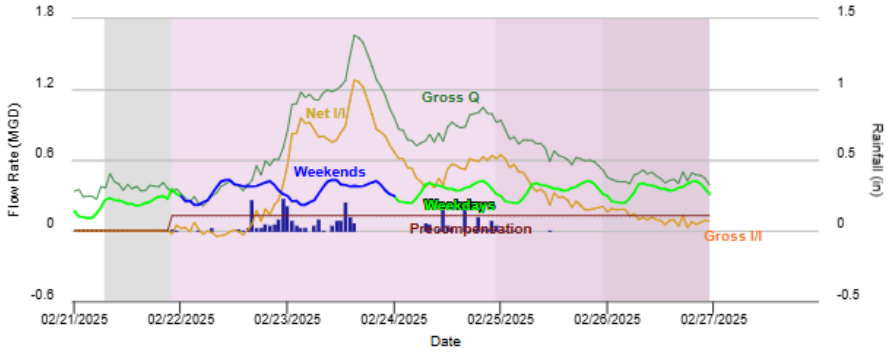
DRY DAYS | STORM EVENTS | STATISTICS

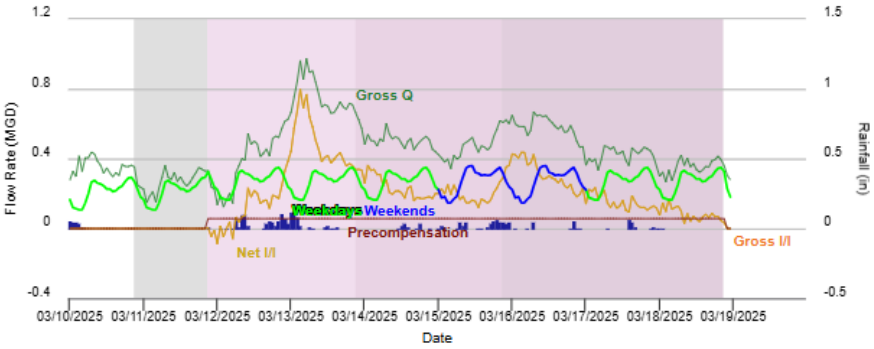
Dry Day Hydrograph

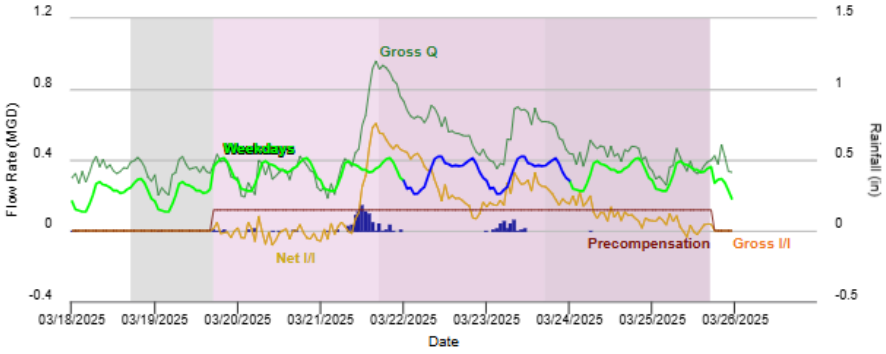


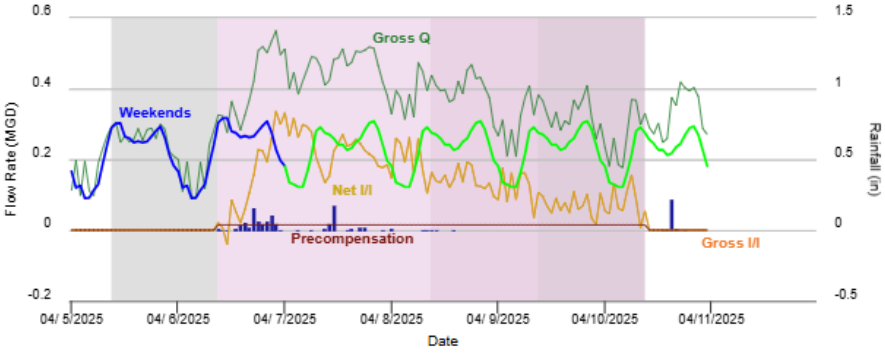



Gross Q
Net I/I
Weekends
Weekdays
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
0.9
0.6
0.3
0
-0.3
1.5
1
0.5
0
-0.5
02/14/2025
02/15/2025
02/16/2025
02/17/2025
02/18/2025
02/19/2025
02/20/2025

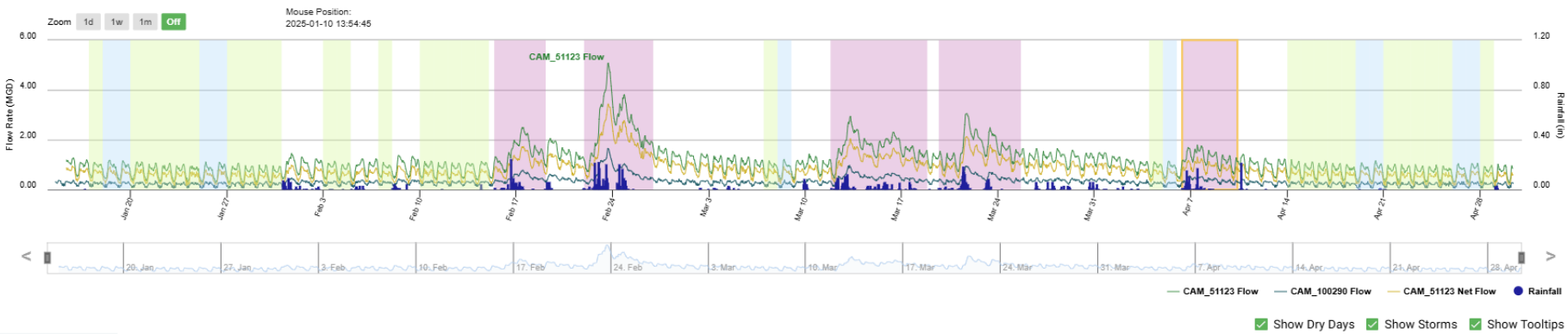

Gross Q
Net I/I
Weekends
Weekdays
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
1.8
1.2
0.6
0
-0.6
1.5
1
0.5
0
-0.5
02/21/2025
02/22/2025
02/23/2025
02/24/2025
02/25/2025
02/26/2025
02/27/2025


Gross Q
Weekdays
Weekends
Precompensation
Net I/I
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
1.2
0.8
0.4
0
-0.4
1.5
1
0.5
0
-0.5
03/10/2025
03/11/2025
03/12/2025
03/13/2025
03/14/2025
03/15/2025
03/16/2025
03/17/2025
03/18/2025
03/19/2025


Gross Q
Weekdays
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
1.2
0.8
0.4
0
-0.4
1.5
1
0.5
0
-0.5
03/18/2025
03/19/2025
03/20/2025
03/21/2025
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03/23/2025
03/24/2025
03/25/2025
03/26/2025

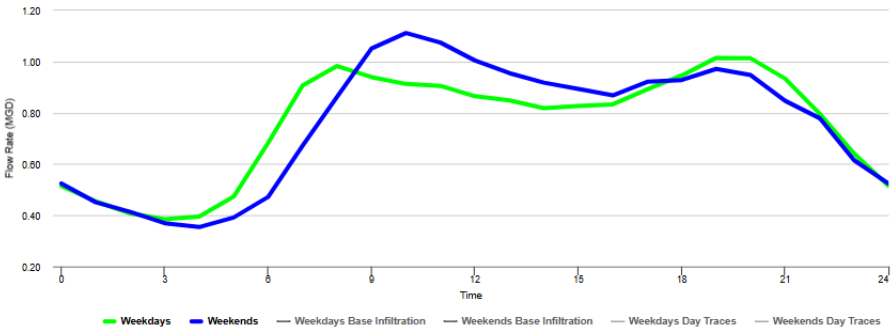

Gross Q
Weekends
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
0.6
0.4
0.2
0
-0.2
1.5
1
0.5
0
-0.5
04/ 5/2025
04/ 6/2025
04/ 7/2025
04/ 8/2025
04/ 9/2025
04/10/2025
04/11/2025

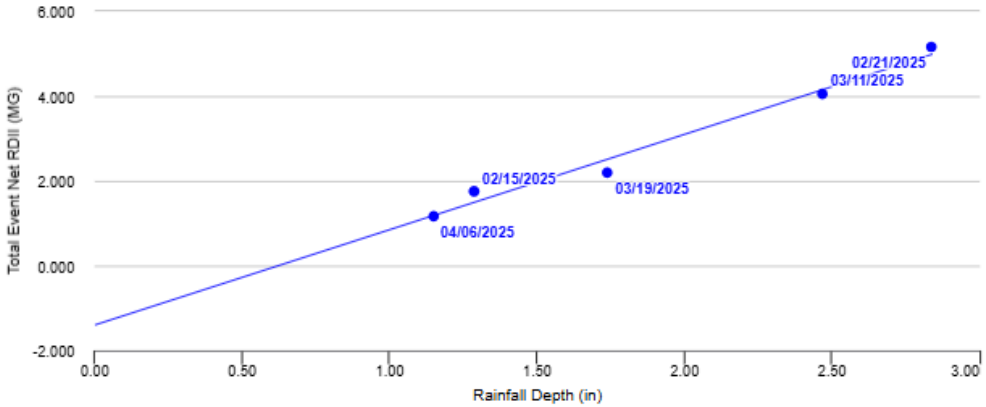
Hydrograph with Basin Rainfall: 01/14/2025 - 04/30/2025 | Basin CAM_51123 | Edit Dry Days

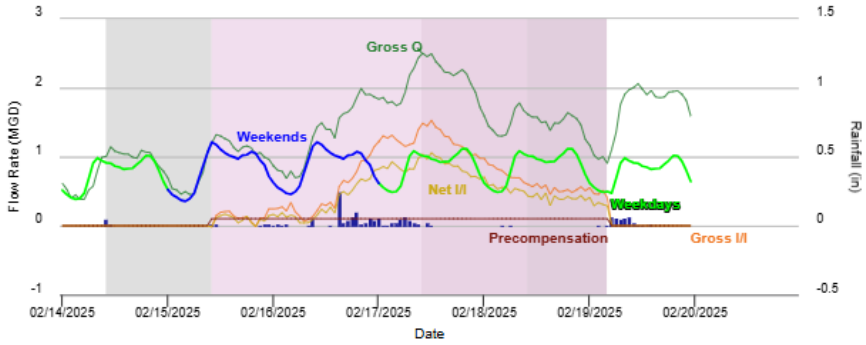


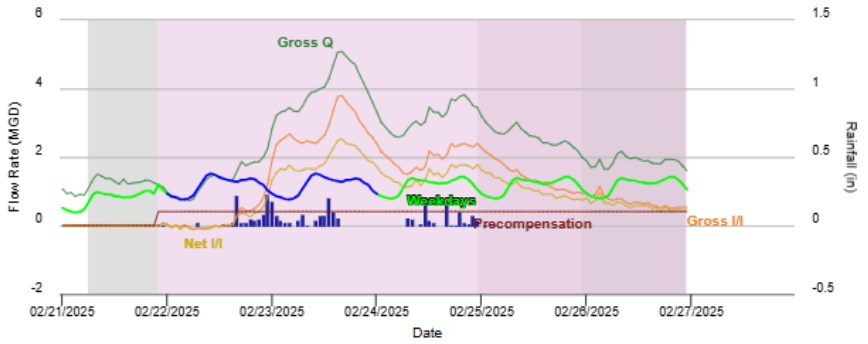
DRY DAYS | STORM EVENTS | STATISTICS

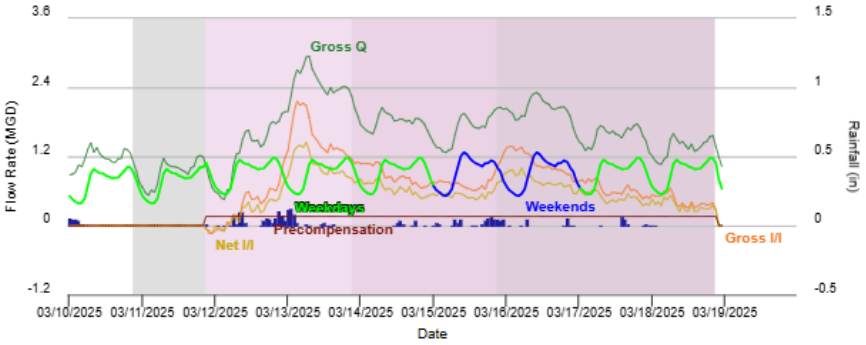
Dry Day Hydrograph

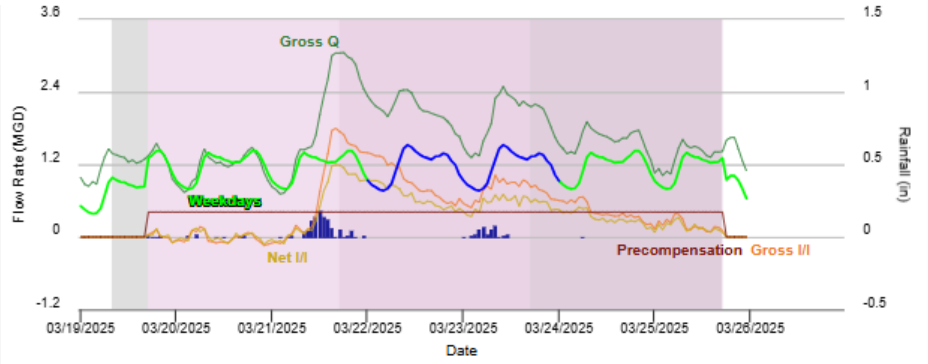


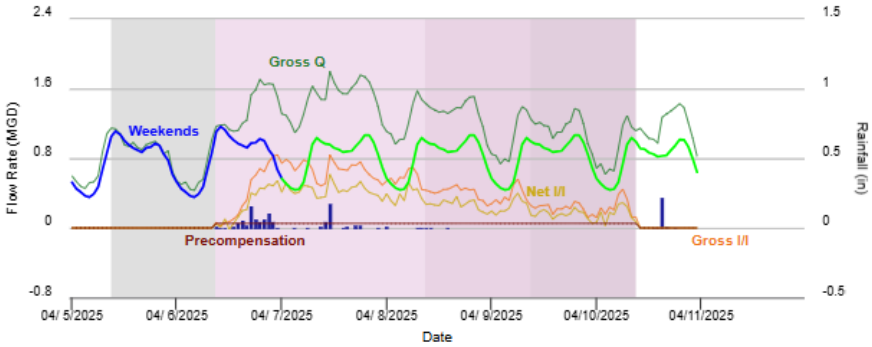



Gross Q
Weekends
Net I/I
Weekdays
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
02/14/2025
02/15/2025
02/16/2025
02/17/2025
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02/19/2025
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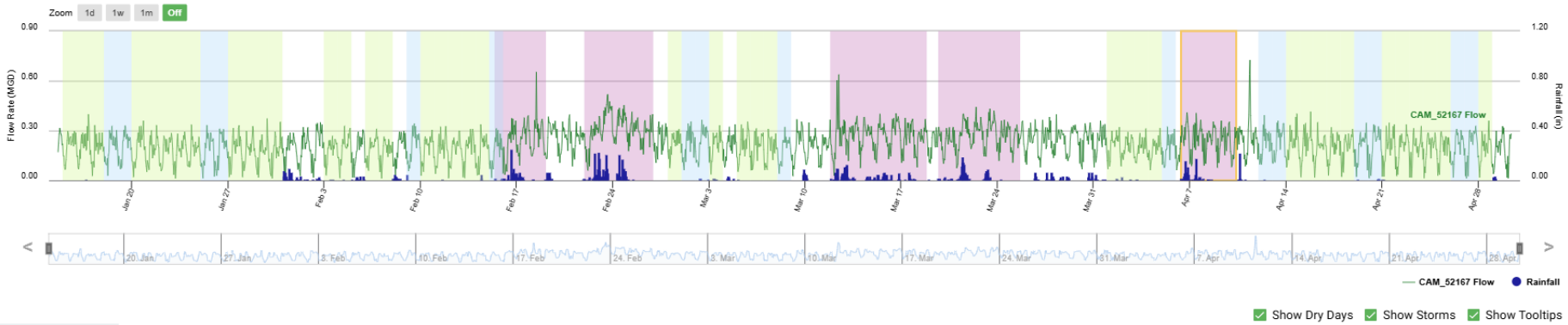

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Weekdays
Precompensation
Gross I/I
Net I/I
Flow Rate (MGD)
Rainfall (in)
Date
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02/22/2025
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02/24/2025
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02/27/2025


Gross Q
Weekdays
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Precompensation
Net I/I
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Flow Rate (MGD)
Rainfall (in)
Date
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Gross Q
Weekdays
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Flow Rate (MGD)
Rainfall (in)
Date
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Gross Q
Weekends
Net I/I
Precompensation
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Flow Rate (MGD)
Rainfall (in)
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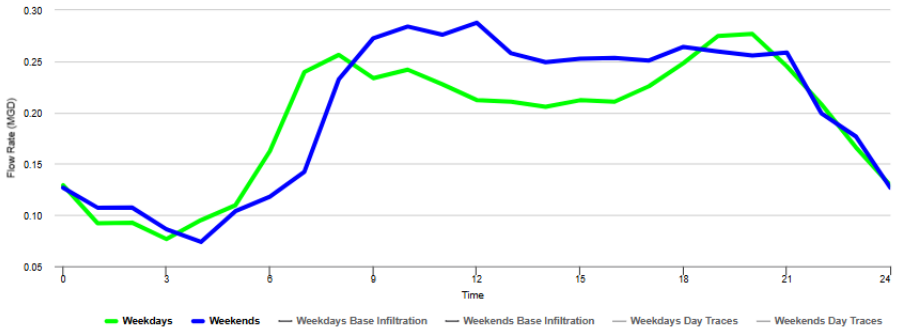
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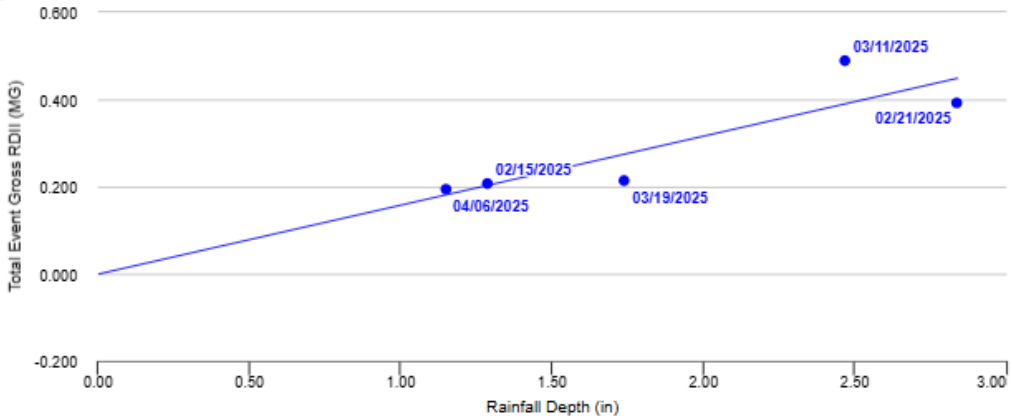


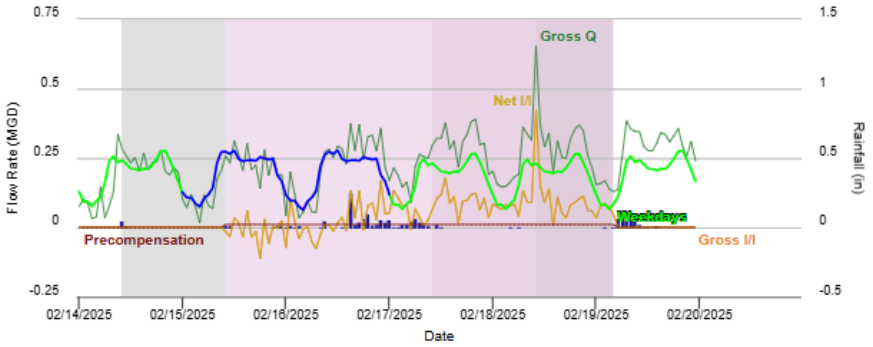
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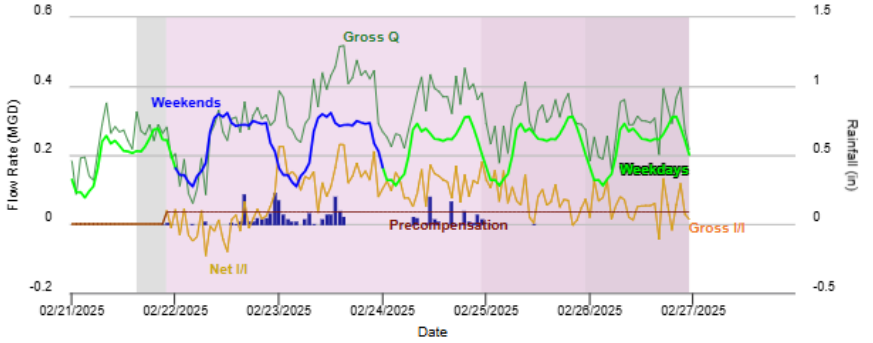
DRY DAYS | STORM EVENTS | STATISTICS

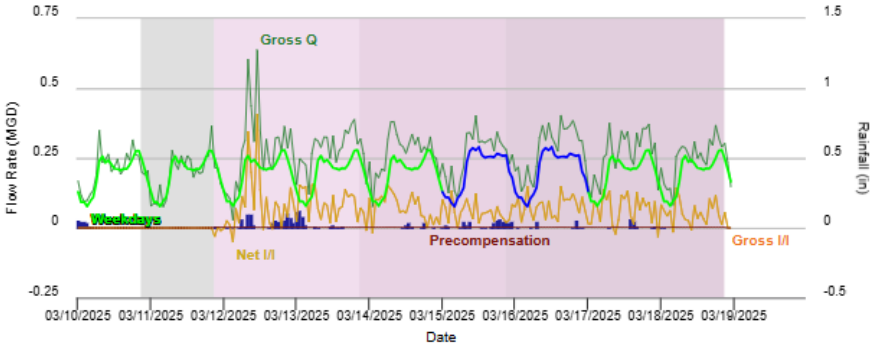
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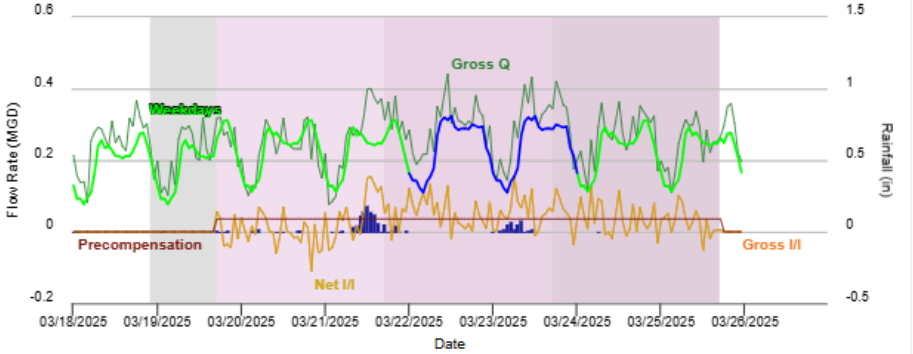


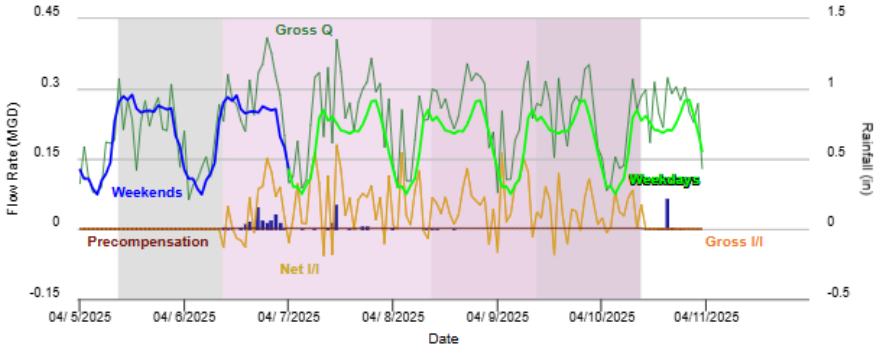



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Precompensation
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Flow Rate (MGD)
Rainfall (in)
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1.5
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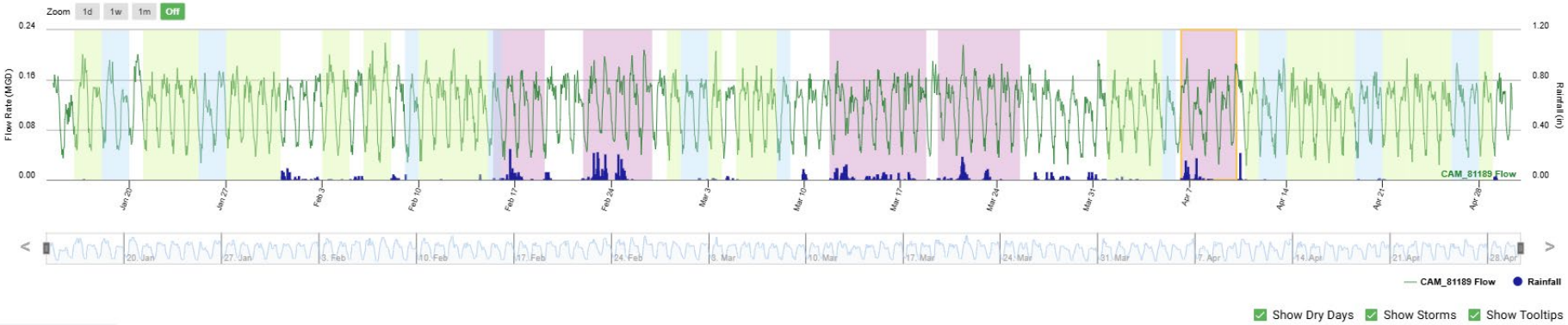

Gross Q
Weekends
Weekdays
Precompensation
Gross I/I
Net I/I
Flow Rate (MGD)
Rainfall (in)
Date
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0.2
0
-0.2
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02/21/2025
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02/27/2025


Gross Q
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Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
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Gross Q
Weekdays
Precompensation
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Flow Rate (MGD)
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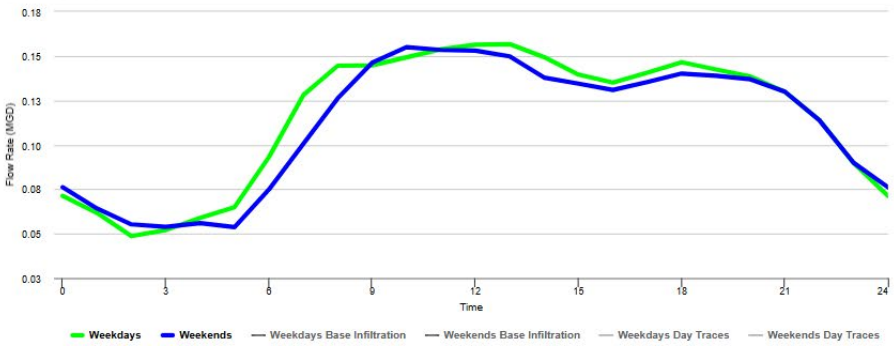

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Weekdays
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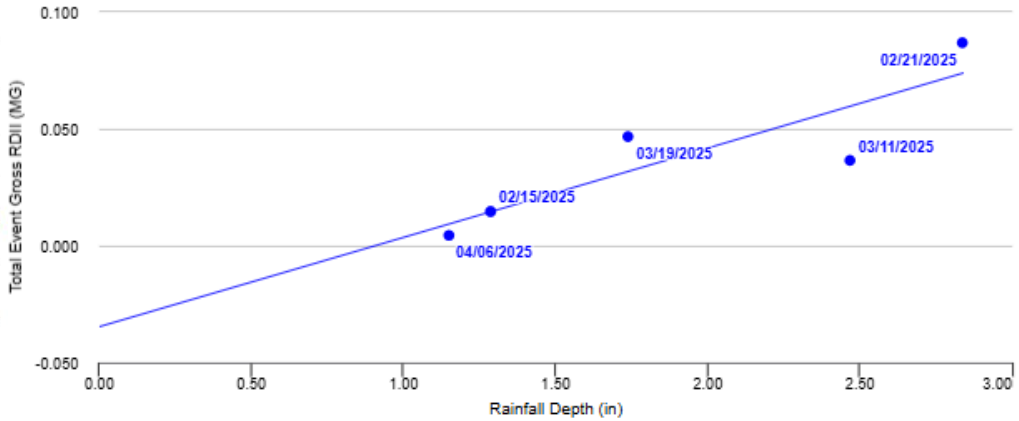
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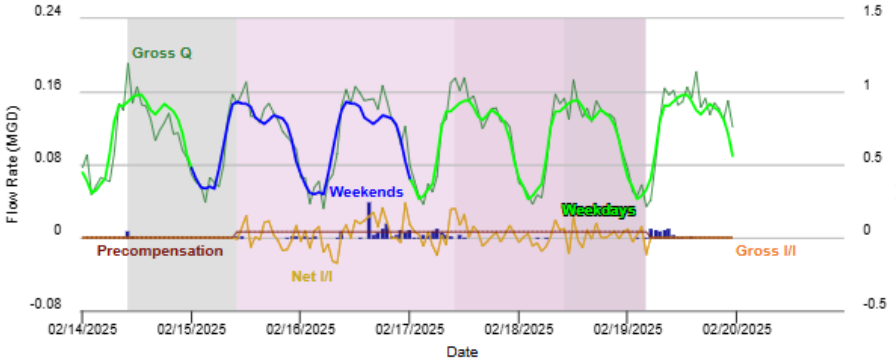


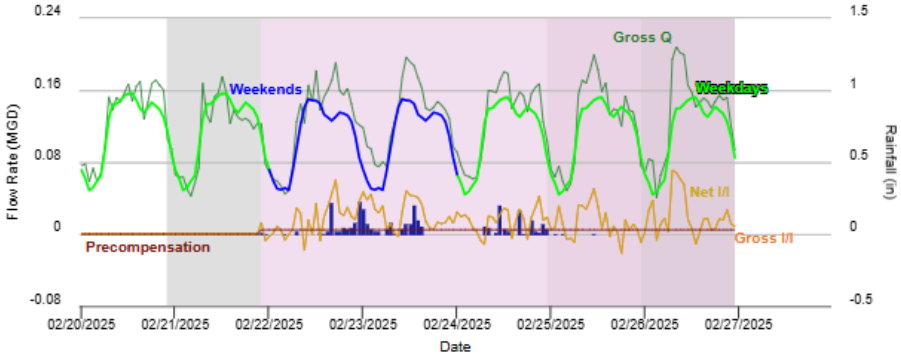
DRY DAYS | STORM EVENTS | STATISTICS

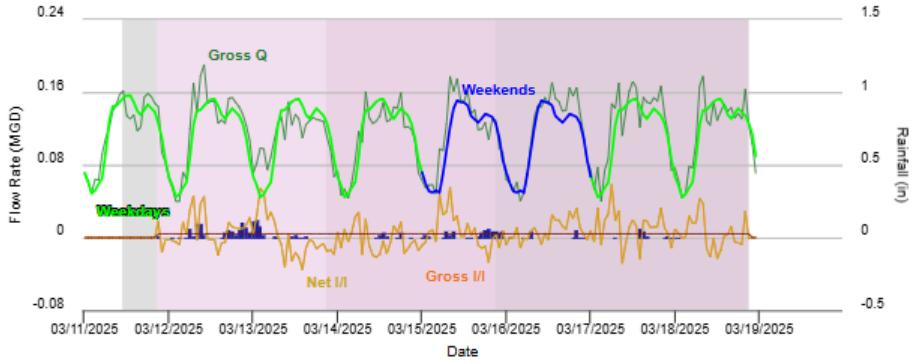
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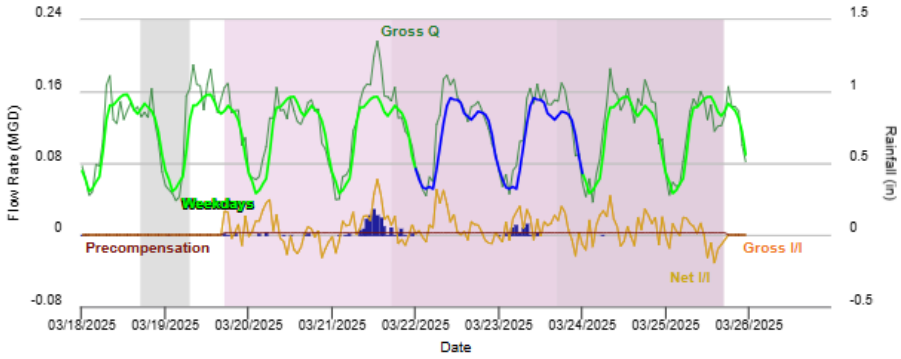


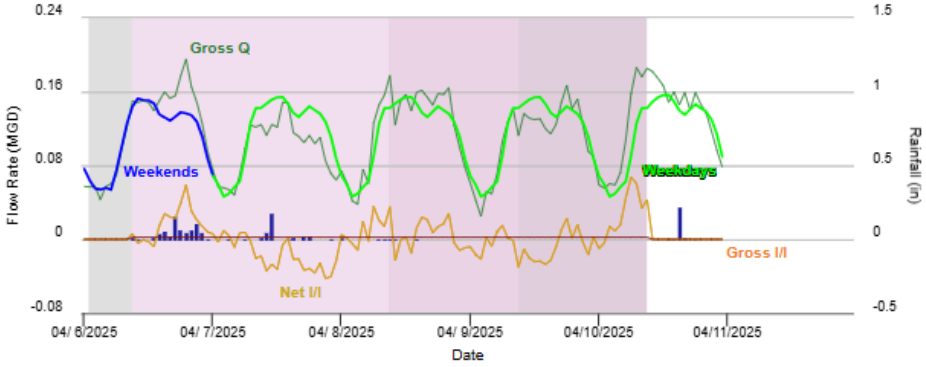



Gross Q
Weekends
Weekdays
Precompensation
Net I/I
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
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0.08
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1.5
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02/14/2025
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Gross Q
Weekends
Weekdays
Net I/I
Precompensation
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
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02/20/2025
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02/26/2025
02/27/2025


Gross Q
Weekends
Weekdays
Net I/I
Gross I/I
Flow Rate (MGD)
Rainfall (in)
Date
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0.08
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1.5
1
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03/11/2025
03/12/2025
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03/19/2025


Gross Q
Weekdays
Precompensation
Gross I/I
Net I/I
Flow Rate (MGD)
Rainfall (in)
Date
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0.16
0.08
0
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1
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03/18/2025
03/19/2025
03/20/2025
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03/22/2025
03/23/2025
03/24/2025
03/25/2025
03/26/2025


Gross Q
Weekends
Weekdays
Gross I/I
Net I/I
Flow Rate (MGD)
Rainfall (in)
Date
0.24
0.16
0.08
0
-0.08
1.5
1
0.5
0
-0.5
04/ 6/2025
04/ 7/2025
04/ 8/2025
04/ 9/2025
04/10/2025
04/11/2025

ATTACHMENT B

ADWF DEVELOPMENT REVIEW PACKET

ADWF DEVELOPMENT REVIEW PACKET

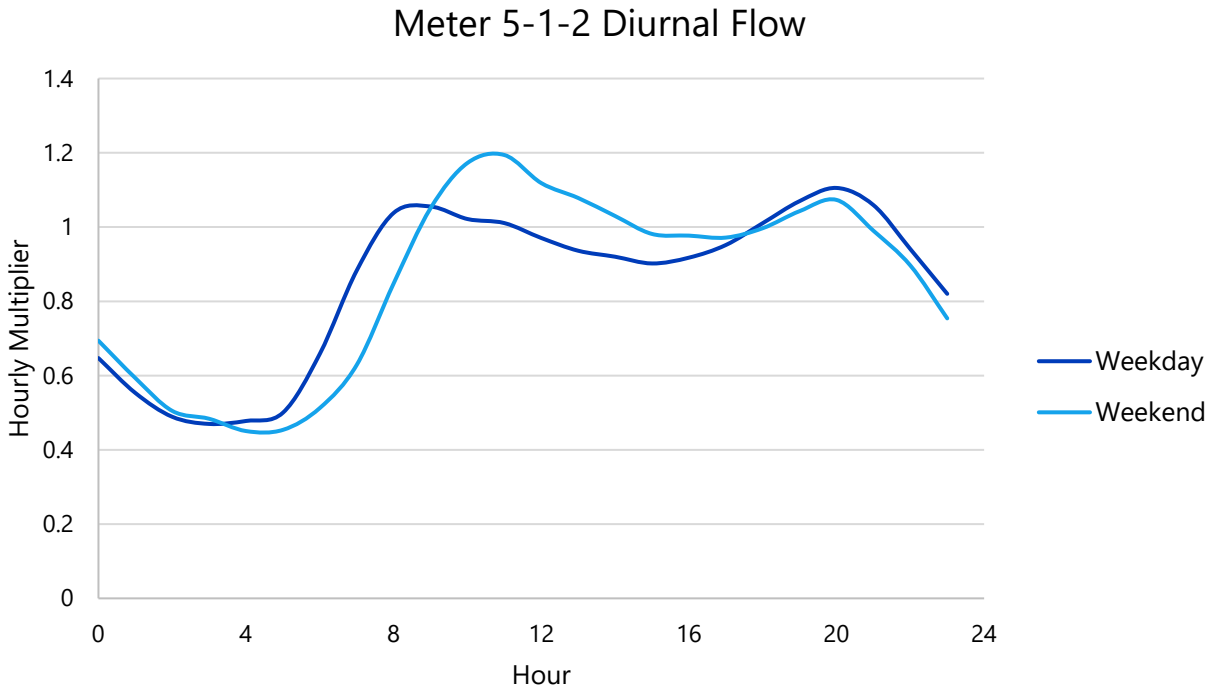


Figure B.1 Meter 5-1-2 Diurnal Flow

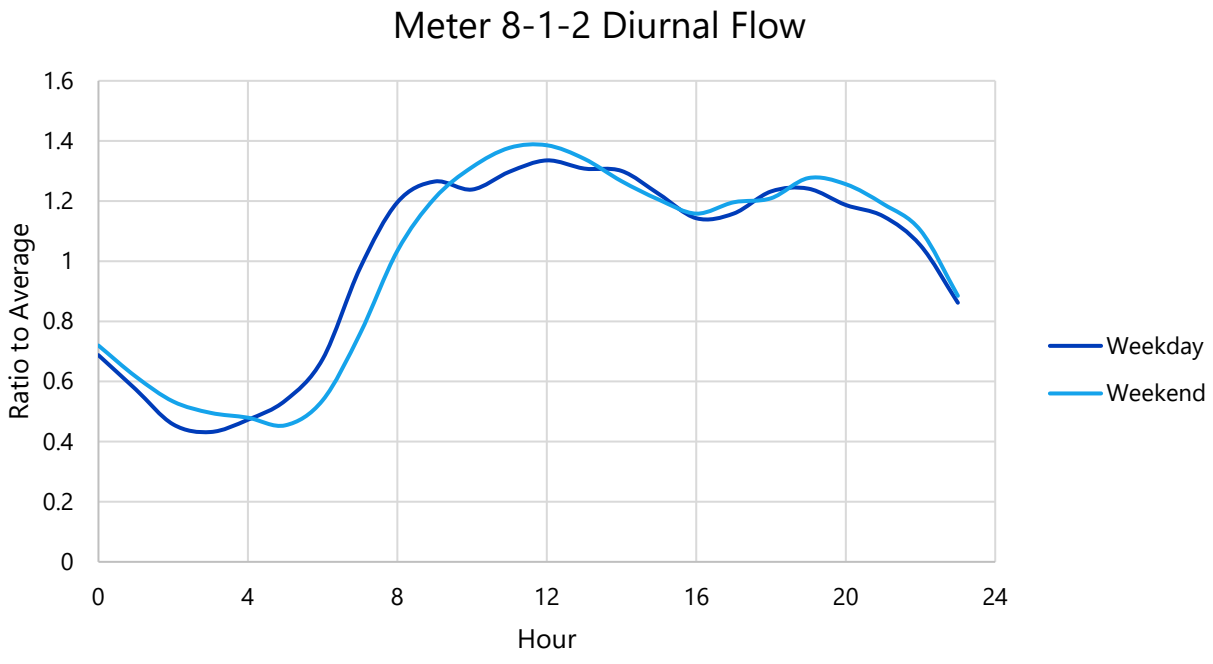


Figure B.2 Meter 8-1-2 Diurnal Flow

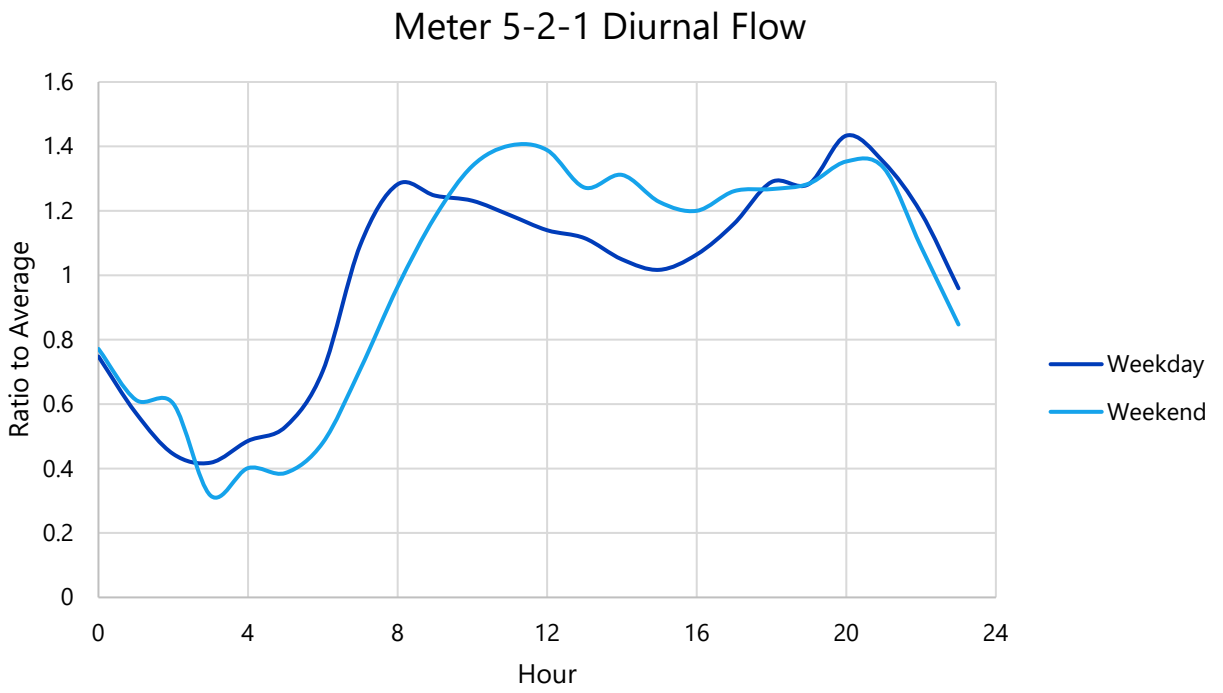


Figure B.3 Meter 5-2-1 Dry Weather Flow

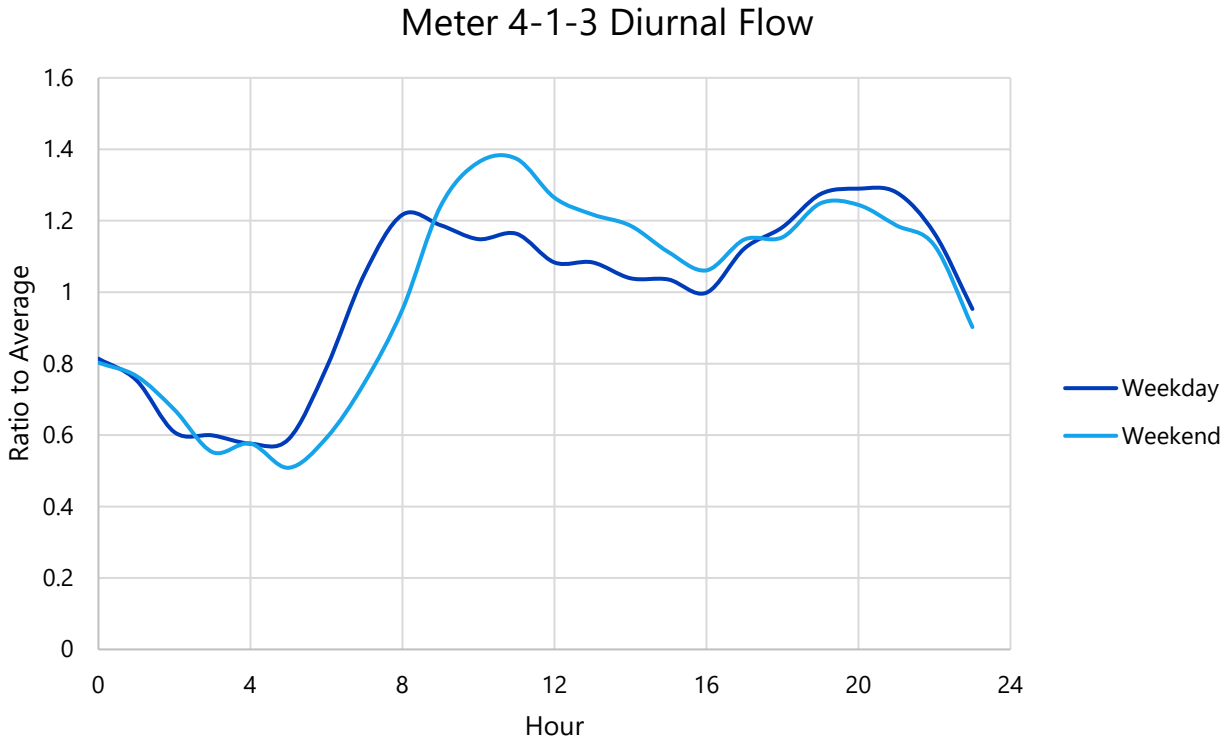


Figure B.4 Meter 4-1-3 Diurnal Flow

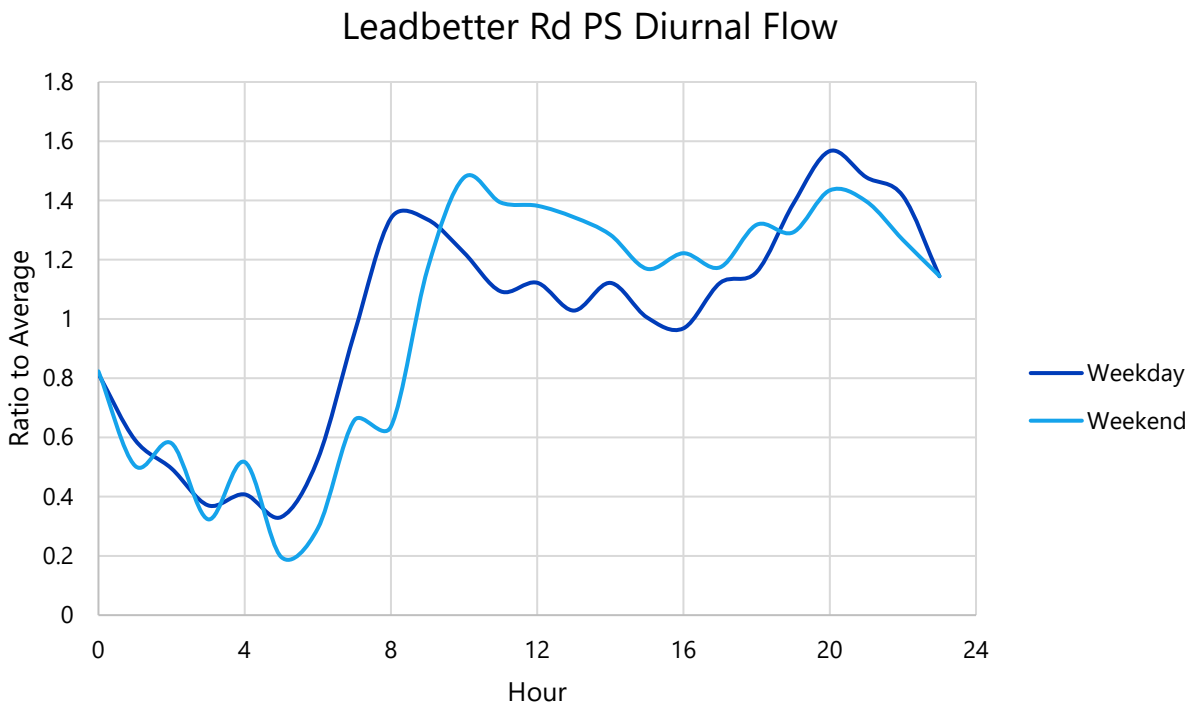


Figure B.5 Leadbetter Rd PS Diurnal Flow

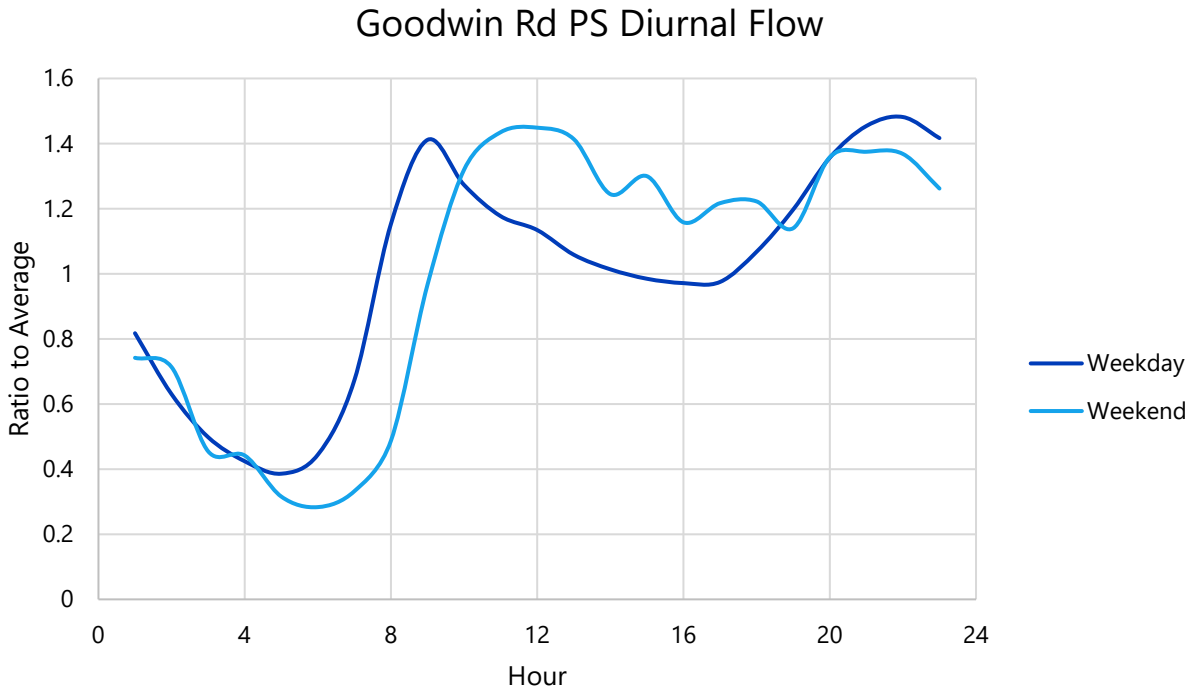


Figure B.6 Goodwin Rd PS Diurnal Flow

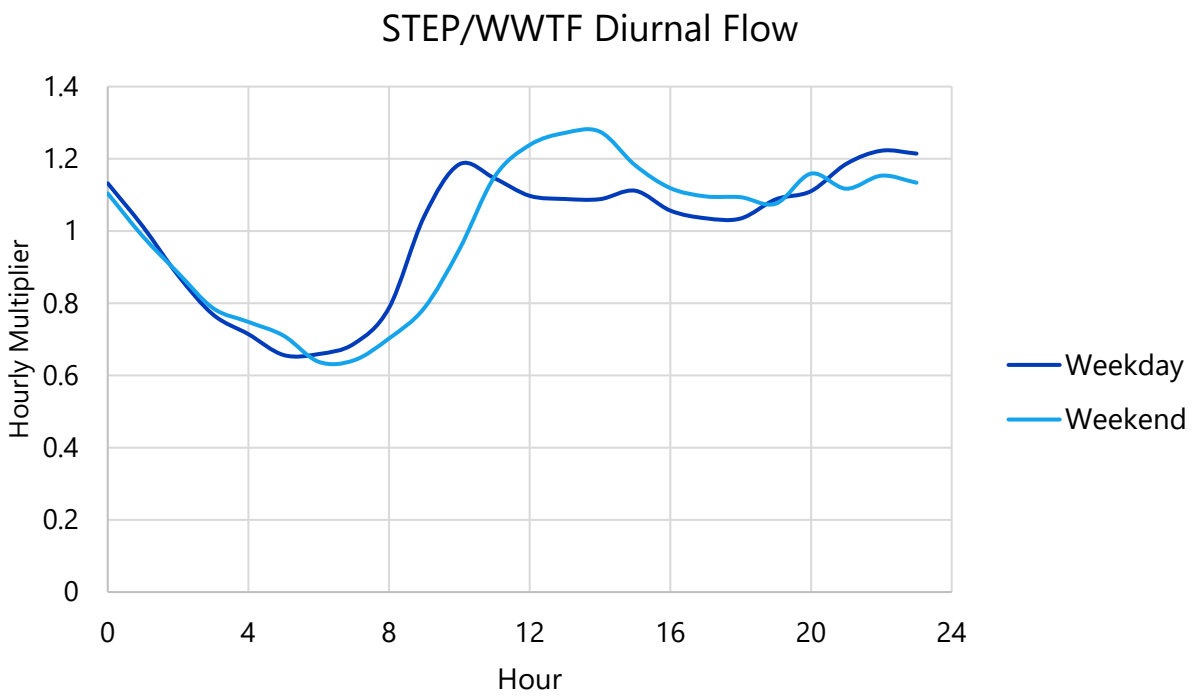


Figure B.7 STEP/WWTF Diurnal Flow

ATTACHMENT C

DRAFT 2045 COMPREHENSIVE PLAN



ourCamas 2045

DRAFT - *Last Updated July 2025*

Comprehensive Plan

ourCamas 2045

Acknowledgements

Thank you to the members of the Camas community for sharing your time and insights in the development of Our Camas 2045.

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ourCamas 2045



Vision

01

01. Vision

Our Camas Vision Statement

This vision is written in the present tense, as if describing the city as it exists in 2045. Some aspects of the vision can be found in Camas today, while others represent aspirations. The vision provides a framework for the goals and policies of every element of Our Camas 2045.

Our Community



Camas is an inclusive community where residents experience a sense of belonging and connection. Community-wide events foster civic pride, strong bonds among neighbors and a welcoming atmosphere for new residents. Community amenities and recreation facilities throughout Camas promote active lifestyles and social interaction. Camas is recognized for excellent schools and its commitment to lifelong learning. The City promotes a strong culture of public safety, transparent communication, and good governance, allowing residents to thrive in their neighborhoods and engage in decision-making that shapes their community.

Our Environment



Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Our Neighborhoods



Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Our Downtown



Charming, vibrant, and walkable, Downtown Camas is the city's living room. Downtown's history is complemented by new businesses and inclusive housing options. Expansion, resiliency and a dynamic economic landscape are critical to its success. Downtown Camas anchors the community while fostering a culture of pride, support, and connection.

ourCamas 2045



Introduction

02

02. Introduction

Our Camas 2045

Our Camas 2045 is a roadmap for the future of the city and guides land use development and public facility investment decisions between now and 2045.

Camas has a long and rich history. More than 10,000 years ago, Native Americans occupied the Columbia River Valley. The Lewis and Clark Corps of Discovery camped by the river in 1806. In the late 1800s, the La Camas Colony Company of Portland purchased 2,600 acres and began planning the construction of a paper mill to supply newsprint for The Oregonian. The construction of the mill brought the platting of the town and the City of Camas was incorporated in 1906. Today, Camas is a vibrant and diverse community that occupies approximately 16 square miles and is home to over 27,000 people.

Our Camas 2045 is an update to the prior City of Camas comprehensive plan, Camas 2035. This update incorporates new state legislation to support additional housing and climate planning and establishes a new vision for the community's future.

The history of Camas comprehensive planning dates back to 1963 when the first plan was prepared. In 1990, the state adopted the Growth Management Act (GMA) with the goal of managing the growth of cities that had previously grown in an uncoordinated fashion. GMA requires municipalities to update their comprehensive plans every 10 years to ensure future growth can be accommodated with housing and jobs, and public services and facilities are available to serve new residential, commercial, and employment areas.

The last major update to the City's comprehensive plan was in 2016. Since that time, the city has grown by over 5,000 people, added new residential areas in Grass Valley and Green Mountain, and completed the North Shore Subarea Plan, which established a new vision and zoning for the North Shore of Lacamas Lake and sets the stage for future residential, mixed use, and employment development. In conjunction with Our Camas 2045, the city prepared a downtown subarea plan. Our Downtown 2045 establishes a detailed vision and action plan to catalyze public and private investment in the historic downtown. Both plans work together to guide future development and ensure Camas' future remains as vibrant as its past.

What is a Comprehensive Plan?

Our Camas 2045 guides land use development and public facility investment decisions between now and 2045. Our Camas 2045 has eight elements that work together to achieve the community's vision and ensure long-term economic vitality:

- Community Character
- Land Use
- Housing
- Natural Environment
- Climate Change & Resiliency
- Transportation
- Public Facilities & Services
- Economic Development

Each element sets goals that will implement the vision and expresses policies that will guide land use and infrastructure decisions for the 20-year planning horizon. The elements are supported by the comprehensive plan map, which identifies land use designations throughout the City and within its urban growth area.1

Why Plan?

Planning is choosing what to do and how and when to do it. Planning is part of our everyday lives. We plan our vacations, our budgets, and even our trips to the grocery store. The detailed planning of our daily lives derives from a set of goals that we want to accomplish – in a day, in the next six months, or the next two years.

In the same way and for the same purpose, the City's plan is the basis of coordinated action – it enables public and private interests to undertake projects with a clear understanding of community goals and policies.

Our Camas 2045 helps the City identify deficiencies and take steps to remedy them. Planning can find desirable and reasonable solutions before the problem is beyond the community's economic capabilities. The plan is crucial to avoiding uncoordinated activities as the City adapts to changing conditions and experiences the population growth that is anticipated.

The plan is not intended as a rigid system of goals and development policies; rather, it is:

- Long range – looks ahead 20 years to anticipate growth and resulting community needs.
- Comprehensive – relates and integrates all types of uses and necessary public facilities.
- General – establishes general locations and areas for the elements and indicates their relationships to each other and the population they serve.
- Responsive – through regular updates, adjusts to changing conditions, unforeseen circumstances, and local and regional trends.

How is a Comprehensive Plan Related to Other Plans?

Our Camas 2045 is part of a family of state, regional, and local plans. Some, like statewide GMA and Clark County's Comprehensive Growth Management Plan, set the overall planning framework and guide the content of the Camas comprehensive plan.

Others, like plans that are specific to particular subareas, supply more detailed information about individual topics or smaller parts of the City.

Growth Management Act

The GMA establishes state goals, sets deadlines for compliance, and offers direction on how to prepare comprehensive plans and development regulations. GMA also establishes requirements for early and continuous public participation. GMA requires state and local governments to manage growth by identifying and protecting critical areas and natural resource lands, designating urban growth areas, and preparing comprehensive plans and implementing them through capital investments and development regulations.

The GMA legislation, which is Chapter 36.70A of the Revised Code of Washington (RCW), contains 15 goals.

For a community's plan to be valid, it must meet the requirements of the GMA through consistency with state statutory goals, countywide policies, and the plans of adjacent jurisdictions.

The fifteen statutory goals identified in the GMA (RCW 36.70A) are:

1. **Urban growth**. Encourage development in urban areas where adequate public facilities and services exist or can be provided in an efficient manner.
2. **Reduce sprawl.** Reduce the inappropriate conversion of undeveloped land into sprawling, low-density development.
3. **Transportation.** Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.
4. **Housing.** Plan for and accommodate housing affordable to all economic segments of the population of this state, promote a variety of residential densities and housing types, and encourage preservation of existing housing stock.
5. **Economic development.** Encourage economic development throughout the state that is consistent with adopted comprehensive plans, promote economic opportunity for all citizens of this state, especially for unemployed and for disadvantaged persons, promote the retention and expansion of existing businesses and recruitment of new businesses, recognize regional differences impacting economic development opportunities, and encourage growth in areas experiencing insufficient economic growth, all within the capacities of the state's natural resources, public services, and public facilities.
6. **Property rights.** Private property shall not be taken for public use without just compensation having been made. The property rights of landowners shall be protected from arbitrary and discriminatory actions.
7. **Permits.** Applications for both state and local government permits should be processed in a timely and fair manner to ensure predictability.

8. **Natural resource industries.** Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forestlands and productive agricultural lands, and discourage incompatible uses.
9. **Open space and recreation.** Retain open space and green space, enhance recreational opportunities, enhance fish and wildlife habitat, increase access to natural resource lands and water, and develop parks and recreation facilities.
10. **Environment.** Protect and enhance the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.
11. **Citizen participation and coordination.** Encourage the involvement of citizens in the planning process, including the participation of vulnerable populations and overburdened communities, and ensure coordination between communities and jurisdictions to reconcile conflicts.
12. **Public facilities and services.** Ensure that those public facilities and services necessary to support development shall be adequate to serve the development at the time the development is available for occupancy and use without decreasing current service levels below locally established minimum standards.
13. **Historic preservation.** Identify and encourage the preservation of lands, sites, and structures, that have historical or archaeological significance.
14. **Climate change and resiliency.** Ensure that comprehensive plans, development regulations, and regional policies, plans, and strategies under RCW 36.70A.210 and chapter 47.80 RCW adapt to and mitigate the effects of a changing climate; support reductions in greenhouse gas emissions and per capita vehicle miles traveled; prepare for climate impact scenarios; foster resiliency to climate impacts and natural hazards; protect and enhance environmental, economic, and human health and safety; and advance environmental justice.
15. **Shorelines of the state.** For shorelines of the state, the goals and policies of the shoreline management act as set forth in RCW 90.58.020 shall be considered an element of the county's or city's comprehensive plan.

Urban Growth Areas

An urban growth area is a defined area of land adjacent to city limits within which urban growth is encouraged and beyond which growth can occur only if it is not urban in nature.

Each county that adopts a comprehensive plan under the GMA must designate urban growth areas. The City of Camas has 11,848 acres of land within the urban growth areas. This land, combined with the vacant land available within the City limits, must accommodate the City's population and employment projections as established by the state's Office of Financial Management. The population and employment projections for the City for the year 2045 are 37,080 people and 11,615 jobs. The City is proposing urban growth area expansion to accommodate increased job capacity (see the Land Use Element for additional details).

County Planning Goals and Policies

The Comprehensive Growth Management Plan, adopted by Clark County and its cities and last updated in 2016, guides local jurisdictions as they work to decide questions of regional land use and services.

Clark County is in the final stages of fully updating this plan for 2025 through 2045. As County and city plans were developed, representatives of the City of Camas met on a regular basis over the span of two years with officials of the County and its cities to coordinate efforts. This level of communication helps ensure that the plans and capital projects of these jurisdictions are consistent when adopted. Our Camas 2045 is consistent with the concepts put forward in the County's Comprehensive Growth Management Plan, and the initial drafts of its pending comprehensive plan, and the countywide planning policies as required by RCW 36.70A.100 and 210, WAC 365-196-305; 400(2)(c); 510 and 520.

Local Plans

The goals and policies included in Our Camas 2045 are implemented through development regulations established in the Camas Zoning Code (Title 18 of the Camas Municipal Codes) as well as the standards set forth in existing plans and policy documents.

Our Camas 2045 has been developed to ensure consistency with all other relevant local plans as listed below:

- Strategic Plan (updated annually)
- Legacy Lands Master Plan (in development)
- Lake Management Plan (2024)
- North Shore Subarea Plan (October 2022)
- Camas Water System Plan (October 2019)
- Camas General Sewer Plan (June 2022)
- Camas General Sewer/Wastewater Facility Plan (November 2011)
- City of Camas Parks, Recreation, and Open Space Comprehensive Plan (March 2022)
- Camas Design Standards Manual–Engineering (adopted October 20, 2014, Res. 1308, updated annually)
- Camas Design Review Manual (May 2, 2016)
- Camas Shoreline Master Program (spring 2021)
- Downtown Design Manual (revision in process, to be adopted with Our Downtown Camas 2045, the Downtown Subarea Plan)
- Camas Stormwater Design Standards Manual (June 2022)
- Six-Year Street Plan (Updated annually)
- 2025–2030 Capital Facilities Plan Project List (to be updated with Our Camas 2045)
- Transportation Impact Fee Update (May 2012)

Amending a Comprehensive Plan

The City is required to review its comprehensive plan at least every ten years. However, the City's comprehensive plan and development regulations are reviewed and evaluated regularly.

Our Camas 2045 is based on the best available information. As years go by, new information or changing circumstances – for instance, a revised sewer or water plan – may prompt changes to this plan. By state law, amending a comprehensive plan can occur only once a year and must follow the procedures that are set forth in RCW 36.70A.130.

Amendments to a comprehensive plan require legislative action, which entails the adoption of a resolution or ordinance following notice and public hearing indicating, at a minimum, a finding that a review and evaluation has occurred and identifying the revisions made, or that a revision was not needed and the reasons.

The review and evaluation must include the consideration of critical area ordinances, population projections, and other plans and policies in effect.

Under certain circumstances, amendments can occur more frequently:

- The initial adoption of a subarea plan. Subareas must clarify, supplement, or implement jurisdiction-wide comprehensive plan policies, and may only be adopted if the cumulative impacts of the proposed plan are addressed by appropriate environmental review under chapter 43.21C RCW.
- The development of an initial subarea plan for economic development located outside of the 100 year floodplain in a county that has completed a state-funded pilot project that is based on watershed characterization and local habitat assessment
- The adoption or amendment of a shoreline master program under the procedures set forth in Chapter 90.58 RCW.
- The amendment of the capital facilities element of a comprehensive plan that occurs concurrently with the adoption or amendment of a county or city budget.
- The adoption of comprehensive plan amendments necessary to enact a planned action under RCW 43.21C.440, provided that amendments are considered in accordance with the public participation program established by the county or city under this subsection (2)(a) and all persons who have requested notice of a comprehensive plan update are given notice of the amendments and an opportunity to comment.

Developing Our Camas 2045

Our Camas 2045 began with a citywide outreach process to better understand the community's vision and priorities related to Camas' future. The Our Camas Visioning process reached over 1,000 community members through community conversations, community events, an online survey, online mapping tools, and the project website.

The City hosted two Community Summits. The first, held in June 2024, was an open house event where members of the public could provide feedback on the draft vision statement and goals, as well as provide ideas to achieve the vision and goals. The second Community Summit was held in October 2024 and provided a forum for community members to provide feedback on the draft land use alternatives, development scales, review development concepts for downtown, and learn about the County's climate planning efforts and greenhouse gas inventory.

There were several advisory committees that participated in the development of the plan.

- Project Advisory Committee (PAC) – technical stakeholders, agency partners, service providers
- Community Advisory Community (CAC) – broad cross-section of community interests

- Climate Policy Advisory Team (CPAT) – community members advising on climate goals and policies
- Existing advisory bodies that consulted on the vision, goals, policies, and plan:
    - Downtown Camas Association (DCA)
    - City Council
    - Planning Commission

Following preparation of the draft plan, the City hosted pop-up events throughout the summer and fall of 2025 to seek input on the preferred alternative map and draft goals and policies.

In addition to the outreach efforts described above, the City maintained a public engagement website throughout the visioning process and the development of Our Camas 2045. During spring 2024, a community survey and interactive map gathered feedback from the community on things they like about Camas, things they would change in the future, important topics to address in the plan, and areas of opportunity or concern both downtown and in the wider Camas community. A second online survey accompanied the second community summit to seek input on the draft land use alternatives and development concepts for downtown. The City prepared a Story Map in Spring 2025 to present and obtain feedback on the preferred land use alternative and proposed zoning and comprehensive plan land use designation changes.

The City of Camas values residents' opinions and is committed to being responsive. The final comprehensive plan incorporates the contributions and comments from those who participated in the project engagement. A summary of all engagement activities is included in Appendix X.

ourCamas 2045



Community Character

03

Community Character

This element integrates art, culture, growth and identity into the comprehensive plan, while ensuring community engagement is inclusive and open.

03. Community Character

Vision

In 2045, Camas is an inclusive community where residents experience a sense of belonging and connection. The city's unique identity is defined by its small-town feel and the incorporation of the natural landscape into walkable neighborhoods and high-quality development. Camas maintains its distinct sense of place through inclusive community engagement, sustainable development practices, and intentional placemaking that reinforces Camas' beauty, livability, and lasting connection to nature.

Introduction

The community character element establishes a framework for preserving and enhancing the physical, cultural, and social characteristics that make Camas feel like Camas. Community character is shaped not only by the built environment, but also by the natural landscape, cultural identity, historic context, and the ways in which people engage with their surroundings. As Camas plans for continued growth through the 2045 horizon, this element ensures that the qualities residents value—such as the City's small-town atmosphere, its connection to nature, and its strong civic identity—are maintained and reinforced through thoughtful development, design standards, public investment, and public engagement.

Camas' natural and built environment is defined by its integration of the natural features of the land with the development of housing, commercial buildings and its connecting infrastructure. In 2025, the City of Camas is home to 16 parks, 12 miles of scenic trails, and over 1,060 acres of parks and open space. From the forested paths around Lacamas Lake to the many playgrounds throughout the city, the natural beauty of Camas is a defining part of community life.

Camas' diversifying community is comprised of just over 27,000 people and expected to grow to over 37,000 by 2045. While most people who live in Camas commute to nearby cities for employment, in 2025, there are approximately 9,550 jobs within the city with the largest employment sectors being education and

healthcare, followed by professional services. The Georgia Pacific Mill remains a significant part of the city's economic history and a symbol of Camas' working roots.

The majority of housing in Camas is single family detached homes. Most residents own their home, with renters making up 20% of residents. There are approximately 10,000 housing units in Camas in 2025. By 2045, the city needs to add 4,226 new units to support the growing population. Camas also needs a greater variety of housing types at a range of price points to meet residents' diverse needs. By 2045, new multifamily and mixed-use buildings near transit, in Downtown, North Shore, and along NW Parker Street and Pacific Rim Boulevard will expand options for existing and new residents. These future developments will complement the strong sense of place already present in Camas' established neighborhoods like Prune Hill, Crown Park, and Evergreen Terrace.

Access to public art and community events is an important priority to define and enhance the identity of Camas. Beloved local traditions like Camas Days, the Camas Farmers Markets, and seasonal parades and festivals foster a deep sense of connection and pride. New development will include and support inclusive public gathering spaces to host events, ensuring that the community spirit thrives as the city grows.

Key community resources to preserve and enhance include the existing built infrastructure, high quality schools, access to living wage jobs, parks, open space and recreational amenities, and the distinctive Downtown area, where historic storefronts, local restaurants, and venues like the Liberty Theatre draw residents and visitors alike.

The community will connect with city government and processes through accessible engagement and neighborhood leadership. Ongoing collaboration will help ensure that Camas remains a place where people feel heard, welcomed, and at home.

Community Character Goals and Policies

Goal CC-1 Art, Culture, and Heritage

Camas is a city where history, art, and culture are celebrated and accessible to all. Camas events and activities will instill a sense of belonging among residents of all ages, making Camas an ideal place to live and work.

Policy CC-1.1 Encourage and promote a wide range of artistic and cultural activities by reducing barriers and increasing access to hosting and attending community events that define and enhance Camas' community identity.

Policy CC-1.2 Incentivize development sites to create spaces conducive to the provision of art and other cultural activities and amenities. Encourage murals, sculptures, interactive art installations, and

interpretive displays that celebrate the history, culture, and creativity of Camas.

Policy CC-1.3 Develop a process to memorialize historic sites and create and maintain an official inventory of Camas' historic and cultural resources.

Policy CC-1.4 Support the formation of a local arts commission that provides funding and support for local artists and artistic events in Camas.

Policy CC-1.5 Require a percentage of capital project budgets to be allocated for public art and design enhancements.

Policy CC-1.6 Prioritize naming streets, parks, and public facilities after historically significant people, events, geographic features, or native flora and fauna. Consider allowing naming rights in recognition of significant donations.

Goal CC-2 Sustainable Growth and Distinct Identity

Camas' unique identity is enhanced by high-quality urban design that respects the natural landscape, fosters a connection to nature, and integrates sustainable development.

Policy CC-2.1 Establish and enforce clear and objective design standards to ensure that new development respects and enhances Camas' architectural, historical, and natural character.

Policy CC-2.2 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features, and natural contours of undeveloped properties.

Policy CC-2.3 Promote and provide educational resources for tree-lined streets, rain gardens, and preservation and use of native landscaping to reinforce Camas' connection to nature.

Policy CC-2.4 Align development regulations and design guidelines with dark sky standards to encourage the preservation of the night sky.

Policy CC-2.5 Establish distinctive gateway features at major points of entry into Camas, including attractive signage, landscaping, and public art that reflect Camas' distinct identity.

Policy CC-2.6 Ensure that street signage, lighting, landscaping, and street furniture are designed and maintained with a cohesive aesthetic that enhances community identity.

Policy CC-2.7 Revise the City's sign standards to ensure that all permanent and temporary signage is attractive and well-maintained, with clear regulations and enforcement mechanisms.

Policy CC-2.8 Provide educational and volunteer programs related to climate science, the connections between habitat conditions and native species, and effective ways to mitigate the impacts of climate change.

Goal CC-3 Community Engagement

Camas will have a strong sense of community through open communication, inclusive and meaningful outreach efforts, and enduring partnerships throughout the community.

Policy CC-3.1 Increase access to public engagement by ensuring materials and procedures are accessible for all community members, especially vulnerable groups such as low-income, Limited English Proficiency (LEP) individuals, youth, elderly, and differently abled.

Policy CC-3.2 Utilize outreach strategies such as focus groups and listening posts that accommodate the needs of everyone and account for the broad spectrum of community members.

Policy CC-3.3 Develop and implement strategies to support neighborhood leadership and associations to increase community involvement and provide opportunities to participate in the development processes.

Policy CC-3.4 Regularly inform the community of activities and events through a range of outreach methods including traditional and social media, partnerships with schools, and information at fairs and events.

Policy CC-3.5 Develop a City education program to inform the community on the inner workings of their local government, city functions, and an opportunity to engage with staff.

ourCamas 2045



Land Use

04

Land Use Element

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past.

04. Land Use

Vision

Camas embraces its small-town feel while responsibly managing growth, ensuring a prosperous and livable future for all. Camas provides a variety of housing options that meet the needs of all residents, while ensuring the town's charm and livability are sustained. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities and access to high wage jobs. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity.

Land Use Overview

The City of Camas is home to great schools, family-wage jobs, high quality neighborhoods, and an abundance of open space and recreational amenities. Camas has grown into a dynamic, vibrant city with diversified employment opportunities and services that cater to its residents' various needs. In 2025, Camas maintains its small town charm and character, and downtown remains the heart of the City with a mix of restaurants, shops, professional offices, and residential development. The Grass Valley area is home to several national and international technology and manufacturing firms. Newer residential development has occurred recently in the Green Mountain area, and planned transportation improvements in the North Shore area will improve connectivity and provide better transportation options throughout the City.

The land use element is designed to support development that adheres to the City's vision to ensure Camas' future is as bright as its past. The GMA identifies the land use element as the foundation of the comprehensive plan. GMA outlines the framework by which the plan will be implemented and establishes land use designations to accommodate the City's population and employment projections. The development of land in accordance with the goals and policies included in the land use element will ensure the achievement of an appropriate balance of public facilities, housing, employment, services, and recreational uses throughout the City.

Population Projections

GMA requires that each jurisdiction accommodate its share of the region's growth. The City of Camas is expected to have a population of 37,080 by 2045 (based on the County adopted growth rate of 1.2 percent per year), a 7,729-person increase from the 2023 population of 29,352. During the same period, Camas is expected to add 13,658 jobs.

Land Use Designations

In order to ensure the City's vision and land use goals are achieved, land use designations are used to assign a variety of development uses and building densities to land throughout the City. The plan identifies areas for residential, commercial, mixed use, mixed employment and industrial development. The plan also identifies areas for parks and open space to support recreation and enhance natural areas, including habitat and wildlife corridors.

Table 1 Land Use Designations

Comprehensive Plan Designation	Corresponding Zones	Total (Acres)[1]
Residential Low	Residential 15,000 (R-15)	407
	Residential 12,000 (R-12)	27
	Residential 10,000 (R-10)	280
	Residential 7,500 (R-7.5)	151
	Residential 6,000 (R-6)	19
	North Shore Lower Density (LD-NS)	145
	Downtown Residential (R-DT)	68
Residential Medium	Multi-Family 10 (MF-10)	37
Residential High	Multi-Family 18 (MF-18)	41
	Multi-Family 26 (MF-26)	33
	Multi-Family 34 (MF-34)	6
	North Shore Higher Density (HD-NS)	109
Mixed Use	Mixed Use (MX)	141
	North Shore Mixed-Use (MX-NS)	85
	Downtown Mixed-Use Low Rise (MX-LR)	41
	Downtown Mixed-Use Mid Rise (MX-MR)	55
Mixed Employment	Mixed Employment (ME)	235
	North Shore Mixed Employment (ME-NS)	99
Commercial	Neighborhood Commercial (NC)	2
	Community Commercial (CC)	63
	North Shore Commercial (C-NS)	54
	Regional Commercial (RC)	298

	Historic Main Street Core (HMSC)	17
Industrial	Heavy Industrial	545
Parks and Open Space	Neighborhood Park (NP) Special Use Park (SU) Open Space (OS)	1,343

[1]Total acres within each zoning designation are gross acres and inclusive of rights-of-way and infrastructure.

Overlays

In addition to the land use designations listed in Table 1, land use overlays further define appropriate uses and development standards for particular areas within the City. Overlays in Camas include an Airport Overlay and a Design Overlay. Development within all overlay areas must comply with the goals and policies of the underlying land use designation and the specific standards included in the overlay.

The Airport Overlay area applies to land adjacent to Grove Field, an airport owned and operated by the Port of Camas-Washougal and located northeast of Lacamas Lake. Grove Field adjoins the City's UGA and is proposed to be included in the UGA with this update. The Airport Overlay is designated to ensure land uses adjacent to the airport are compatible with air traffic and do not interfere with safe air navigation. For example, the comprehensive plan designation of lands adjacent to the airport is generally Mixed Employment, rather than residential, and the Airport Overlay area restricts uses tending to have higher concentrations of people, such as schools or hospitals.

The Design Overlay is a new overlay with the 2025 update and replaces the Gateways and Corridors Overlay included in the prior plan. The Design Overlay generally applies to the following locations. The specific extents of the overlay are included on the Camas Zoning Map.

- 6th Avenue
- 3rd Avenue
- Everett Street
- 38th Avenue
- Lake Road
- Green Mountain - Goodwin
- Brady Road
- Union Street
- Parker Street

The Design Overlay is intended to enhance the walkability, pedestrian experience, and design of the corridors it covers. Development/redevelopment within a designated Design Overlay must adhere to the Design Overlay goals and policies included in this element. See Goal LU-6 and Policies LU-6.1 – 6.7.

Figure 2 Comprehensive Plan Map

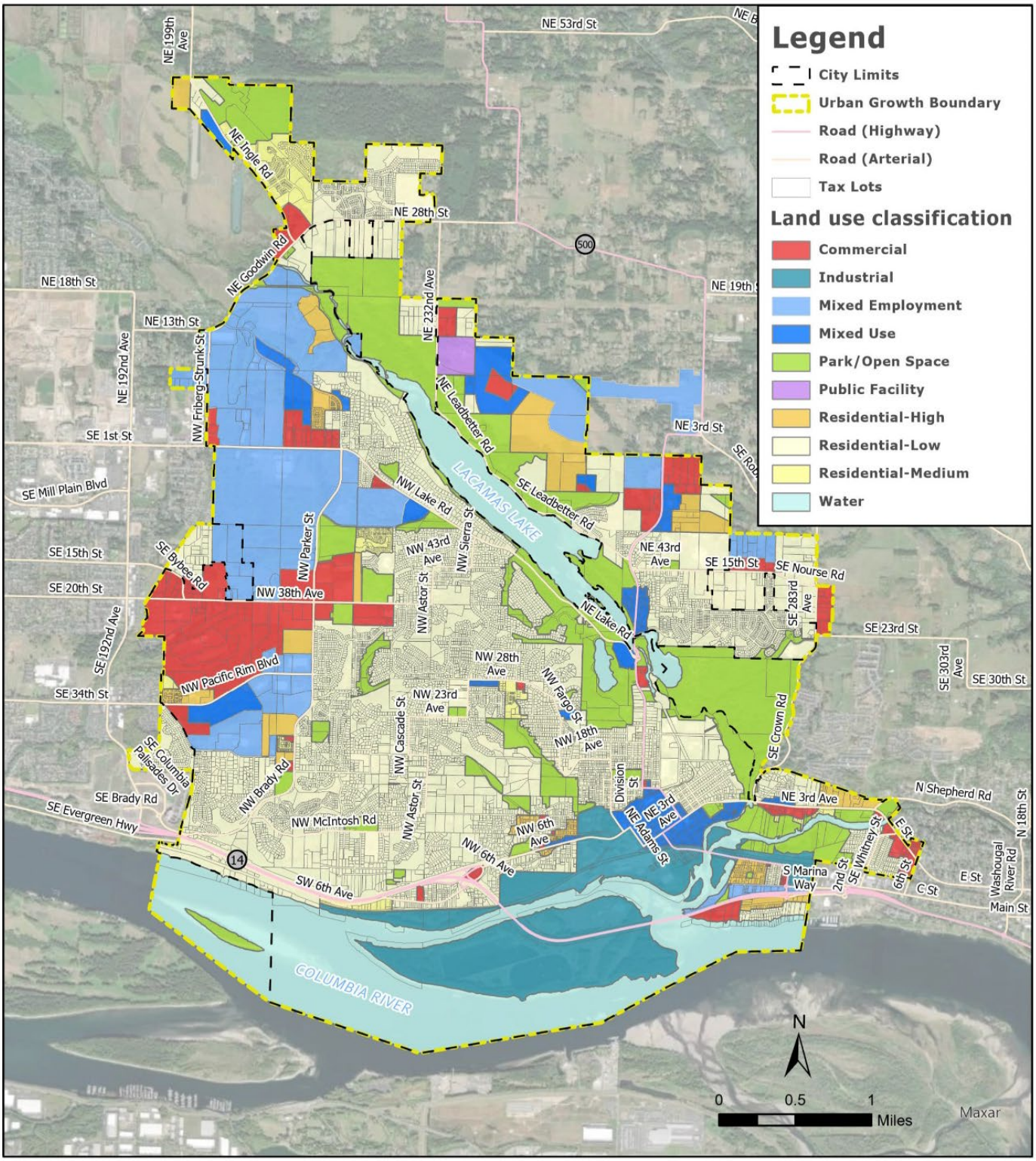
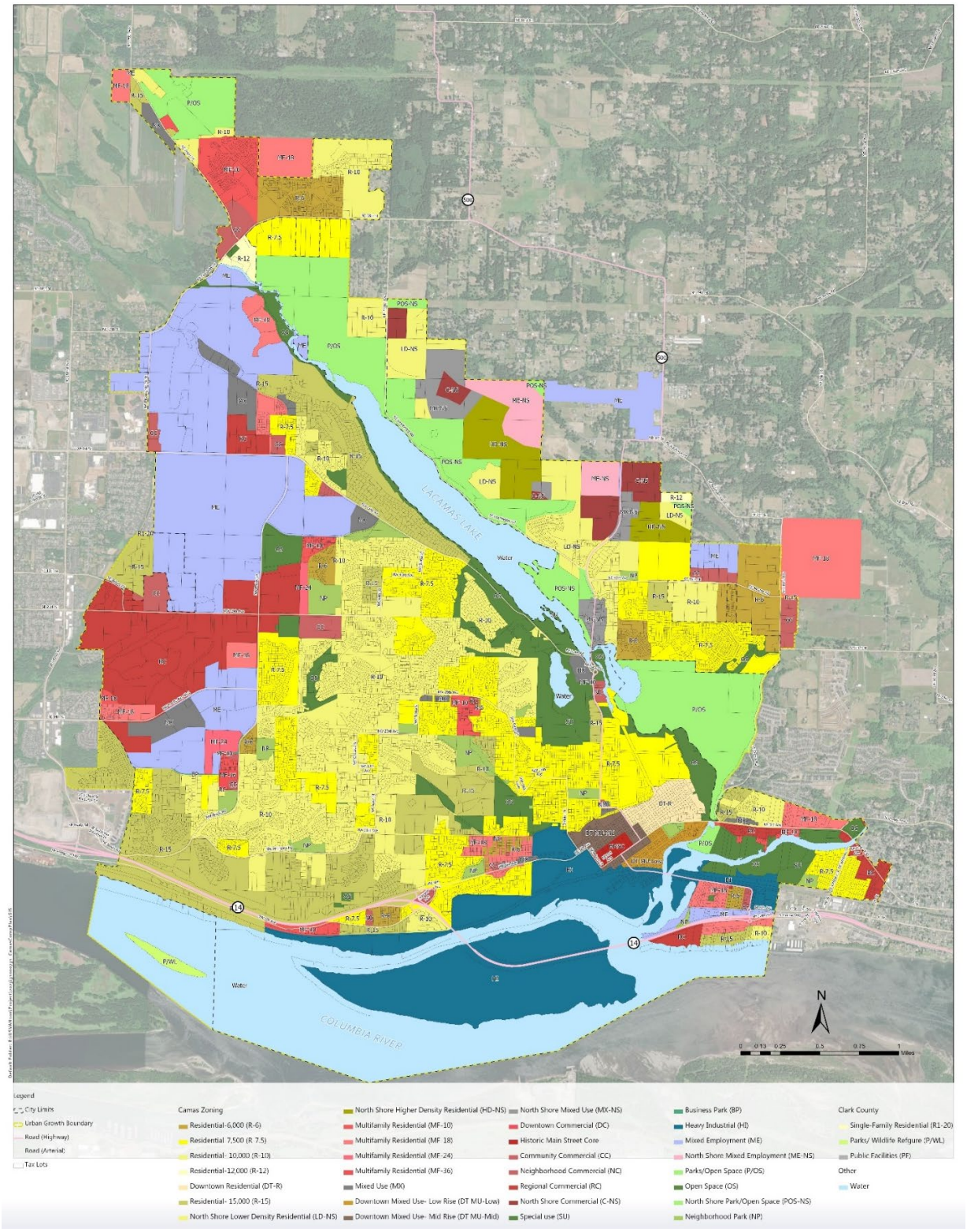


Figure 3 Zoning Map



Land Use Goals and Policies

Goal LU-1 Citywide Land Use

Maintain a land use pattern that respects the natural environment and existing uses while accommodating a mix of housing and employment opportunities to meet the City's growth projections in coordination with the capital improvement plan.

Policy LU-1.1 Ensure the appropriate mix of commercial, residential, and industrial zoned land accommodates the City's share of the regional population and employment projections for the 20-year planning horizon.

Policy LU-1.2 Coordinate with Clark County, the state, and special districts to identify future needs for essential public facilities such as airports, state education facilities, state and regional transportation facilities, state and local correctional facilities, solid waste handling facilities, regional parks and others as identified in RCW 36.70A.200. (See policies ED-3.1, 3.2, and 3.3 regarding Grove Field airport, policy TR-2.1 regarding transportation, and policy PFS-4.27 regarding solid waste.)

Policy LU-1.3 Implement design standards for new development, redevelopment, and infill that consider the surrounding built and natural environments and support a natural transition between uses.

Policy LU-1.4 Ensure that park and recreation land is distributed equitably throughout the City and work to achieve park and continuous trail corridors from Green Mountain to the Columbia River. (See policies PFS-2.1 and 2.4 regarding increasing connectivity to natural areas and continuous trail around Lacamas Lake.)

Policy LU-1.5 Ensure adequate public facilities, including roads, emergency services, utilities, and schools, exist to serve new development, and mitigate potential impacts to current residents. Establish and maintain policies for impact fees for new development.

Policy LU-1.6 Ensure consistency with County-wide planning policies.

Policy LU-1.7 Evaluate and improve design and building standards for new and redeveloped sites in high-risk natural hazard areas.

Policy LU-1.8 Incorporate sustainable and low climate impact design into development codes and standards.

Policy LU-1.9 Encourage high density concentrations of housing, commercial, and other uses needed in daily life along major transportation corridors to support the reduction in vehicle miles traveled and opportunities to increase physical activity.

Policy LU-1.10 Protect the viability of the airport as a significant economic resource to the community by encouraging compatible land uses and densities, and reducing hazards that may endanger the lives and property of the public and aviation users consistent with state laws RCW 36.701A.510 and RCW 36.70547.

Goal LU-2 Employment Land

Create a diversified economy and serve Camas residents, businesses, and tourists by providing sufficient land throughout the City to support a variety of business types and employment opportunities.

Policy LU-2.1 Protect employment land to ensure an adequate supply of commercial and industrial land to meet 20-year employment projections. Encourage a balance of new and existing commercial, light industrial, knowledge-based business, medical, and high-tech uses.

Policy LU-2.2 Encourage mixed-use developments (residential and commercial) that support adjacent uses, reduce vehicle miles traveled, and balance job creation.

Policy LU-2.3 Implement development and landscaping standards to ensure industrial development and other employment lands integrate with the surrounding neighborhoods.

Goal LU-3 Neighborhoods

Create vibrant, stable, and livable neighborhoods with a variety of housing choices that meet all stages in the life cycle and the range of affordability.

Policy LU-3.1 Encourage connectivity between neighborhoods and adjoining natural areas and trails to increase access to recreation amenities. (See policies PFS-2.1 and 2.2)

Policy LU-3.2 Discourage exclusive neighborhoods, privacy walls, and gated communities.

Policy LU-3.3 Provide commercial zoning within a half mile of residential areas for the development of food retailers (grocery stores and farmers' markets) to improve food access.

Goal LU-4 Natural Environment

Develop an interconnected network of parks, trails, and open space to enhance the quality of life for Camas residents and visitors and support and preserve wildlife corridors and natural resources.

Policy LU-4.1 Maintain development regulations that encourage the preservation of trees and natural areas, including the use of density bonuses and other tools to protect sensitive areas and encourage tree replacement. (See policy NE-4.1)

Policy LU-4.2 Support the purchase and preservation of open space by the City and private owners. Encourage careful consideration and integration of the natural environment in planning activities to maintain the park-like setting of Camas.

Policy LU-4.3 Encourage connectivity and increase access to regional trails throughout the City to support multi-modal transportation and physical activity. (See policies PFS-2.1)

Policy LU-4.4 Protect the quality and quantity of groundwater used for public water supplies through conservation of water usage and treatment of runoff.

Goal LU-5 Mixed-Use Areas

Foster economically and socially diverse mixed-use neighborhoods that meet the multi-modal transportation, housing, employment, education, recreation, and health needs of the community.

Policy LU-5.1 Mixed-use developments should be unique to the area in which they are located, encourage small business development, provide a mix of housing types to ensure affordability, increase pedestrian and transit connections, and include design that is sensitive to the natural environment.

Policy LU-5.2 Develop mixed-use areas that are oriented to the public street and scaled and designed to integrate with surrounding land uses.

Policy LU-5.3 Create a mixed-use zone that requires developments to include a minimum percentage of commercial space in both vertical and horizontal mixed-use settings.

Goal LU-6 Design Overlay Areas

Create attractive and welcoming areas in the City and distinguish Camas from adjacent jurisdictions through the development of design overlays.

Policy LU-6.1 Encourage development and redevelopment along the design overlay corridors that respects the historic character of the areas, improves pedestrian mobility/safety, and supports small-scale retail and commercial services.

Policy LU-6.2 Encourage development of commercial uses and multi-family residential within the NE 6th Avenue and NE 3rd Avenue design overlay corridors to support downtown businesses (such as through the Downtown subarea plan). Consider rezoning low-density residential land to support the downtown area. Consider rezoning low-density residential land to support the downtown area.

Policy LU-6.3 Orient building entrances toward the street and provide pedestrian connections from building entrances to the sidewalk. Encourage landscaping, rather than parking, between the building and the street to create a welcoming streetscape.

Policy LU-6.4 Collaborate with partners to support community events, public art, and infrastructure investments that celebrate cultural heritage, provide community amenities, and strengthen community branding. Develop area identities through events, festivals,

signage, and other improvements that help establish or enhance existing character within the overlay areas.

Policy LU-6.5 Encourage the designation and development of design overlay features in strategic areas to create a distinct pedestrian scale identity and attract visitors.

Policy LU-6.6 Identify streets in the design overlay areas as public places to encourage pedestrian and bicycle mobility and to reinforce the connection between the corridors and the surrounding neighborhoods.

Policy LU-6.7 Improve and increase wayfinding signage in design overlay areas to nearby recreational and other amenities.

ourCamas 2045



Housing

05

05. Housing

Vision

In the year 2045, residents of Camas continue to appreciate their safe, diverse, and welcoming community. Those raised in Camas will return for living-wage jobs and to ultimately retire here. Camas is a well-planned and connected city where residents enjoy pedestrian and bicycle paths between neighborhoods and to downtown. Camas provides a wide variety of housing options that meets the needs of all residents and provides a range of housing for all ages, abilities, needs, preferences, and income levels.

Background

This element of the comprehensive plan sets out the vision, goals, and policies to address current and projected housing needs for the next 20 years (2025 to 2045), inclusive of the diverse needs of the whole community across the income spectrum. Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

The housing element is supported by a housing needs assessment (provided below) that quantifies existing housing stock and projected housing needed to accommodate projected growth. Housing analysis is an important exercise as the housing needs in Camas tend to continually evolve based on changes in the broader economy, local demographics, and the regulatory environment. In addition to an assessment of housing needs based on the best available existing data, the housing element goals and policies reflect community input, state legislative requirements, and City of Camas' priorities.

The following section provides background on the planning framework and highlights the analytical findings associated with current and projected housing including details on Camas' community demographics, housing stock, housing market dynamics, expected housing demand, and special housing needs. The insights from this analysis help to build a factual basis for the housing policy updates.

Housing Challenges

Camas is facing housing challenges that could benefit from improved access to more housing options including more housing for seniors and young adults, smaller housing, more rental units, and affordable homeownership opportunities, all of which the City can have a role in supporting.

Planning Framework

In Clark County, RCW 36.70A.040 requires all cities to "fully plan" for the Elements of a Comprehensive Plan, including land use, housing, capital facilities, utilities, transportation, and climate change.[1] The current update process is part of a periodic update also required by the Growth Management Act (GMA), as part of an established schedule by the County.

At the state level, the GMA requires local jurisdictions to adopt Housing Elements that are consistent with statewide goals and objectives. The Housing Element must include an inventory and analysis of existing and projected housing needs that identifies the number of housing units by income level necessary to manage projected growth including permanent supportive and emergency housing.

Recent state legislation calls for cities to expand middle housing allowances in single family residential zones (HB 1110) and support Accessory Dwelling Unit development (HB 1337). These changes require cities to allow up to two Accessory Dwelling Units (ADUs) on all lots zoned to allow single-family homes. Lots with critical areas or their buffers are exempt from the requirements of both HB 1110 and HB 1337. In addition, via HB 1220, the Washington State Department of Commerce instructed local governments to "plan for and accommodate" housing affordable to all income levels.

MIDDLE HOUSING POLICY IN WA

'Middle housing' refers to moderate-density housing types between single-family detached homes and larger multifamily housing. HB 1110 became effective in July 2023 and requires that designated Growth Management Act (GMA) planning cities in Washington must allow certain minimum densities for middle housing within 6 months after their periodic update due date.

Camas is counted as a Tier 2 city under this policy, which must allow for 2 dwelling units per lot or higher in predominantly residential zones, as well as 4 dwelling units per lot within a quarter mile of major transit stops and for affordable housing (ESHB 1110, Sec. 3(1)(c)).

The Clark County Countywide Planning Policies provide helpful guidance on the Comprehensive Plan update. Clark County is currently in the process of updating its Comprehensive Plan and its Countywide Planning Policies. The existing 20-year growth plan spans 2015-2035 and includes a Housing Element with relevant policies for jurisdictions within the County. Please see Appendix X for a summary of the existing relevant Clark County Countywide Planning Policies.

Lastly, the City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and

[1] The GMA includes other optional Elements for economic development, parks and recreation, conservation, energy, sub areas, and ports.

interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings helped to shape the updates to the Camas Housing Element.

Community Engagement

The project team held interactive open houses and interviewed stakeholders to learn about housing challenges, opportunities, and actions. Engagement activities identified the following themes that could contribute to future decision-making related to housing in Camas.

Housing Insights

- **North Shore:** Need infill development.
- **General:** Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Housing Strategies

- Citywide: Maintain the strength, vitality, and stability of all neighborhoods and promote the development of a variety of housing choices that meet the needs of all members of the community. This goal seems very wide and difficult to achieve. More focused on affordability?
- More moderate density in and near Downtown with good connectivity (Safe, lit, easy).
- Be intentional- positive in messaging about adding middle housing and moderate density so community gets accustomed to why it is so important for our community and culture to include all. Show that it's not scary.
- Consider incentivizing housing developers through zoning, taxes and fees, and partnerships.
- Partnerships: Partner with Vancouver Housing Authority and other organizations to develop affordable housing. Partner with habitat for humanity and housing authority. Proud ground for moderate- and low-income housing.
- Attract a large senior housing project.
- More 4-5 story multi-family units, especially Downtown.
- Builder incentives to focus on mixed use/ apartments.
- Don't forget the bike paths.
- Make it easy to build ADUs in backyards.
- Support yes in my backyard policies.

- Incentivize small developers (housing & economic development combined!).

Housing Action Plan

The City of Camas completed its Housing Action Plan (HAP) in 2021, including a housing needs assessment and a thorough community engagement process focused on learning about housing experiences and identifying ways to meet housing needs and overcome core challenges. The engagement included two virtual public meetings, seven focus groups and interviews, a housing survey with over 300 responses, a project website, and written public comments. Key findings about community priorities and HAP goals and strategies are summarized below.

HAP Goals

- **Develop Housing to Accommodate Growth.** Thoughtful changes to Camas' zoning and development regulations can allow the City to better accommodate projected growth.
- **Diversify the Mix.** A greater variety of housing types can better serve young families, small households, seniors, people with disabilities, and people with diverse incomes.
- **Increase Housing Affordability.** Young families, seniors, and people who work in Camas may have difficulty finding affordable housing in Camas.
- **Preserve Existing Affordable Housing.** Camas should adopt strategies to preserve its existing affordable housing and prevent the displacement of residents. Community members noted concern for preserving existing affordable housing, particularly smaller single-family properties, in older neighborhoods near Downtown.

STRATEGY	GOALS			
	DEVELOP HOUSING	DIVERSIFY HOUSING MIX	INCREASE HOUSING AFFORDABILITY	PRESERVE AFFORDABLE HOUSING
Strategy 1: Expand housing opportunity in mixed use and downtown commercial districts	♦	♦		
Strategy 2: Consider making targeted rezones during Comprehensive Plan updates	♦			
Strategy 3: Diversify allowed housing types and update related lot and dimensional standards	♦	♦	♦	
Strategy 4: Focus on key areas with residential development or redevelopment potential. Expand more mixed-use areas throughout the city.	♦	♦		
Strategy 5: Continue community conversations around housing and housing for all	♦	♦	♦	♦
Strategy 6: Communicate available affordable housing resources			♦	
Strategy 7: Build partnerships to develop and preserve affordable housing for individuals, families, and seniors. Explore expansion of the MFTE program.			♦	♦
Strategy 8: Explore funding source and cost reduction options for affordable housing	♦	♦	♦	♦

Housing Targets

Planning for future housing demand is critical to ensure that the City can meet demand driven by population growth. This section summarizes projected future housing demand for Camas to provide context for the City's housing policies.

Population and Housing Allocations

Table 2 below demonstrates the City of Camas and Clark County's anticipated population forecast between 2023 and 2045. Since 2000, Camas has grown at a faster rate than the County overall with an Average Annual Growth Rate (AAGR) of 5.2% in the City (including annexations), compared to the County's AAGR of 2.4% (Housing Appendix). However, the County's estimates assume a slower growth scenario for the City in the next 22 years. With this assumption, new population growth in Camas is estimated to comprise 4.05% of growth in Clark County overall.

The population growth forecast indicates that the City of Camas will make up 4.05 percent of new growth population in Clark County between 2023 and 2045 with an AAGR of 1.2% in the City. The County's methodology also acknowledges Washington State Department of Commerce's HAPT estimates for current housing supply in Camas and allocates a number of net new units for the Urban Growth Area(s).

Table 2 Population Growth Forecast, Camas and Clark County, 2023 to 2045

Source: Clark County Interim Population Allocations and Clark County Comprehensive Plan 2025 Update, 2025 Population, Housing, and Employment Allocation – Issue Paper 5.

Jurisdiction	2023 Est. Population	Vacant Buildable Land Model Percent Capacity	2023-2045 Growth	2045 Estimate	Change (percent)	AAGR
City of Camas	**29,352**	**4.26%**	**7,729** ***(4.05% of total growth)***	**37,080**	**26%**	**1.2%**
Clark County	527,400	100%	190,754 *(100% of total growth)*	718,154	36%	1.6%

In May 2024, Clark County adopted housing allocations for jurisdictions located within county boundaries. In total, this shows an estimated 4,226 housing units needed by 2045 in the City of Camas and UGA(s).[2] The City would add about 311 new units to meet the new permanent

[2] The Washington State Department of Commerce Housing for All Planning Tool (HAPT) provides two allocation methods for determining the share of a County's housing supply to be met by jurisdictions. Method A assumes all housing needs will be accommodated through new housing production. Method B assumes all jurisdictions will accommodate equivalent shares of the total countywide housing need at each income level, proportional to their size, in the projection year. Clark County elected to use a hybrid method of 75/25 for Camas.

supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045. Camas currently has 143 units of housing affordable for households at or below 30% of AMI that are not Permanently Supportive Housing (PSH)[3] and 14 emergency units[4] according to the HAPT estimate. With this allocation, the City will need to accommodate 172 new units of temporary emergency housing by 2045.[5]

HOUSING ALLOCATIONS

In 2021, HB 1220 created a new way that communities in the state are required to plan for housing needs. This legislation requires that jurisdictions plan for sufficient land capacity for housing needs, including all economic segments of the population (moderate, low, very low and extremely low income, as well as emergency housing and permanent supportive housing).

- **Since 2000, the City of Camas had an average annual growth rate of 221 new housing units per year.**
- **Comparatively, the City will need to add an average of 195 new housing units per year between 2024 and 2045 to reach its allocation of net new units.**

[3] Permanent Supportive Housing is defined as: "subsidized, leased housing with no limit on length of stay that prioritizes people who need comprehensive support services to retain tenancy and utilizes admissions practices designed to use lower barriers to entry than would be typical for other subsidized or unsubsidized rental housing, especially related to rental history, criminal history, and personal behaviors" Washington RCW 36.70A.030(31).

[4] Temporary emergency housing is defined as: "temporary indoor accommodations for individuals or families who are homeless or at imminent risk of becoming homeless that is intended to address the basic health, food, clothing, and personal hygiene needs of individuals or families. Emergency housing may or may not require occupants to enter into a lease or an occupancy agreement." – Washington RCW 36.70A.030(14).

[5] Clark County's interim allocations do not include designated temporary emergency housing units at the City level. Estimates in this section for the City of Camas are derived directly from the Department of Commerce HAPT tool.

Figure 4 Housing Unit Allocations by Income, Camas and its UGA, 2024-2045

Source: Washington State Department of Commerce HAPT, Clark County Interim Housing Allocations, City of Camas
Note: Current supply includes both the estimate from the HAPT with the addition of 599 additional units since its calibration in 2020.



4,226 new homes will be needed over the next 20 years in the City of Camas

In addition, there will also need to be:
172 Emergency housing beds (temporary housing)

	0-30% AMI		>30-50% AMI	>50-80% AMI	>80-100% AMI	>100-120% AMI	>120% AMI	Total	Emergency housing beds
	Non-PSH	PSH							
2024: Current Housing Supply Estimate	143	0	458	1,874	1,182	1,965	4,201	**9,832**	14
2024-2045: New Housing Unit Needed for the Allocation	**564**	**331**	**811**	**955**	**516**	**249**	**799**	**4,226**	172
2045: Total Target Supply	707	331	1,269	2,811	1,627	2,214	4,499	**13,459**	186

Residential Capacity

Residential capacity is generally defined as the amount of existing housing units plus new housing a city can accommodate based on city zoning regulations (e.g., residential density requirements in the zoning code) and land available for new development. Residential capacity relates to residential growth allocations in a number of ways. Evaluating residential growth capacity is necessary to determine whether the housing growth allocation (determined by the

county) can be accommodated within the City of Camas and its UGA. Sufficient capacity is available if residential growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for residential growth capacity. The Vacant Buildable Lands Model (VBLM) for Clark County provided a basis for the available housing capacity in the City of Camas based on available buildable land (including both vacant and underutilized land) and current zoning. The existing zoning and UGA showed insufficient housing capacity.

The City of Camas is proposing zoning modifications that would allow for more residential capacity. Consequently, another analysis was completed to consider future modifications to select zones. According to the housing capacity estimates, Camas would have capacity for 5,329 housing units which would result in a surplus over the 2045 housing target of 4,226 housing units. Results (summarized below) from the updated capacity analysis show sufficient residential growth capacity to meet the 2045 housing target. The estimates depend on the final preferred alternative which could be refined further.

Summary of Housing Analysis Findings

A summary of key findings from the housing data analysis is provided below to help describe key insights to inform Comprehensive Plan policy updates (Technical Appendix provides the full findings).

Community Demographic Trends

- **Since 2000, Camas has grown at a faster rate than Clark County or Washington State overall, more than doubling in size by 2023 from 12,462 to 27,420 persons.** As population increases, the demand for housing also rises and affects planning.
- **In terms of land, Camas has expanded incrementally over time through annexations.** In the 2000's and early 2010's, the City added large new areas on the north side of Lacamas Lake, with a large portion of this area zoned for multifamily housing alongside employment and commercial areas.
- **Camas is becoming a more diverse community.** The share of people of color increased from 13% in 2012 to 24% in 2022 and is slightly more diverse than the county (21% were people of color in 2022).
- **Camas is seeing a larger share of couples and families with children (39%) and has a higher share of both groups than the County or State (24%, 22%, respectively).** The City also had a larger median household size (almost 3 persons) compared to the county (2.65 persons).
- **Median household income in Camas is higher than both Clark County and the state at $133,000 in 2022.** Adjusting for inflation, median income in the City still increased by 31 percentage

points since 2012 which is primarily due to growth in high-income households earning over $100,000 per year.[6]

- **Four out of five households in Camas owned their homes in 2018-2022, at a higher rate than either Clark County or Washington.** The share of renter households stayed the same in Camas since 2012, showing less than a 1% increase over this time period.
- **County-level trends indicate that homeownership disparities exist for some groups by race and ethnicity in Clark County,** with households who are Black or African American, American Indian or Alaska Native, Native Hawaiian or Pacific Islander, Hispanic or Latino, or mixed/other races having lower rates of homeownership.
- **At the County level, income levels also vary by race and ethnicity.** Households who were Black or African American, Native Hawaiian or Pacific Islander, Hispanic or Latino, two or more races, or another race had lower median household incomes than the overall average.
- **Overall levels of housing cost burden are decreasing, but more renters and low-income households experience higher rates.** Around 24% of all Camas households experienced cost burden (2022) with a higher share of renter households experienced cost burden compared to homeowners and with 100% of households earning less than $20,000 experienced severe cost burden (paying at least half of their monthly income towards housing). Although cost burden is generally lower for homeowners, more people of color in Camas who own their homes experience cost burden compared to white, non-Hispanic homeowners.

Existing Housing Inventory

- **Camas has seen growth in their number of housing units in the past two decades,** with a 108% change between 2000 and 2023 (annually this equates with an average of 221 new homes). The City of Camas' growth in housing units was lower than its population change (120%), indicating that the City has not been keeping pace by adding to its supply to meet the rising demand.
- **Camas has steadily low vacancy rates for all housing units in total** (4% in 2022 with little change over the last decade). This level of vacancy is indicative of a healthy housing market with natural rates of turnover; however, the slight decrease could begin to indicate constrained supply of housing.
- **For two-bedroom multifamily units, Camas has seen spikes in vacancy, but these align with new construction trends** which can temporarily raise vacancy rates for newly delivered units but do not indicate long-term vacancy. In 2023, the City saw over 200 new housing units delivered, likely accounting for the fluctuation in vacancies, as well as deliveries in 2017 and 2020.
- **Since 2015, the City has permitted 2,763 new housing units.** Single detached homes have accounted for the largest share (70%) of new permits in the City of Camas, and another 8 percent

[6] The median income in Camas is above the area median income (AMI) for 2023. HUD determined the AMI to be $114,400 for a family of four in the Portland-Vancouver-Hillsboro, OR-WA MSA (including Camas). This is lower than median income in Camas itself which was $133,000 in 2022 (Exhibit 14) and has been consistently lower than the City over time.

were made up of attached townhomes. While apartments, condos, and units in mixed-use buildings made up 20 percent of new permits between 2015-2024, middle housing types like duplexes, triplexes, quadplexes, and accessory dwelling units (ADUs) were only 2 percent of all permits.

- **Median home sale prices in Camas has increased over the last ten years,** with Camas' average prices generally remaining higher than the County. In 2023, the average home sale price in the City was **$704,000,** increasing by 119% since 2013 which is more expensive than the average home in the City of Portland (by $196,000) or Clark County (by $173,000).
- **Prices are also increasing quickly in Camas and Clark County for the average 2-bedroom multifamily rental.** The average 2-bedroom apartment rent was over $1,800 in the City and over $1,700 in Clark County (2024 year-to-date), indicating a 35% increase since 2010. Average 2-bedroom multifamily rents in Portland tracked closely with Camas in the 2010's, while rents in Vancouver remained lower (generally following countywide trends).
- **Compared with home sale price and rent increases in Camas, only households earning over 150% or more of AMI would be able to afford the average home in the City as of 2023.** However, the average 2-bedroom apartment is still affordable to households between 50 and 80% AMI in Camas.
- **The City of Camas had 98 units of regulated affordable housing in 6 buildings** according to data from Oregon Metro and the City. Approximately half of these units are affordable respectively for residents between 30-50% of AMI and 50-80% of AMI. The City also has several long-term care residential facilities for older adults providing 135 units.

Future Housing Demand

- **Since 2000, Camas has grown at a faster rate than Clark County overall but is expected to slow based on County estimates for 2045.** The County's projections assume that new population growth in Camas is estimated to grow at an annual rate of 1.2% to account for 4.05% of county growth.
- **County allocations show the need for 4,226 new housing units in Camas by 2045, adding around 211 new housing units per year.**
- **The City would add about 331 new units to meet the new permanent supportive housing target and 1,766 units affordable to low-income households below 80% of AMI by 2045.**
- **Camas residents with disabilities may require additional housing features for accessibility.** Around 8% of residents in Camas had at least one disability (2022), with the most common being cognitive difficulties, followed by ambulatory and vision difficulties. These disabilities can require housing accommodations such as zero-step entryways, ramps, lifts, or other accessibility features.

Housing Goals and Policies

Goal H-1 Citywide Housing

Promote safe, attractive, and vibrant neighborhoods with access to housing, jobs, services, schools, amenities, and healthy active living that meet the needs of all members of the community.

Policy H-1.1 Provide a range of housing choices and options to support all ages and income levels. Provide an adequate supply of land to accommodate the City's housing growth target.

Policy H-1.2 Support low impact development (LID) in residential development that minimizes both impervious areas and site grading to retain the natural contours of the land. LID strategies include conserving native vegetation, narrower streets, stormwater gardens, and other landscape practices that store and filter runoff.

Policy H-1.3 Promote the use of flexible development options (e.g., planned residential developments and development agreements) to create a variety of accessible housing types within new developments.

Policy H-1.4 Require new residential developments to demonstrate how proposed lot, street, and utility layouts can accommodate development of single-story dwellings, duplexes, and attached or detached accessory dwelling units.

Policy H-1.5 Ensure housing in mixed-use buildings (or developments) will complement the commercial and retail portion of the development and increase local living-wage jobs. Amend the municipal code to support mixed-use and middle housing development in the Downtown Subarea and near other community hubs.

Policy H-1.6 Support in-fill housing development on vacant or underutilized sites, subject to design review guidelines, that have adequate urban services. Ensure development compatibility with the surrounding neighborhood.

Policy H-1.7 Require all new housing developments to provide a range of housing types and sizes that are evaluated through the land use approval process and stipulated on the final plat.

Policy H-1.8 Support the maintenance, repair, and rehabilitation of Camas' existing housing stock by promoting resources that provide financial and other assistance to community members to maintain or repair health and safety features of their home.

Policy H-1.9 Support investment in existing neighborhoods to enhance livability, safety, and accessibility in a way that preserves unique physical character.

Policy H-1.10 Develop objective design standards to ensure new development is compatible in scale, architectural style, and landscape composition with existing and planned neighborhoods.

Policy H-1.11 Provide ongoing education and community engagement regarding Camas' housing needs, including available programs and incentives. Provide permit process support to affordable housing developers.

Policy H-1.12 Achieve and sustain the housing targets by income group allocation for Camas as adopted by the Clark County Council. Monitor and assess the City's progress in meeting housing needs at least every five years.

Policy H-1.13 Support and encourage housing legislation at the county, state, and federal levels that promotes and supports the City's housing goals and policies.

Goal H-2 Housing Choice and Affordability

Create a diversified housing stock that meets the needs of all lifestyles and economic segments of the community through new developments, preservation, and collaborative partnerships.

Policy H-2.1 Support and encourage a wide variety of housing types throughout the City to provide choice, diversity, and affordability and promote homeownership.

Policy H-2.2 Promote the preservation and rehabilitation of the City's existing affordable housing stock of all types, including low-cost rentals and

affordable owner-occupied single-family homes. Support measures that preserve affordable housing, such as home repair programs with partners to rehabilitate existing housing that serve low to moderate-income households.

Policy H-2.3 Create opportunities for ownership housing in a variety of settings, styles, sizes, and affordability levels throughout Camas.

Policy H-2.4 Provide incentives and bonuses for the development of affordable housing and middle housing. Ensure that any affordable housing built with the support of city incentives or bonuses (including, but not limited to, public funds, through development agreements, incentives, or by regulation) remains affordable for the longest possible term.

Policy H-2.5 Participate in collaborative partnerships with local and regional public and non-profit housing groups to ensure that affordable housing and supportive services are provided throughout the City.

Policy H-2.6 Encourage and support collaborations between for-profit and non-profit developers to expand affordable housing options.

Policy H-2.7 Evaluate the existing Multifamily Tax Exemption (MFTE) program provisions and participation. Consider changes and expansions to program options and associated costs and benefits that support housing production and affordable housing targets.

Policy H-2.8 Review and update the Camas Municipal Code to be consistent with State guidelines for housing and residential use.

Policy H-2.9 Plan for and accommodate Camas' allocated share of countywide future housing needs for moderate-, low-, very low-, and extremely low-income households as well as manufactured housing, multifamily housing, group homes, foster care facilities, emergency housing, emergency shelters, and permanent supportive housing.

Goal H-3 Housing Accessibility and Livability

Encourage and support a variety of housing opportunities for those with special needs, particularly those with challenges relating to age, health, or disability.

Policy H-3.1 Encourage and incentivize special needs and senior housing to be dispersed throughout the community and close to public transportation, shopping, medical clinics, and other essential services.

Policy H-3.2 Encourage, support, and work with partners, such as the Clark County Health District, that support social and health service organizations and offer programs and facilities to help persons with special needs remain in the community.

Policy H-3.3 Treat residential structures occupied by persons with disabilities the same as residential structures occupied by a family or by non-disabled unrelated individuals.

Policy H-3.4 Encourage the creation and retrofitting of senior housing and accessible housing types that allow residents to "age in place" to support aging populations and allow residents to continue living in Camas.

Policy H-3.5 Develop and implement a strategy or action plan to work with partners to secure grants and loans by agencies, private developers, and nonprofit organizations that are tied to the provision of permanent supportive housing, emergency shelter beds, transitional housing, and other housing serving at-risk populations.

Policy H-3.6 Work with other jurisdictions and health and social service organizations to develop a coordinated, regional approach to address the impacts of displacement and people at risk of becoming homeless.

Policy H-3.7 Promote the use of universal design principles for new development or redevelopment housing projects to ensure housing is designed for all people and abilities.

Goal H-4 Streamlining Permitting for Housing

Support the development of quality and sustainable housing in Camas with streamlined regulations and permitting processes.

Policy H-4.1 Periodically review and update the City's residential zoning regulations, design standards, and permitting procedures to promote quality development with timely and predictable outcomes.

Policy H-4.2 Create regulations and procedures that balance clarity and objectivity with flexibility for design innovation.

Policy H-4.3 Study the impacts of land use policy decisions and zoning code amendments and minimize the negative impacts to housing supply and affordability.

Policy H-4.4 Classify the development of middle housing and accessory dwelling units as permitted uses in lower density residential zones, consistent with the Growth Management Act.

Policy H-4.5 Review and update policies, codes, and ordinances to allow for a mix of housing types and variable lot and unit sizes in new subdivisions and development projects to promote housing choice diversity and affordability.

Policy H-4.6 Annually review the number and type of housing units built in Camas and permit timelines associated with new housing developments to inform additional changes to permitting, incentives, and housing programs.

ourCamas 2045



Natural Environment

06

06. Natural Environment

Nature in Camas

Camas has an abundance of natural areas that make it an ideal place to live. This element balances Camas' natural environment with the demands of a growing city.

Vision

Camas embraces its connection to nature and enjoys a wealth of outdoor recreational opportunities. Access to forests, clean water, parks, and trails is foundational to Camas' quality of life. The community shares a deep reverence for Camas' beauty, scenery, and tranquility, and is committed to preserving and enhancing its natural resources and tree canopy. Through proactive planning, the City mitigates the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come.

Natural Setting

Camas is blessed with an abundance of natural areas and physical features, making it a highly attractive place for people to call home. Residents and businesses who seek an exceptional quality of life are buoyed by the natural surroundings of Camas and enjoy such amenities as Lacamas, Round and Fallen Leaf Lakes, Lacamas Creek, and the Washougal River greenway. Residents also enjoy the beauty and quiet of the open space and greenbelt network throughout the community, stitched together by the City through many decades of planning and implementation.

As envisioned decades ago and to be held in perpetuity as natural, legacy lands along Lacamas Lake, Fallen Leaf Lake, and near Green Mountain are treasured for their mature stands of evergreen and deciduous trees and offer a respite for many in the community. When people think of Camas, they think of a place that values the natural environment on par with other facets of the community. Camas is a place where stewardship of greenbelts, natural areas, and open space is an essential fiber in the fabric of the community.

Overview

The natural environment element of the comprehensive plan provides a policy framework for the identification, protection, and improvement of Camas' natural environment. Goals and policies include those for environmental stewardship, the protection of

environmentally sensitive lands (critical areas), natural areas and open space, shorelines, and landscaping and tree enhancement.

Environmental stewardship refers to the City's role as chief steward of the environment for the Camas community. A chief steward in this context means how the City, on behalf of the residents, establishes a responsible relationship between the people and the land they inhabit.

Stewardship has three prongs for the benefit of all community members. The first prong relates to compliance with the Growth Management Act (GMA) and the identification, designation, and protection of certain environmentally sensitive lands, which, in GMA, are known as critical areas. The second prong relates to the community and its steadfast approach to keeping Camas a place that balances growth with preservation of a natural areas and open space network. Camas has longed placed a premium on its open space network of environmentally sensitive lands, with or without GMA requirements. The third prong is an ethic of volunteerism and stewardship from the community's citizenry, which manifests in many ways including active volunteer groups, active boards and committees, and public involvement on issues related to the environment.

The City of Camas has preserved over 700 acres of open space across 31 sites, including forests, wetlands, riparian corridors, and steep slopes, with nearly half of this land concentrated around Lacamas Lake. These natural areas, distinct from developed parks, are managed to protect ecosystem functions, water quality, native vegetation, and wildlife habitats, while allowing for limited public access through trails and modest amenities. The City prioritizes conservation and restoration of high-value landscapes such as waterfronts, forested hillsides, and sensitive wetlands, balancing environmental stewardship with recreational use. Key efforts include protecting watercourses within three major watersheds, regulating development on steep slopes and wetlands, and maintaining resilient forest lands to support biodiversity and ecological health.

Environmental Stewardship

One of the most demanding roles the City of Camas must fulfill is that of chief steward of the community's environment while also accommodating growth. The City has the duty to implement land use policies via development regulations and the responsibility to comply with federal and state statutes related to the environment.

Facing federal and state mandates, the City strives to ensure that its environment is managed in compliance with applicable laws and does so in a wise manner. While simultaneously accommodating growth, the City encourages the preservation, restoration, and improvement of the natural environment in all development.

Goal NE-1 Environmental Stewardship

Preserve Camas' natural environment citywide by developing a sustainable urban environment and protecting natural areas and open space, including critical areas.

Policy NE-1.1 Support a cleanup of the Camas Mill and other contaminated sites to protect natural resources and the city's water supply.

Policy NE-1.2 Support programs and regulations that monitor, maintain, conserve and protect water quality in Camas, including watersheds, Lacamas Lake Basin, Columbia River Basin, and Washougal River Basin.

Policy NE-1.3 Encourage restoration and protection of natural areas through the removal of invasive species.

Policy NE-1.4 Support and implement actions identified in adopted plans, including adaptive management of natural resources that is consistent with best available science and climate guidance to improve climate resiliency.

Policy NE-1.5 Protect and restore natural resources, valuable historic and cultural areas, climate refugia, habitat areas and corridors to provide biological and hydrological connectivity that fosters resilience to climate impacts.

Policy NE-1.6 Create and support natural resource management plans that consider climate change impacts and guide adaptive management.

Policy NE-1.7 Include immediate and long-term environmental impacts in the policy and regulatory decision-making process. Identify and quantify the ecosystem services benefits of natural systems and include these natural capital assets in cost-benefit assessments for community and development planning.

Policy NE-1.8 Promote and incentivize public and private landowners to restore and create local habitats and corridors to increase the availability throughout the city.

Policy NE-1.9 Regulate land use and development to protect natural topographic, geologic, vegetative, and hydrologic features of undeveloped properties.

Policy NE-1.10 Promote soil stability and minimize and control soil erosion using best management practices, best available science, ecologically sustainable site design, natural drainage systems and protection of existing native vegetation.

Critical Areas

The natural environment includes specific environmentally sensitive areas that the GMA requires the City to identify, designate, and protect. Referred to in statute (RCW 36.70A) as *critical areas.* Under GMA, critical areas include wetlands, critical aquifer recharge areas, frequently flooded areas, geologically hazardous areas, and fish and wildlife habitat conservation areas. Each of these critical areas is present in the City. The law further requires that the City use best available science (BAS) when developing policies and regulations to designate and protect critical areas. GMA also recognizes that salmonids (salmon and trout) play an important role in the ecosystem and are vital cultural and economic resources, which require jurisdictions to give 'special consideration to conservation and protection measures necessary to preserve or enhance anadromous fisheries'.

Functions of Critical Areas

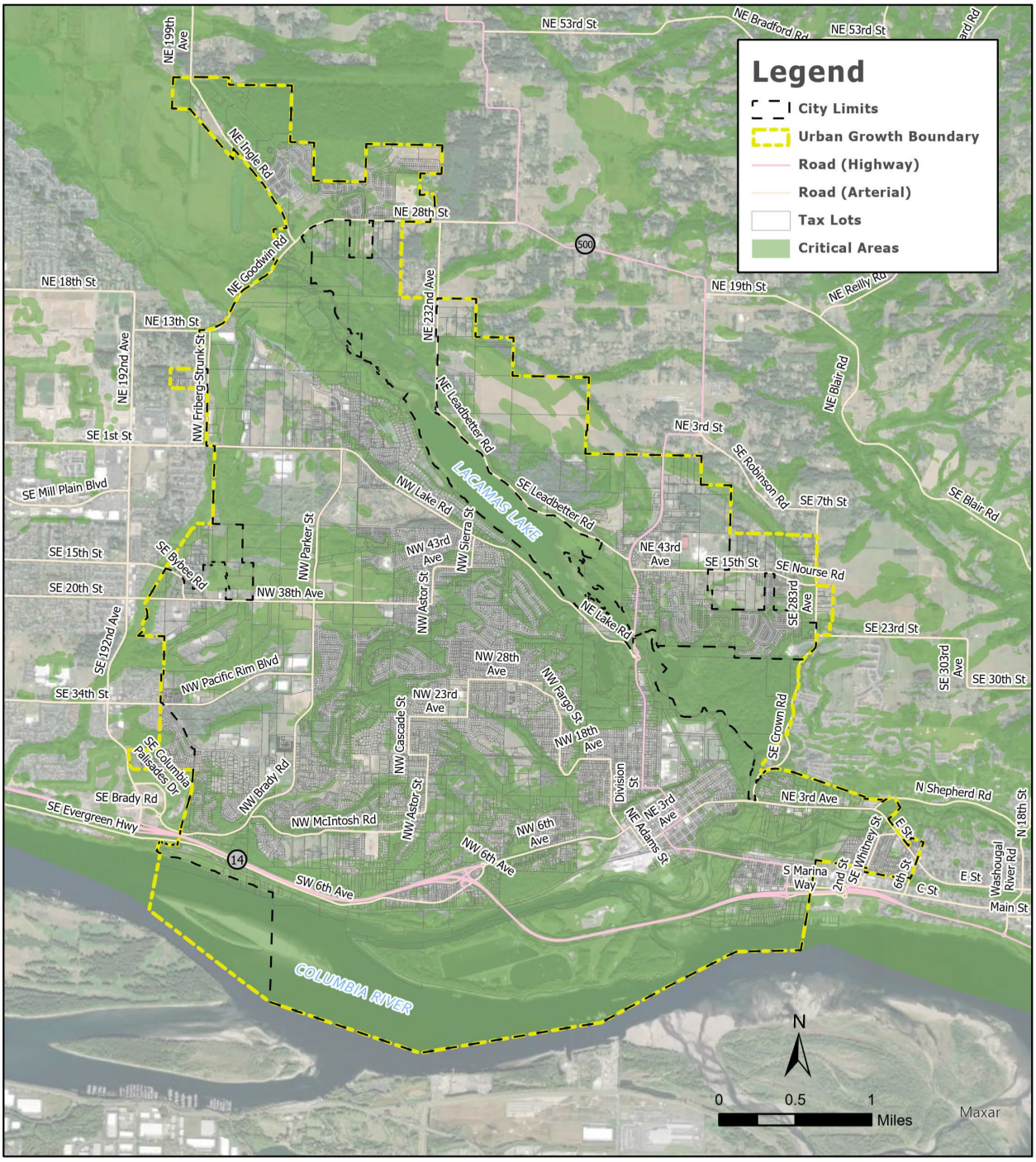
Critical areas perform key functions that enhance the environment and protect us from natural hazards. The beneficial functions and values that critical areas provide include, but are not limited to, water quality protection and enhancement; fish and wildlife habitat; food chain support; flood storage, conveyance, and attenuation of flood waters; groundwater recharge and discharge; drinking water quality and quantity; erosion control; protection from natural hazards; historical, cultural, archaeological, and aesthetic value; and recreation. Identifying the functions and values of local critical areas is essential to defining the purpose of a critical areas protection program.

Each type of critical area performs different functions and each community assesses the values of the critical areas in its environment differently. Therefore, the purpose of protecting critical areas is unique for each community. Critical areas protection is necessary to protect the public's health and safety and is essential to comply with state laws in Washington. It may also provide compliance with federal laws for such things as water quality and endangered species. There are also economic reasons to protect critical areas. For example, protection of drinking water quality and quantity supports sustainable growth, and critical areas support resource industries, such as salmon and other fisheries.

Critical areas are environmentally sensitive and hazardous areas that the State and City have identified for certain development considerations or restrictions to protect their functions and values, while allowing for reasonable use of property. Critical areas protection is regulated through the Camas Municipal Code (CMC) Title 16, which identifies five types of critical areas: wetlands, fish and wildlife habitat conservation areas, geologically hazardous areas (steep

slopes, erosion hazard areas, and seismic hazard areas), critical aquifer recharge areas (CARAs), and frequently flooded areas.

Figure 5 6Critical Areas



Wetlands

Wetlands are defined as those areas, designated in accordance with the approved federal wetland delineation manual and applicable regional supplements, which are inundated or

saturated by surface or ground water at a frequency and duration, and under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands in the community are generally located in and around the Grass Valley area in west Camas, Lacamas Lake, Lacamas Creek, and the Washougal River greenway. The largest mapped wetland is located around the south end of Lacamas Lake, identified as lake habitat. NWI does not identify mapped wetlands in downtown Camas.

Critical Aquifer Recharge Areas

Critical aquifer recharge areas (CARAs) are those areas with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge. The quality and quantity of groundwater in an aquifer is inextricably linked to its recharge area. To determine the threat to groundwater quality, existing land use activities and their potential to lead to contamination should be evaluated.

The goal of establishing CARAs is to protect the functions and values of the community's drinking water supply by preventing pollution and/or contamination of the supply directly or recharge areas indirectly.

Frequently Flooded Areas

Floodplains and other areas subject to flooding perform important hydrologic functions and may present a risk to persons and property. Classifications of frequently flooded areas should include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency (FEMA) and the National Flood Insurance Program (NFIP), known as the 'special flood hazard area', which is defined further as having a special flood, mudflow, or flood-related erosion hazards and shown on Flood Insurance Rate Maps (FIRM), which also includes the regulatory floodway.

Geologically Hazardous Areas

In the physical context of Camas, geologically hazardous areas include areas susceptible to erosion hazard, seismic hazard, mine hazard, and other geological events. Geologically hazardous areas in Camas include severe erosion hazard areas adjacent to Lacamas Lake, north of the Columbia River, and to the east along the Washougal River.

Fish and Wildlife Habitat Conservation Areas

Fish and Wildlife Habitat Conservation Areas (FWHCAs) are critical ecological zones that support essential habitats and species necessary for maintaining ecosystem integrity and biodiversity. These areas may include rare ecosystems, high-density wildlife zones, breeding and migration corridors, and habitats for endangered or sensitive species. Their designation plays a key role in guiding land use planning, urban growth boundaries, and conservation strategies. FWHCAs must be identified using the best available science, considering factors such as habitat connectivity, human activity levels, riparian and salmonid protection, and the impact of

surrounding land uses. Buffer zones are also recommended to minimize conflicts between development and habitat preservation.

Aquatic and Riparian Habitat

Fish and wildlife habitat conservation areas in Camas include habitats for state or federally listed endangered, threatened, or sensitive species, as well as areas associated with state priority species identified by the Washington Department of Fish and Wildlife. These areas encompass naturally occurring ponds under twenty acres, classified state waters, and water bodies stocked with game fish by governmental or tribal entities. Key aquatic habitats in Camas include the Columbia and Washougal Rivers, Lacamas Creek, Camas Slough, Lacamas Lake, and various streams, ponds, and wetlands, all often bordered by riparian zones. Lacamas Lake is the largest aquatic habitat in the city aside from the Columbia River system.

Terrestrial Habitat

Terrestrial habitats in Camas, like aquatic ones, include areas supporting state or federally listed endangered, threatened, or sensitive species, as well as state priority species identified by the Washington Department of Fish and Wildlife (WDFW), State Natural Area Preserves, and locally important habitats. Locally designated habitats include Oregon white oak trees and stands, and Camas lily fields of specific sizes. While much of the city is mapped as "cave rich" by WDFW, actual cave presence is limited, though caves are considered a priority habitat feature. The Camas biodiversity corridor, which includes mature timber and sightings of Vaux swifts, runs through parts of the city. Oak woodland habitat is primarily found near Lacamas Lake, and the northern part of Camas including the Lacamas Prairie Natural Area Preserve, which protects rare Willamette Valley wet prairie habitat and several endangered plant species, including Bradshaw's lomatium.

Critical Areas Goals & Policies

Preserve, maintain, and restore the City's critical areas to protect their function and value.

Policy NE-2.1 Use best management practices and best available science to preserve, protect, and restore the biological health and diversity of Camas' critical areas.

Policy NE-2.2 Preserve and restore aquatic and riparian habitats consistent with applicable regulations.

Policy NE-2.3 Preserve and avoid development of areas with endangered, threatened, and sensitive species and species of local importance as required by local, state, and federal laws.

Policy NE-2.4 Ensure that development throughout the City meets or exceeds standards and practices for long-term wetland protection and mitigation.

Shorelines

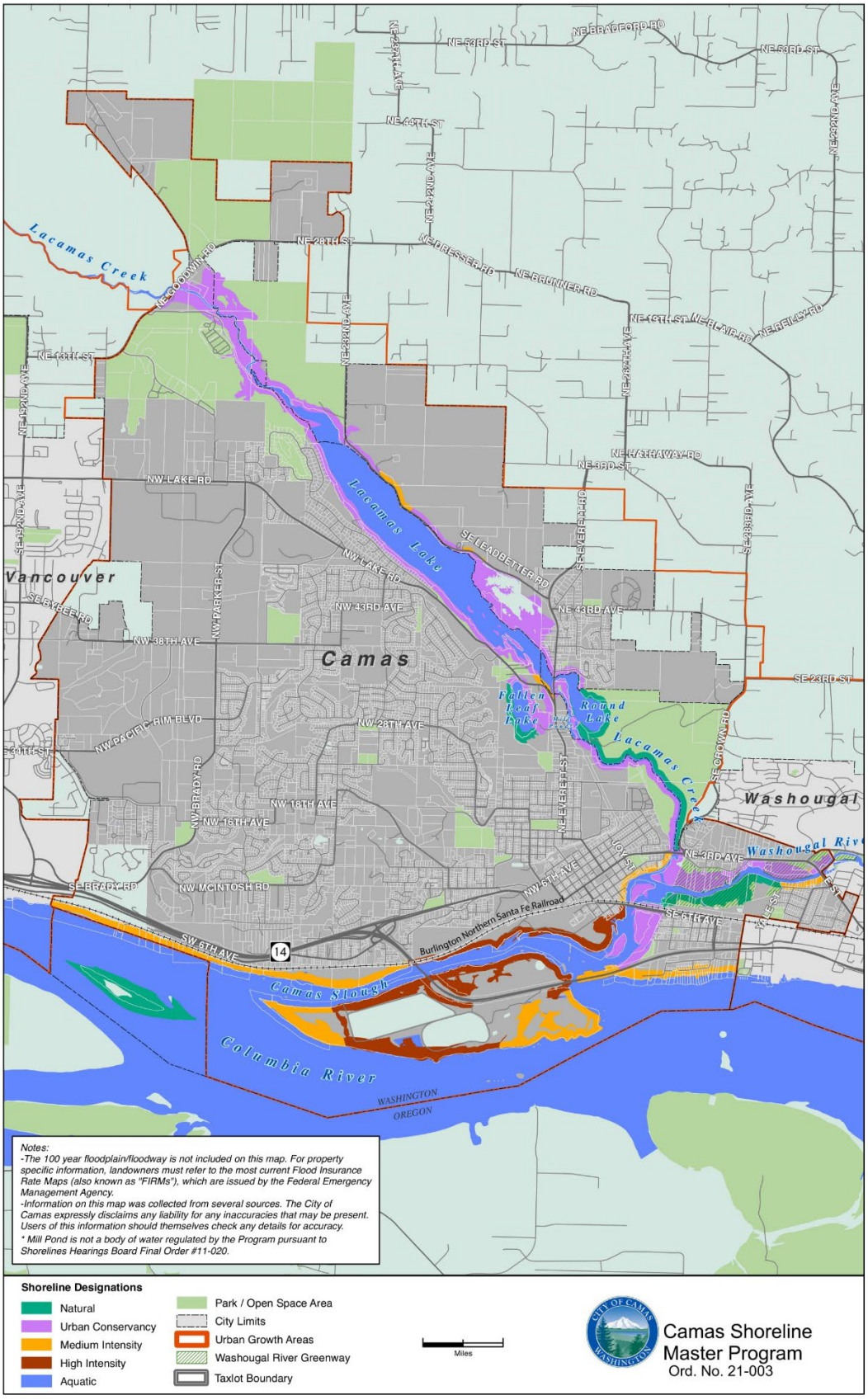
Overview

The Shoreline Management Act, enacted in 1972, created a collaborative framework between Washington State and local governments to manage and protect shorelines. Under this law, local jurisdictions are required to develop Shoreline Master Programs (SMPs) tailored to their specific needs.

Camas encompasses 946 acres of shoreline across 26 miles, including areas along Lacamas Creek, several lakes, and the Columbia and Washougal Rivers. The SMP outlines strategies to minimize flood risks, enhance recreational opportunities, and ensure sustainable shoreline use through voluntary programs and regulatory measures.

To guide development and conservation, Camas assigns specific shoreline designations based on land use, ecological characteristics, and community vision. These designations—Aquatic, Natural, Urban Conservancy, Medium Intensity, and High Intensity—are aligned with state guidelines and the city's comprehensive plan. Each designation comes with tailored policies and development regulations, such as height and setback limits. For example, High Intensity areas support industrial use, while Natural areas prioritize ecological preservation. These designations help ensure that shoreline development aligns with environmental protection and long-term community goals.

Figure 7 Shoreline Map



Shoreline Goals and Policies

Goal NE-3 Shorelines

Use the full potential of shoreline in accordance with the opportunities presented by their relationship to the surrounding area their natural resource values, and their unique aesthetic qualities offered by water, topography, and views. Develop a physical environment that is both ordered and diversified, and which integrates water and shoreline uses while achieving a net gain of ecological function.

Policy NE-3.1 Adopt the goals and policies as outlined in the current Camas Shoreline Master Program.

Landscape Enhancement and Tree Preservation

The natural landscape and existing tree cover are important aspects of Camas' natural environment. Native, mature landscaping and trees contribute to the City's ecological health, supply valuable animal habitat, and enhance the community's natural beauty.

Goal NE-4 Landscape Enhancement and Tree Preservation

Preserve existing natural landscapes and tree canopy. Support opportunities for increasing native and climate resilient landscaping and tree canopy.

Policy NE-4.1 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.2 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collecting and maintaining data on citywide tree canopy.

Policy NE-4.3 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.4 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

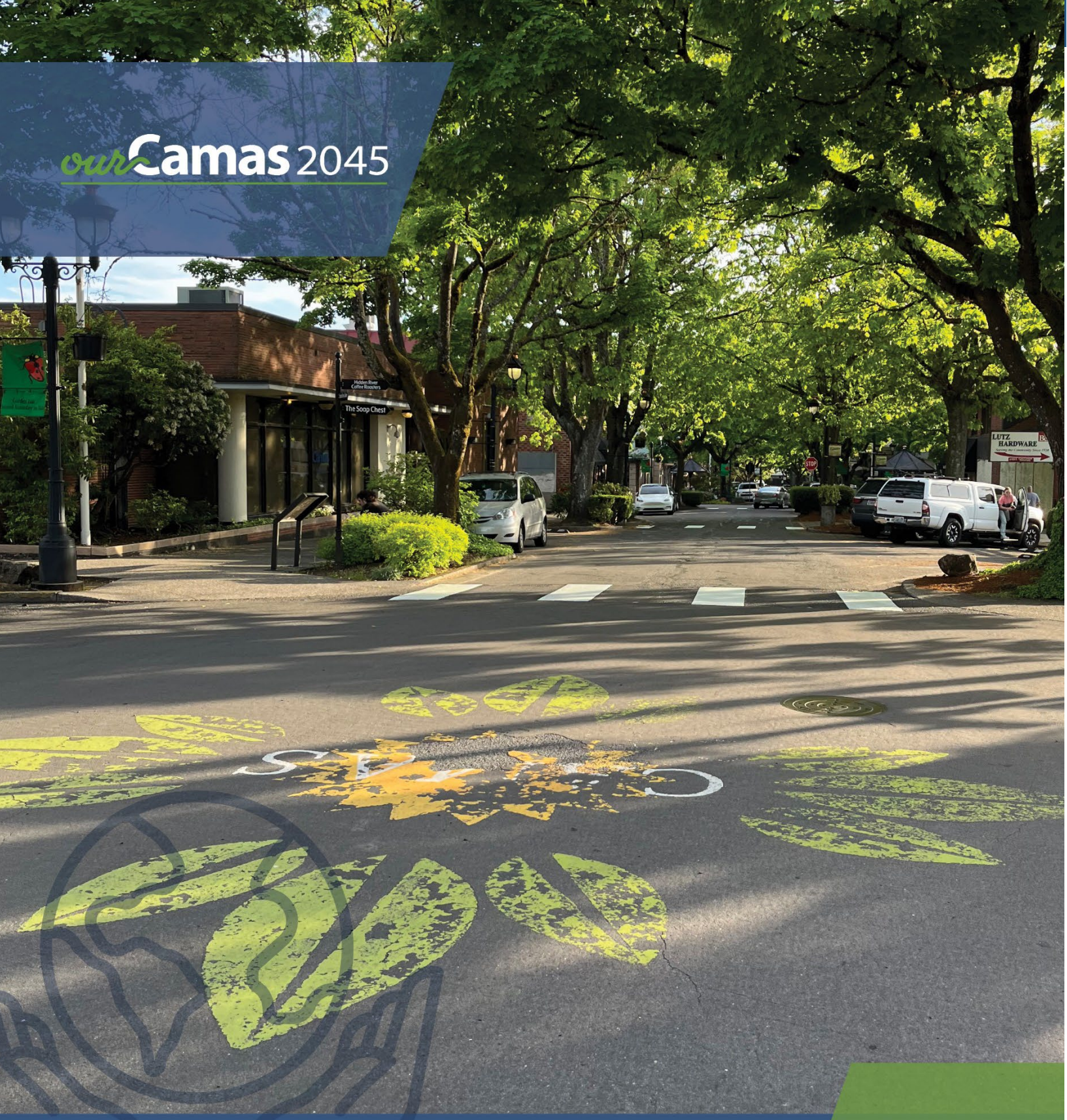
Policy NE-4.5 Develop and implement a program to prioritize retention of existing trees and planting of new trees within development sites to maximize cooling and energy savings. Encourage planting of hardy and climate resilient native trees.

Policy NE-4.6 Develop an urban forestry program that articulates a long-term strategy for future-proofing the City's tree canopy, including actions for tree protection, management, education, and collection and maintaining data on citywide tree canopy.

Policy NE-4.7 Require the use of native and climate resilient plants in residential, commercial, and industrial landscapes to support the implementation of low impact development.

Policy NE-4.8 Develop and implement a program to mitigate and compensate for tree canopy loss when retention of mature trees within development sites is impractical.

ourCamas 2045



Climate Change & Resliency

07

07. Climate Change & Resiliency

Vision

In 2045, Camas has proactive plans to reduce greenhouse gas (GHG) emissions and mitigate the effects of changing climate conditions and natural hazards, ensuring a resilient community for generations to come. The most vulnerable communities are protected, and climate planning contributes to improvements in community health and well-being.

Introduction

The City developed this climate change and resiliency element consistent with House Bill 1181, signed into law in 2023. This new state law integrates climate planning into Washington's GMA and requires cities and counties to include a climate element in their comprehensive plans.

Climate change refers to long-term shifts in temperatures and weather patterns. The burning of fossil fuels and other human activities are increasing emissions of greenhouse gases (GHGs) that trap heat in the atmosphere and contribute to global and local climate change. Negative effects include impacts on the community caused by natural hazards that are exacerbated by climate change (e.g., the increased frequency and severity of drought conditions). Natural hazards are also referred to as "climate hazards" in this element as climate change is anticipated to affect the frequency and intensity of natural hazards.

The purpose of this climate element is twofold: to reduce contributions to climate change (i.e., GHG emissions) and to build community resilience to climate change.

To support these two overarching goals, the City formed a Climate Policy Advisory Group (CPAT) to advise on the creation of this new element. The 17 CPAT members included community members, City staff, City Council and Planning Commission liaisons, and representatives from the Port of Camas-Washougal, Clark Public Utilities, NW Natural, and the Camas School District. CPAT members held five meetings between early 2024 and early 2025.

The CPAT was instrumental in the identification and development of climate goals and policies.

Community Impacts from Climate Change

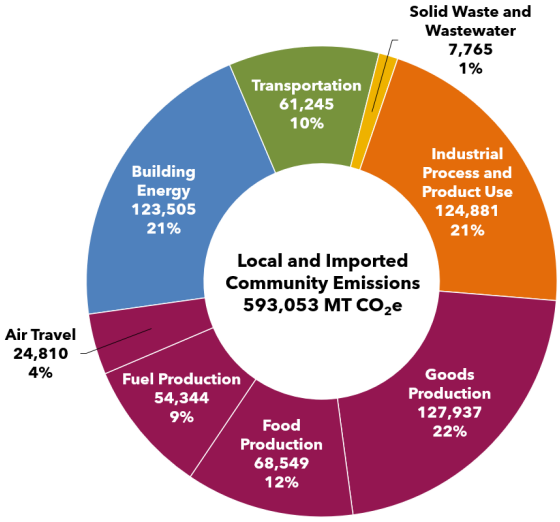
Climate hazards (i.e., natural hazards exacerbated by climate change) of the highest concern and priority are extreme heat and precipitation. Camas can address anticipated impacts by reducing GHG emissions and building community resiliency.

Climate Overview

Greenhouse Gas Emissions

The GHG reduction subelement identifies actions to reduce GHG emissions and decrease per capita vehicle miles traveled (VMT). One of the requirements of the GHG reduction subelement is to meet the GHG reduction requirements in RCW 36.70a.070(9)(d), including reducing per capita VMT within Camas but without increasing GHG emissions elsewhere in the state. To identify actions for VMT reduction, Clark County worked with local cities to prepare a VMT study and travel market assessment to understand baseline travel patterns and strategies for VMT reduction. According to the VMT study, data from the Highway Performance Monitoring System shows that the city's estimated per capita VMT, which represents the average weekday VMT within Camas divided by the city's population, is 11.1. The travel market assessment identified key travel destinations in the city for short trips (i.e., trips 3 miles or less), showing that areas near Lacamas Lake, Camas high school, and Downtown Camas are popular destinations. Both assessments will help inform a regional target for VMT, which will be established outside the climate element/comprehensive plan framework. In addition to VMT reduction, Clark County's Countywide Planning Policies establish requirements for cities to reach net-zero emissions by 2050 (14.1.2) in alignment with statewide GHG emission reductions (RCW 70A.45.020(1)) and set interim (5-year) objectives or targets (14.1.4). A GHG inventory for Camas was also prepared to inform GHG reduction strategies. The inventory provides an estimate of the city's carbon footprint from local emissions (building energy, transportation, solid waste and wastewater, and industrial process and product use) and imported emissions (consumption of goods). Figure 8 Camas Emissions, 2022 shows the combined and per capita emissions for the city.

Figure 8 Camas Emissions, 2022



With a population of 27,250, all 2022 GHG emissions combined (local and imported) for City of Camas totaled

593,035 MT CO_2e

21.8 MT CO_2e Per Capita

Local emissions include sector-based emissions that are generated within Camas. Imported emissions are generated outside of Camas to produce and provide the goods, food, services, air travel, and production of transport of fuels consumed by households. Additionally, wildfires have become one of the largest sources of carbon emissions in Washington state. From 2014 to 2018, wildfires in the state generated 39,200,000 MT CO_2e.

Figure 9 Local and Imported Emissions in Camas

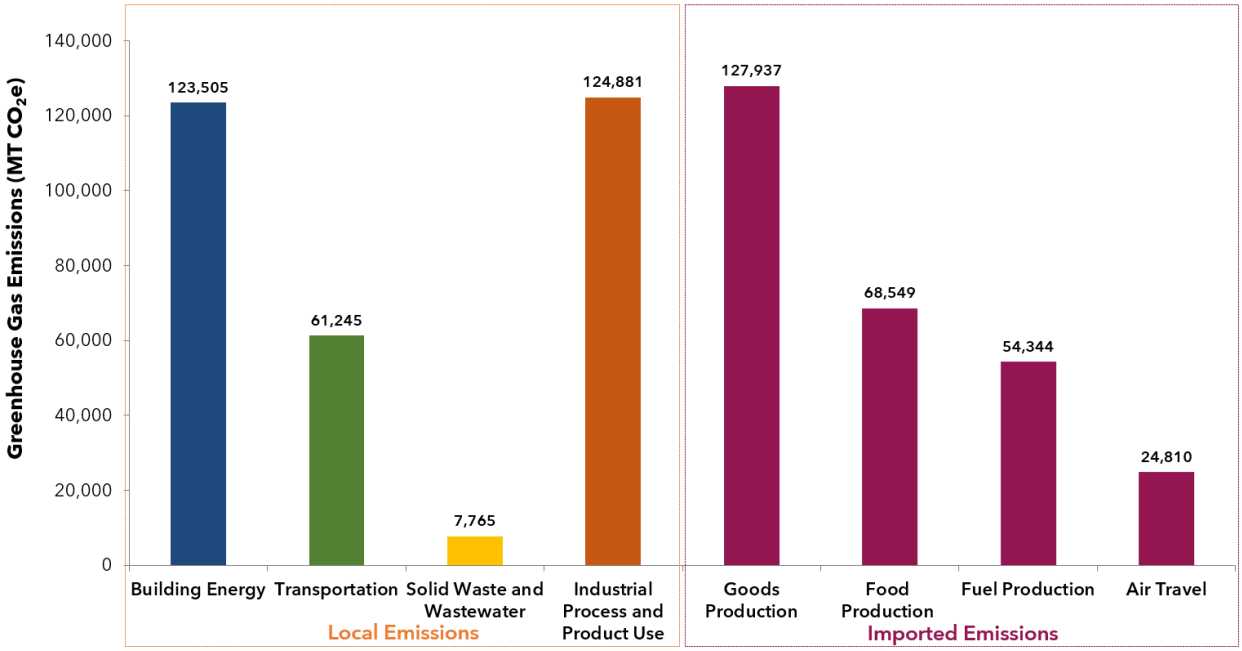


Figure 9 shows a breakdown of the sources of local and imported emissions in Camas. Most sources of local emissions include **industrial process and product use** and **building energy**, which accounts for **78%** of local emissions. Emissions from the industrial process and product use sector generally involve facilities with silicon semiconductor manufacturing. While emissions from these facilities contribute to a large share of local emissions, demand for these goods is global and not specific to Camas. Therefore, goals and policies target reducing local emissions and support existing GHG reduction strategies or targets that are being implemented by businesses and industries in Camas.

Climate Resiliency

Community resiliency is the ongoing process of preparing for, anticipating, and responding to natural hazards created or aggravated by climate change.

Natural hazards relevant to Camas are identified in the 2023 Clark County Natural Hazard Mitigation Plan (NHMP) (CRESA 2023). Table 3 Natural Hazards in Camas lists hazards of concern in order of ranking and their priority, which were evaluated as part of the risk assessment in the NHMP. The risk rating reflects the probability of a hazard weighted against its potential impact on people, property, and the economy. The table also shows the projected climate impacts for each hazard and how hazards have affected the community in the past.

Table 3 Natural Hazards in Camas

Natural Hazard (NHMP Rating[7])	Projected Changes by 2050[8]	Effects on the Community[9]
Extreme Heat (High)	40+ days per year that feel hotter than 90 degrees.	Increased demand for air conditioning, higher utility bills, heat-related illness for sensitive populations and youth at school playgrounds and sports fields, disruption of outdoor activities.
Extreme Precipitation (High)	12% increase in total annual precipitation	Overflowing of streams or rivers, unsafe driving and walking conditions.
Landslide (Medium)	13% increase in heavy rain events	Physical damage to residential and commercial property, energy infrastructure, communication infrastructure, and transportation infrastructure.
Flood (Medium)	17% increase in peak streamflow in Washougal River	Property damage, particularly for older buildings and low-income housing near the floodplain, and temporary or permanent displacement. Temporary closures of businesses and other services.
Wildfire (Medium)	9+ days per year that have high fire danger	Wildfire smoke can impact human health, particularly people with respiratory illnesses or diseases. Increased health risks and property damage for communities near the wildland-urban interface[10].

[7] 2023 CRESA Regional Natural Hazard Mitigation Plan Volume 2 – Planning Partner Annexes
[8] University of Washington's Climate Mapping for a Resilient Washington webtool. Projections are based on a "business as usual" emissions scenario.
[9] Includes effects identified by the Camas community in a 2025 survey.
[10] Clark County Code (15.13.030) defines the wildland-urban interface as areas with elevation in excess of 500 feet and one or more of the following conditions: (a) slope equal to or greater than 25%, (b) forest type vegetation, and (c) outside of an organized fire protection district.

Drought (Low)	14% decrease in summer rains	Impacts to water quality and quantity, decrease in habitat quality and quantity for salmon and other aquatic species.

Vulnerability

Vulnerable Communities

Climate change can impact certain groups of people (vulnerable populations) and areas of the city (overburdened communities) differently. Vulnerable populations are groups of people who are more vulnerable to environmental harms due to socioeconomic factors and other health risk factors (RCW 70A.02.010(14)). Overburdened communities are areas where vulnerable populations experience environmental harms and health impacts (RCW 70A.02.010(11)). Together, vulnerable and overburdened communities are disproportionately impacted by climate change due to the concentration of environmental harms (e.g., air pollution near major roadways) and socioeconomic characteristics (e.g., low income, youth and children). People and communities in Camas who are vulnerable to climate hazards are generally described in the *Our Camas 2045* Equity Framework (see **Introduction** for a description of Equity Communities in Camas).

In addition to communities described in the Equity Framework, CPAT members identified additional communities that could be more vulnerable to climate hazards. These communities include areas that are located near floodplains (such as Lacamas Lake and the Columbia River), near mobile sources of air pollution (such as major roadways), near steep slopes and steep road grades, and/or near the wildland urban interface (e.g., homes adjacent to forested areas).

Vulnerable Assets

In Camas, the impact of climate hazards can depend on the proximity of people and buildings to each hazard. The approximate location of these hazards is shown in Figure 10 Wildfire Hazard Areas and Figure 11 Flood and Landslide Hazard Areas. Climate hazard locations are based on data from publicly available sources such as Clark County's Open Data Hub and include approximate areas of increased risk. While this information provides a visualization of higher risk areas, data may not include all potential risks and data gaps may exist depending on when data was published. Therefore, these figures provide a conceptual understanding of the location of climate hazards and potential effects on the community.

Figure 10 Wildfire Hazard Areas

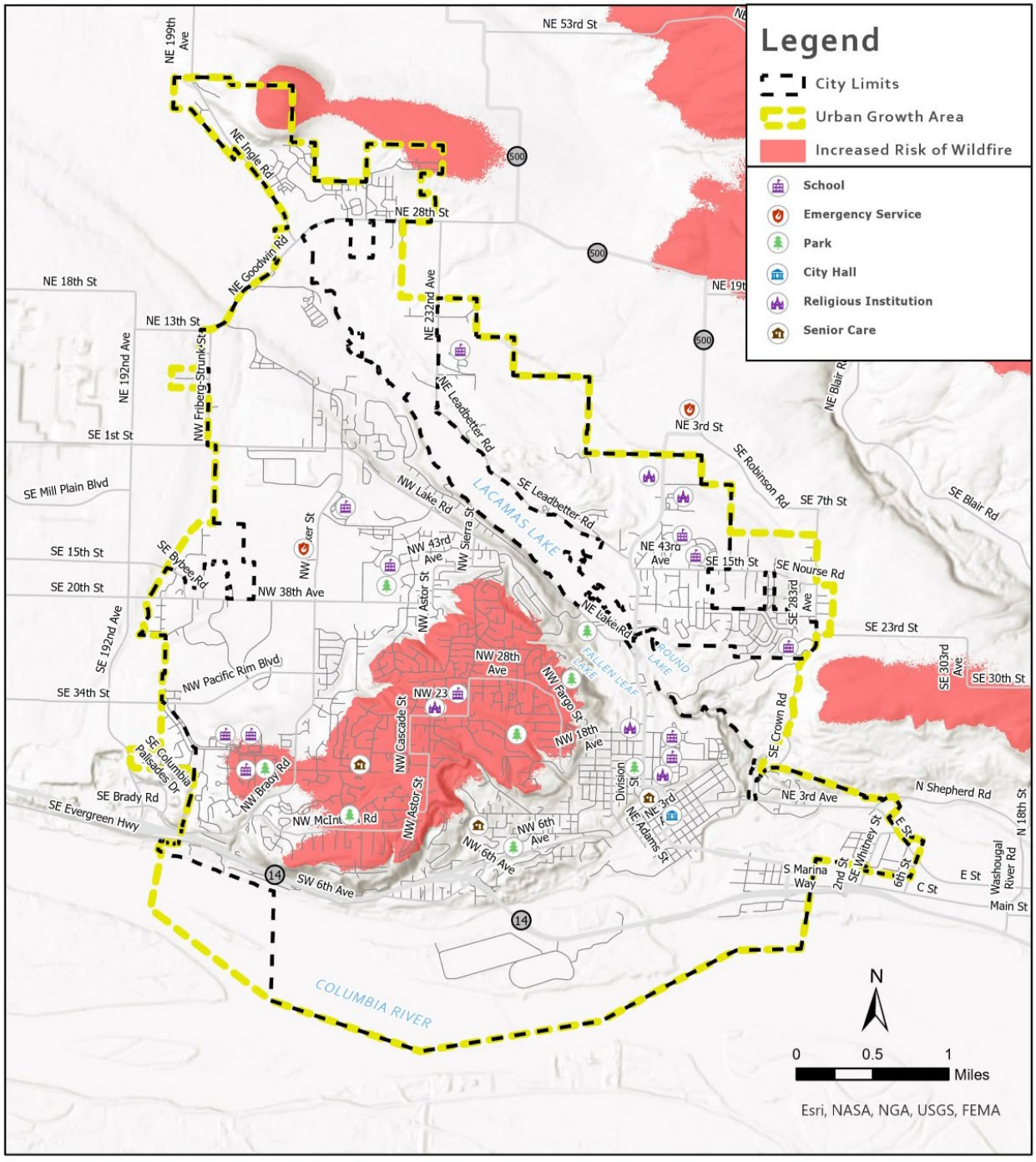
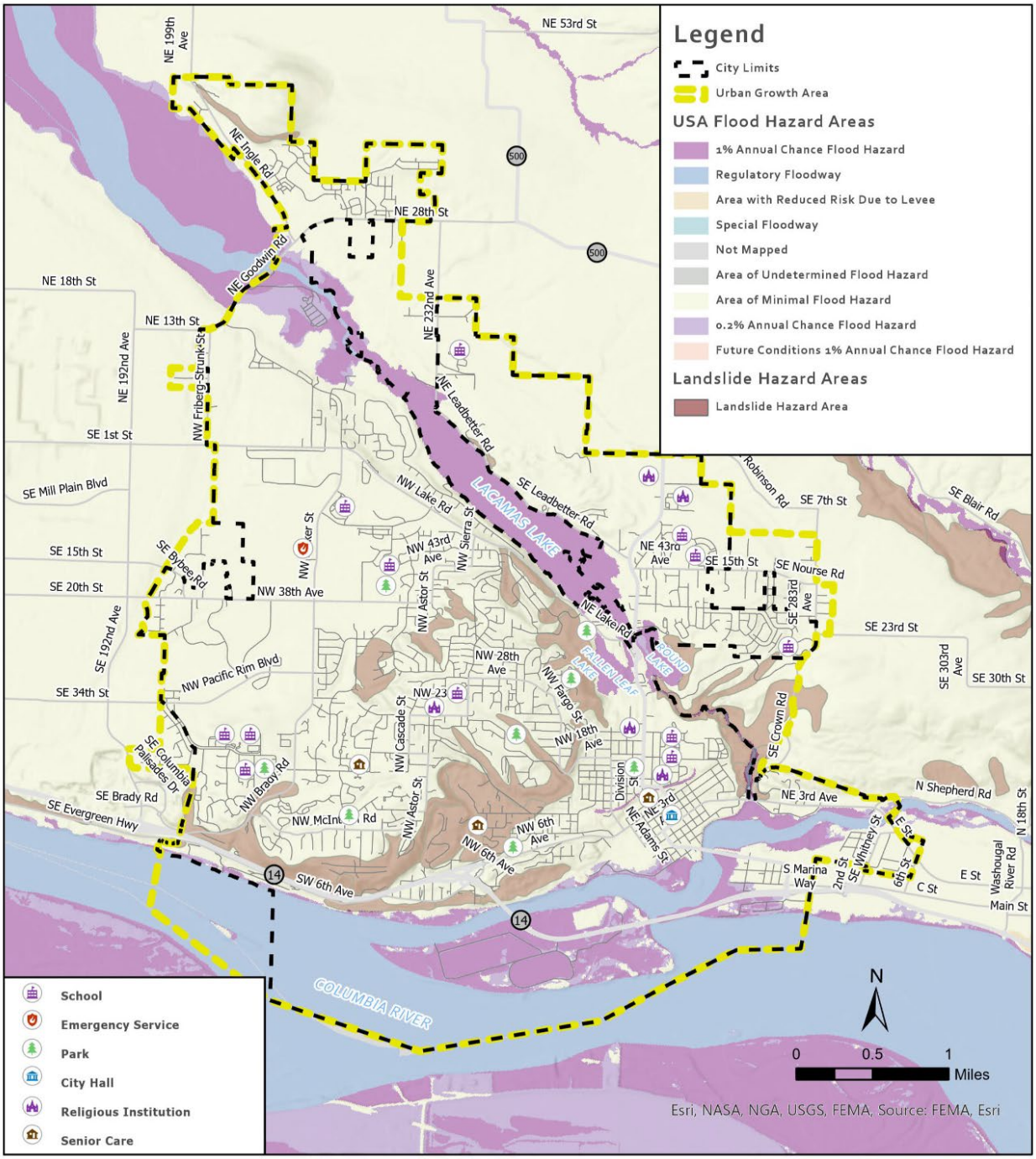


Figure 11 Flood and Landslide Hazard Areas



In Camas, buildings and infrastructure that could be vulnerable to climate hazards include aging water and sewer lines, buildings constructed before adopted seismic codes (e.g., city hall, public works operations center), and high-pressure natural gas lines. High tension power lines may also be vulnerable to severe storms (i.e., wind and ice), homes along the Washougal and Columbia Rivers, including the Georgia Pacific paper mill, may be susceptible to flooding, and the dam at Lacamas Lake could be impacted by an earthquake or flooding.

Extreme heat is one of the highest rated hazards for Camas. Buildings and impervious surfaces such as streets are factors in the urban heat island effect, where urban areas are warmer than surrounding rural or less developed areas. The County's department of public health collected heat data on one day in July 2024 and prepared a heat watch summary report describing how urban heat varies across neighborhoods in the county and how landscape features affect temperature and humidity. Across the county, areas with more buildings and paved surfaces tend to be hotter during the afternoon and evening. In Camas, the hottest areas of the city during the afternoon and evening are near Downtown Camas while cooler areas with more vegetation and shade are in west Camas, northeast of downtown, and near Lacamas Lake.

Vulnerability Assessment

A vulnerability and risk assessment prepared for Camas evaluated the risk of extreme heat on outdoor recreation sites, including (1) Lakes, (2) Parks & Trails, (3) School Playgrounds & Sport Fields, and (4) Downtown Camas. Both vulnerability (sensitivity and adaptive capacity) and risk (probability and magnitude) were evaluated.

The assessment produced composite scores for vulnerability and risk. For the lakes, Lacamas Lake and Round Lake scored high and Fallen Leaf Lake scored low. Under parks and trails, seven scored low, two scored medium, and 11 scored high. School playgrounds and sports fields scored medium (6) and high (6). Lastly, Downtown Camas scored high as it features the hottest area of the city.

To reduce vulnerability and risk, this element includes policies to mitigate the impacts of extreme heat.

Climate Change and Resiliency Goals and Policies

Climate goals and policies are established to meet the State's vision to reduce greenhouse gas emissions, plan for resilience, and support environmental justice. While these goals and policies directly focus on emissions and resiliency, additional policies in other elements of the plan tangentially support these goals. Those policies are noted with a leaf symbol.

Goal CL-1 Energy

Ensure that development and redevelopment projects, including buildings and energy infrastructure (generation, storage, and transmission) are designed to accommodate and use renewable energy, conservation, and efficiency technologies and practices to reduce GHG emissions and increase resiliency to natural hazards.

Policy CL-1.1 Support residents' efforts to improve energy efficiency and resiliency in existing and new residences.

Policy CL-1.2 Encourage renewable energy sources for new and existing buildings.

Policy CL-1.3 Provide commercial buildings, particularly restaurants and food services, with incentives to retrofit buildings for energy efficiency (e.g., grant programs, reduce permit fees, etc.).

Policy CL-1.4 Incentivize and streamline the review process for renewable resource projects.

Goal CL-2 Transportation

Improve the efficiency and resiliency of the transportation system to achieve GHG reduction goals and better withstand natural hazards.

Policy CL-2.1 Promote and complement state and utility incentives to provide electric vehicle charging infrastructure throughout the city, particularly at existing and new multi-family buildings and large employers.

Policy CL-2.2 Provide homeowners and renters information on state and federal tax credits/rebates for electric vehicles, renewable resources and energy efficiency.

Policy CL-2.3 Incorporate projected hydrologic climate impacts into the design and maintenance of water-crossing structures (e.g., climate-smart culverts and bridges).

Goal CL-3 Local Agency Sustainability and Preparedness

Support agencies, districts, and businesses in establishing and achieving their own sustainability goals, initiatives, and programs.

Policy CL-3.1 Support the sustainability initiatives of local agencies, districts, and businesses.

Policy CL-3.2 Support local businesses efforts to bolster climate preparedness and continuity of operations (e.g., develop on-site electricity storage to reduce energy demand during peak hours, incentives to install backup power, building retrofits).

Policy CL-3.3 Support the local economy's resilience to climate disruptions by providing information and resources on how to prepare for extreme heat, flooding, and wildfire.

Policy CL-3.4 Support economic opportunities for green jobs in Camas, including businesses that produce goods or services that benefit the environment and jobs that support business production processes to be more environmentally friendly or use fewer natural resources.

Policy CL-3.5 Develop a sustainable purchasing policy and sustainable construction standards for the City of Camas.

Goal CL-4 Community Health

Protect community health and well-being from the impacts of climate-exacerbated hazards and ensure that the most vulnerable residents do not bear disproportionate health impacts.

Policy CL-4.1 Promote the use of health impact assessments and other tools to identify and address the impacts on health and equity from climate change.

Policy CL-4.2 Develop and implement an urban heat resilience strategy that addresses land use, urban design, urban greening, and waste heat reduction actions.

Goal CL-5 Emergency Preparedness

Enhance emergency preparedness, response, and recovery efforts to mitigate risks and impacts associated with natural hazards.

Policy CL-5.1 Create accessible evacuation plans and outreach materials to help residents plan and practice actions that make evacuation and reunification quicker and safer during a natural hazard event (e.g., notification alerts).

Policy CL-5.2 Develop a comprehensive, communitywide wildfire resilience strategy to improve emergency response capabilities, create fire-resilient landscapes, promote fire-adapted communities, and support the development of community wildfire protection plans.

Policy CL-5.3 Support enhanced data collection for hazard events of all magnitudes to provide a fuller understanding of the community's hazard characteristics.

Policy CL-5.4 Develop resiliency hubs, such as community-serving facilities that support residents, coordinate communication, distribute resources, and enhance quality of life.

Policy CL-5.5 Prepare, plan, and provide ongoing training for those responding to adverse environmental events.

Goal CL-6 Water Resources

Protect and preserve the long-term quality and quantity of Camas' water, and natural and cultural resources from climate change hazards such asdrought and extreme participation.

Policy CL-6.1 Develop and implement a comprehensive drought resilience strategy that factors in projected climate impacts and sets action levels for different drought stages.

Policy CL-6.2 Evaluate the long-term adequacy of water delivery and storage infrastructure to ensure projected changes in hydrological conditions can be anticipated and managed effectively.

Policy CL-6.3 Implement actions recommended by the Lacamas, Round, and Fallen Leaf Lakes Management Plan to reduce the frequency of harmful algae blooms in lakes due to water pollution and projected changes in climate conditions, including higher temperatures.

Policy CL-6.4 Identify funding mechanisms for mitigation measures recommended by the Lake Management Plan to address the impacts of climate hazards on Lacamas, Round, and Fallen Leaf Lakes.

Policy CL-6.5 Introduce adaptive cooling features at local parks and school playgrounds and sports fields to help mitigate the effects of extreme heat on vulnerable park users and young children.

ourCamas 2045



Transportation

08

08. Transportation

GMA Planning Goal

Encourage efficient multimodal transportation systems that will reduce greenhouse gas emissions and per capita vehicle miles traveled, and are based on regional priorities and coordinated with county and city comprehensive plans.

Vision

In 2045, residents of Camas continue to appreciate their safe transportation infrastructure that equitably serves all users.

Introduction

As part of the comprehensive plan periodic update, the City of Camas reviewed and updated its Transportation System Plan (TSP). The TSP is adopted by reference and included as Appendix X. The TSP is a long-range plan to guide transportation investments for Camas and its UGA for the planning horizon to 2045. The TSP provides the following:

- Inventory of the current transportation system for all modes of travel
- Summary of land use assumptions used for estimating travel demands
- Summary of level of service (LOS) standards
- List of actions to address deficiencies
- Forecast of traffic demand for twenty years
- System needs to meet the current and forecasted demand
- Six-year Transportation Improvement Plan (TIP)

These items are foundational to a comprehensive plan and integral to implementing the Land Use plan.

The transportation element is one of the main parts of the comprehensive plan and is an effective tool for shaping the city's future development patterns. Growth and development patterns have a major influence on the fiscal health of local governments and on the economic performance of the community. The nature of public streets can shape the level of traffic congestion, the use of multiple modes, and the character of neighborhoods. Related requirements, such as parking and loading, will influence the cost to develop in a community and can present both opportunities and barriers to how people can access homes, schools, recreational opportunities, and businesses within the community and in the region.

Ownership, control, development, and the operation and maintenance of streets and public rights-of-way are primary functions of local governments. A transportation system is one of the most expensive facilities a community will construct, operate and maintain. Each new facility adds an asset to the city's portfolio, but it also must be managed, resulting in an incremental increase in operating costs and a new set of maintenance, preservation, and rehabilitation obligations.

Decisions about transportation facilities greatly influence the safety and security of the community. How the streets, roads and other transportation facilities are designed, built and maintained will influence safety in multiple ways for all users.

Federal, state, county and city transportation systems are interrelated, so coordination with other units of government is essential. Responsibility for transportation systems spans all levels of government. The Camas transportation network connects to state highways, neighboring city streets and adjacent county roads and indirectly to federal and interstate highways. It also interacts with transportation facilities operated by other special purpose districts like C-TRAN and for-profit businesses. Moreover, the public does not experience the transportation system as a series of separate systems, but as a single, unified system, and it expects all the parts to function in an integrated fashion.

The GMA requires the transportation element to implement and be consistent with the land use element. Counties and cities should use consistent land use assumptions, population forecasts, and planning periods for both elements. Coordination of the land use and transportation elements must be dynamic and iterative with an ongoing feedback loop coordinating land use and transportation in the plan development and in local implementation. The transportation element is also required to be consistent with state and regional plans. The transportation element is certified by the regional transportation organization, which is the Southwest Washington Regional Transportation Council (RTC), to ensure consistency with the regional transportation plan (RTP).

Performance Standards

Level of Service (LOS)

The TSP includes level of service as a measure of performance standards for motor vehicles. A LOS "D" and a vehicle to capacity (v/c) ratio not higher than 0.85 is the minimum performance standard during the highest one-hour period of the day for signalized, all-way stop and roundabout controlled intersections under City jurisdiction. These standards shall be applied to the intersection as a whole.

A LOS "E" and a v/c ratio not higher than 0.90 is the minimum performance standard during the highest one-hour period of the day for two-way stop and yield controlled intersections under City jurisdiction. These standards shall be applied to all intersection approaches serving more than 20 vehicles. Mobility standards do not apply to approaches at intersections serving 20 vehicles or fewer during the highest one-hour period of the day8. This mobility standard allows

more flexibility in the tension between larger intersection and street designs that are sometimes needed to accommodate peak vehicle demands, and the desire to maintain smaller designs that encourage slower vehicle speeds and tend to be more accommodating to pedestrian and bicycle users.

Level of Service for Highways of Statewide Significance is set by the State. In Clark County, the standard is set as LOS "D" for urban areas, including SR 14. Level of Service for regional state highway facilities (not part of the HSS), including SR 500 in Camas, is set through the Southwest Washington RTC. The Southwest Washington RTC Board adopted LOS 'E' or better for non-HSS urban state highway facilities.

As part of the City's TSP update, forecasted 2045 motor vehicle volumes for peak hour conditions were utilized to determine areas on the baseline roadway network that will be congested and may require future investments to accommodate forecasted growth. The corridors recommended to prioritize for improvements include:

- SR 500-NE Everett Street between NE 23rd Avenue and SE Leadbetter Road
- NW 6th Avenue between Norwood Street and Adams Street
- NE 3rd Avenue between NE Dallas Street and SE Lechner Street

Level of Traffic Stress (LTS)

The TSP includes Level of Traffic Stress (LTS) to measure the comfort of those who are walking, biking or rolling on streets shared with vehicles. The best way to make these facilities comfortable to use while walking, biking and rolling is with space, separation, and visibility. The specific application depends on the conditions of each street. LTS is measured on a scale of one to four. A road with an LTS of 1 is best and is suitable for all users. A road with an LTS of 4 has the highest level of stress for a user and is typically used by those with a high level of confidence or those who don't have an alternative option. The TSP indicates LTS 2 is the standard, meaning streets should be comfortable for most adults, including most adults experiencing disabilities. There may be some separation between pedestrians and vehicles, though no physical barrier.

Travel Demands and Characteristics

The number of people who choose to walk, bike, ride transit, or drive alone with the distances they travel is important for assessing how well existing transportation facilities serve the needs of users. Available data on travel demand, travel mode choice, and trip length are used to better understand travel behavior in the community and inform the needs analysis for the transportation system. This data is largely derived from the US Census Bureau on employment-based trips; however, no other travel data is available from this source. The following sections provide a summary of travel demands and characteristics in the City's planning area.

Commuter Trips

Much of the traffic in the Camas planning area, especially during the more congested weekday peak periods, is related to employment. In other words, how do people get to and from work

from their place of residence. People who live in Camas and who are employed overwhelmingly commute to work outside of the planning area (87 percent), while jobs in the planning area are overwhelmingly filled by people who live outside of the planning area (83 percent).[11]

In terms of the predominant travel mode, on average, almost 75 percent of employed residents in the Camas planning area commute to work using single-occupant motor vehicles. About 8 percent of residents carpool to work and the remaining 17 percent work from home, walk, bike, take transit, or use some other means of travel[12].

About 11 percent of employed residents in the Camas planning area worked from home pre-COVID, and that figure likely increased due to COVID-19. It seems likely that a higher percentage of workers will continue a hybrid work schedule that includes teleworking, at least part time. Any increase in the hybrid work week (e.g. 2-3 days in an office with the balance at home or some other remote location) will change the demand on the transportation network, including when and how people travel.

Transportation Demand by Mode

Pedestrian, bicycle, and motor vehicle traffic counts were conducted at key intersections throughout Camas on typical weekdays[13]. This information indicates where and when travel demand is highest for each mode of travel. It also provides a basis for assessing how well existing transportation facilities are able to meet the needs of users during peak demand periods.

- Pedestrian volumes during the PM peak hour are generally highest near downtown Camas, including along NE 3rd Avenue and NE Adams Street (the traffic count summary is included in the appendix). The highest hourly pedestrian activity during the evening peak occurred at the NW Sierra Drive intersection with NW 28th Avenue, near Dorothy Fox Elementary school, with 30 pedestrian crossings in the one-hour period. Other study intersections with more than 15 pedestrian crossings during the one-hour period included many downtown locations such as NE 6th Avenue at NE Adams Street, NE 3rd Avenue at NE Dallas Street, NE 3rd Avenue at NE 4th Street, and Weir Road at NE 3rd Avenue, near the border of Camas and Washougal.
- Bicycle volumes indicate limited biking, with the highest volumes along NW Lake Road, and NW Sierra Street (the traffic count summary is included in the appendix). During the evening peak hour, 20 of the 50 study intersections had no observed bicyclists during the one-hour period. The NE Lake Road at SR 500, NW Lake Road at NW Sierra Street, NW Lake Road at NW Leadbetter Drive, NW Sierra Street at NW 45th Avenue, and NE 6th Avenue at NE Garfield Street intersections had the highest observed bicycle volumes, with 4 or more bicyclists counted during the single hour at each of the intersections.

[11] US Census Bureau, OnTheMap. Home/Work Distance/Direction Analysis, 2015.
[12] US Census Bureau, 2012-2016 American Community Survey
[13] Based on counts conducted in April of 2018.

- Motor vehicle volumes on the roadways in Camas (the traffic count summary is included in the appendix) most commonly peak during weekday evenings between 4:50 and 5:50 p.m. The highest hourly motor vehicle volumes during the evening peak occurred along the NW 6th Avenue corridor between the SR 14 ramps and NE Adams Street, with more than 1,300 trips during the one-hour period. This corridor is the primary entrance into Camas from eastbound travel. The NE Lake Road at NE Everett Street, and NW 6th Avenue at SR 14 Ramps intersections had the highest observed volumes, with more than 1,800 entering vehicle trips during the single hour at each of the intersections.

Active Transportation Networks

Camas is a community with an active citizenry and, therefore, requires a fairly robust active transportation system that includes pedestrian and biking facilities. The TSP inventoried the pedestrian and biking facilities, listed gaps in the systems, and assessed the facilities for how a pedestrian and bicyclist experiences them.

Multimodal Network Design

The design of the streets in the City's planning area is based on the network classifications and area designation. All streets in the planning area are multimodal and include travel lanes and on-street parking for vehicles, sidewalks for pedestrians, and on-street or separated facilities for bicyclists. Accommodating these modes varies by the functional classification and area designations. For a typical street cross-section, the functional classification determines the minimum design requirements for the number of vehicle travel way lanes and on-street parking, and the minimum acceptable bike facility, and the area designation is used to determine the minimum acceptable design for pedestrian facilities, and the minimum travel lane and median/turn lane width. Together, these cross-section standards identify the design characteristics needed to meet the function and demand for each facility type for streets in the City's planning area. Since the actual design of a roadway can vary from segment to segment due to adjacent land uses and demands, this system allows standardization of key characteristics to provide consistency.

The typical designs are intended to be implemented in newly developing or redeveloping areas of the City's planning area, where constrained conditions do not limit the ability to construct the typical cross-section. A variety of physical and natural constraints may prevent adherence to the multimodal network design requirements. A deviation to the street standards may be requested from the City Engineer or City Engineer's designee with justification of constraints to consider a constrained cross-section or other adjustments.

Pedestrian Network

Walking supports healthy lifestyles, is an easy and economical way to travel, and is well-suited for people of all ages and abilities. In this plan, "walking" and "pedestrian" are terms that include people who walk independently or use canes, wheelchairs, or other walking aids, or strollers. Approximately two percent of commuters in the city walk to work, with three percent

utilizing public transportation, which often includes walking at the beginning or end of the trip.[14] In addition to the work commute trips, walking trips are made to and from recreational areas, shopping areas, schools, and other key destinations in the community. Continuous and direct sidewalk connections to all key destinations and along all streets, in addition to safe crossing opportunities along major roadways, are essential to encourage walking and transit use.

A pedestrian network assessment of streets, showing the extent to which the walking network on collector and arterial streets provides a level of comfort and safety for users, was completed throughout the city. About 30 percent of the collector and arterial street miles in Camas were rated "good (i.e., level of traffic stress (LTS) 2)" or "excellent (i.e., LTS 1)" for pedestrians. However, over 35 percent of the collector and arterial street miles rate poorly (i.e., LTS 4). Most of the street miles rated "poor" are located in high growth areas, be that housing or business growth. The pedestrian network in these areas is largely unimproved due to the once rural nature of the surrounding land use. As future urban development occurs, pedestrian facilities will improve in those areas. Overall, the pedestrian network rates relatively high near downtown, and generally poorer towards the edges of the city. See Figure 13 for an inventory of the pedestrian network.

Bicycle Network

Cycling is important for both transportation and recreation in the Camas planning area. This includes people who bike to work and school, bike for recreation or running errands. Approximately one percent of commuters in the city bicycle to work[15]. Riding bicycles also plays a key role in the transportation system's ability to support healthy and active lifestyles and provide a viable alternative to the automobile. Continuous bicycle connections between all activity generators and arterial/collector roadways are desirable to allow for safe and attractive non-motorized travel options.

The bicycle network in the City's planning area, shown in

Figure 12, is composed of bike lanes, roadway shoulders, shared roadways, and shared-use paths.

- Bike lanes are portions of the roadway designated specifically for bicycle travel via a striped lane and pavement stencils. Bike lanes are most appropriate for arterials and collectors, where high traffic volumes and speeds warrant greater separation of the travel modes. Significant segments of continuous bicycle lanes exist along portions of NW Lake Road, NW 38th Avenue, NW Parker Street, NW Friberg-Strunk Street, and SR 500.
- Shoulder bikeways are paved with striped shoulders wide enough for bicycle travel. A six-foot paved shoulder is desired to adequately provide for bicyclists, with a four-foot minimum width in constrained areas. Roadways with shoulders less than four feet are

[14] US Census Bureau, 2012-2016 American Community Survey
[15] US Census Bureau, 2012-2016 American Community Survey

considered shared roadways. Some shoulder bikeways are signed to alert motorists to expect bicycle travel along the roadway

- Shared roadways include those on which bicyclists and motorists share the same travel lane. The most suitable roadways for shared bicycle use are those with low speeds (25 mph or less) and low traffic volumes (3,000 vehicles or fewer per day). Shared roadways, often signed as bicycle routes, serve to provide continuity to other bicycle facilities (e.g., bicycle lanes) or can be designated as a preferred route through the community. Shared roadways can have signs that highlight a special route or provide directional information in bicycling minutes or distance. Most local roadways in the city are considered shared roadways, but do not have signs or pavement markings, although some are planned to be improved in the TSP.
- Shared-use paths provide off-street travel for bicyclists and pedestrians, and are wider than an average sidewalk (e.g., 10 – 14 feet). Shared-use paths are typically paved (asphalt or concrete) but may also consist of an unpaved smooth surface, such as compacted gravel, as long as it meets Americans with Disabilities Act (ADA) standards. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout the residential neighborhoods.

A bicycle network assessment of streets in Camas shows the extent to which the bicycle network on collector and arterial streets provides a level of comfort and safety for users. About 20 percent of the collector and arterial street miles' in Camas rate "good (i.e., LTS 2)" or "excellent (i.e., LTS1)" for bicyclists. However, about 65 percent of the collector and arterial street miles' rate poorly (i.e., LTS 4) for bicyclists.

Overall, the bicycle network rates relatively high on the northwest side of the city and poor on the south and east side. The streets with the lowest ratings are the streets important for local and regional through travel (e.g. portions of NW 6th Avenue, NE 3rd Avenue, and SR 500), where many businesses and services are located. These streets rate low due to the relatively high motor vehicle traffic volumes and speeds and lack of separated bicycle facilities.

Transition Plan for Transportation

Title II of the Americans with Disabilities Act requires cities to establish a transition plan for transportation. The plan shall, at a minimum:

1. Identify physical obstacles in Camas' facilities that limit the accessibility of its programs or activities to individuals with disabilities;
2. Describe in detail the methods that will be used to make the facilities accessible;
3. Specify the schedule for taking the steps necessary to achieve compliance and, if the time period of the transition plan is longer than one year, identify steps that will be taken during each year of the transition period; and
4. Indicate the official responsible for implementation of the plan.

Camas has a relatively well-developed pedestrian network that is also potentially suitable for those who use mobility devices. The network is composed of sidewalks, shared-use paths and pedestrian trails, and other accessways. A large part of downtown Camas was developed prior to 1950, a time in which sidewalks were incorporated into the design of neighborhoods and streets. Although most areas incorporated into Camas over the following decades have sidewalk coverage, a few areas have noticeable gaps that do not make for a complete sidewalk network. These gaps are most significant in southwest, southeast, and northeast Camas, and on roadway segments outside city limits. Paved shared-use paths exist along portions of NW Parker Street, NW 18th Avenue, Lacamas Lake, Washougal River, and scattered throughout residential neighborhoods. Unpaved pedestrian only trails are scattered throughout the city.

Many intersections in older parts of the city lack ADA-compliant ramps, which provide important connections between sidewalks, making it easier to cross streets and handle the vertical drop at curbs. Knowing these conditions, the city has been recently installing new curb ramps in many of these locations. The presence of curb ramps is fairly consistent along streets in downtown Camas, and in the newer neighborhoods in the city. Additional work is required by the City to ensure all existing and future sidewalks have curb ramps.

About 38 percent of street miles (including City arterial, collector and local streets) lack sidewalk coverage along one or both sides (see Figure 13). These gaps are more common along arterial streets than collector streets, at 40 and 23 percent, respectively, of the street miles with no sidewalk on either side. These numbers do not incorporate off-street shared-use paths that may run alongside some roadways. Any future streets constructed in association with development projects will be required to construct sidewalks with curb ramps, increasing the overall sidewalk supply.

Transportation Projects and Priorities

This section describes the transportation system improvement projects- multimodal street improvement, intersection improvement, pedestrian/bike improvement, transit enhancement, and demand/system management – to address the system needs identified in earlier text.

The list of projects was developed through three main sources including stakeholders, relying on previous plans (such as the North Shore Subarea Plan), and independent project team evaluation.

The full list of projects is identified to improve the transportation network along major streets in the City's planning area, regardless of their priority or their likelihood of being funded. The TSP focuses on streets in the planning area with a functional classification of Collector or higher. Additional improvements will occur with private development in the planning area, including the build-out of the local street network consistent with the applicable standards.

The planning process from the TSP screens candidate projects to set aside those that may not be feasible due to environmental or existing development limitations. The remaining projects

are a combination of new and previous ideas for the transportation system that seek to address the gaps and deficiencies in the city.

The full project list, included as Appendix X, includes 99 projects totaling over $180 million in total investments. For the purposes of cost estimates, project design elements are identified, however, the actual design elements for any project are subject to change and will ultimately be determined through a preliminary and final design process and are subject to City, WSDOT, Clark County, and/or other partner agency approval. The projects were assigned to one of several categories:

- Multimodal Street Improvement - these projects will improve or construct new multimodal streets throughout the planning area, each with facilities for motorists, pedestrians, and bicyclists. A total of 29 projects have been identified that, as of 2024, will cost an estimated $72 million to complete.
- Intersection Improvement – these projects will improve safety and mobility at intersections throughout the planning area. A total of 19 projects were identified to construct new or improve existing intersections that, as of 2024, will cost an estimated $64 million to complete.
- Pedestrian/Bike Improvement – these projects include stand-alone sidewalk, path and roadway crossing improvements, and an integrated network of bicycle lanes, marked on-street routes and shared-use paths to facilitate safe and convenient travel citywide. A total of 39 pedestrian and bicycle projects were identified that, as of 2024, will cost an estimated $38 million to complete.
- Transit Enhancement – these projects will enhance the quality and convenience for transit passengers. One transit project was identified that, as of 2024, will cost an estimated $1 million.
- Demand/System Management – this will encourage more efficient usage of the transportation system. Two projects were identified that, as of 2024, will cost an estimated $450,000.

Transportation Facility Maps

Figure 12 Bicycle Facilities

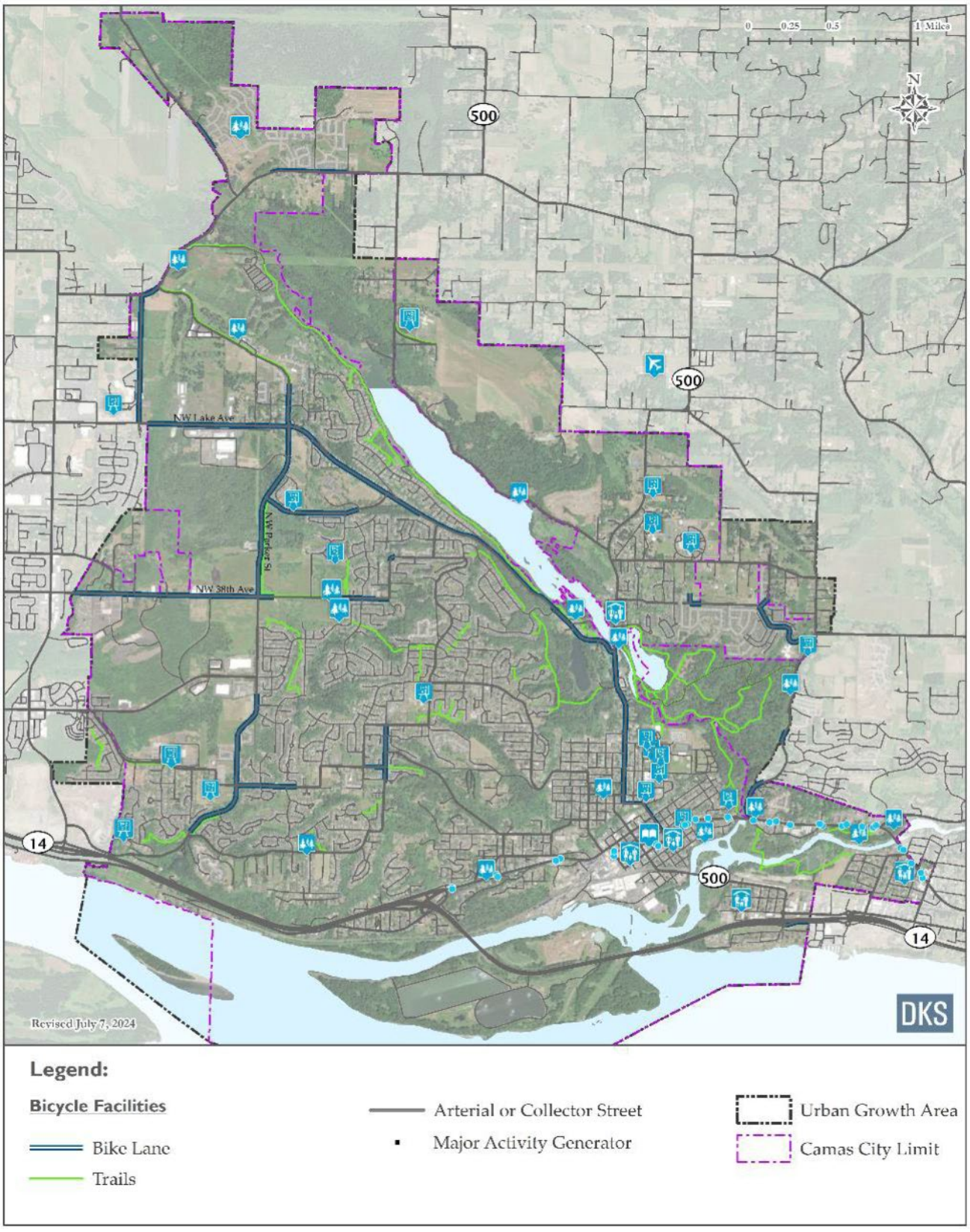


Figure 13 Pedestrian Facilities

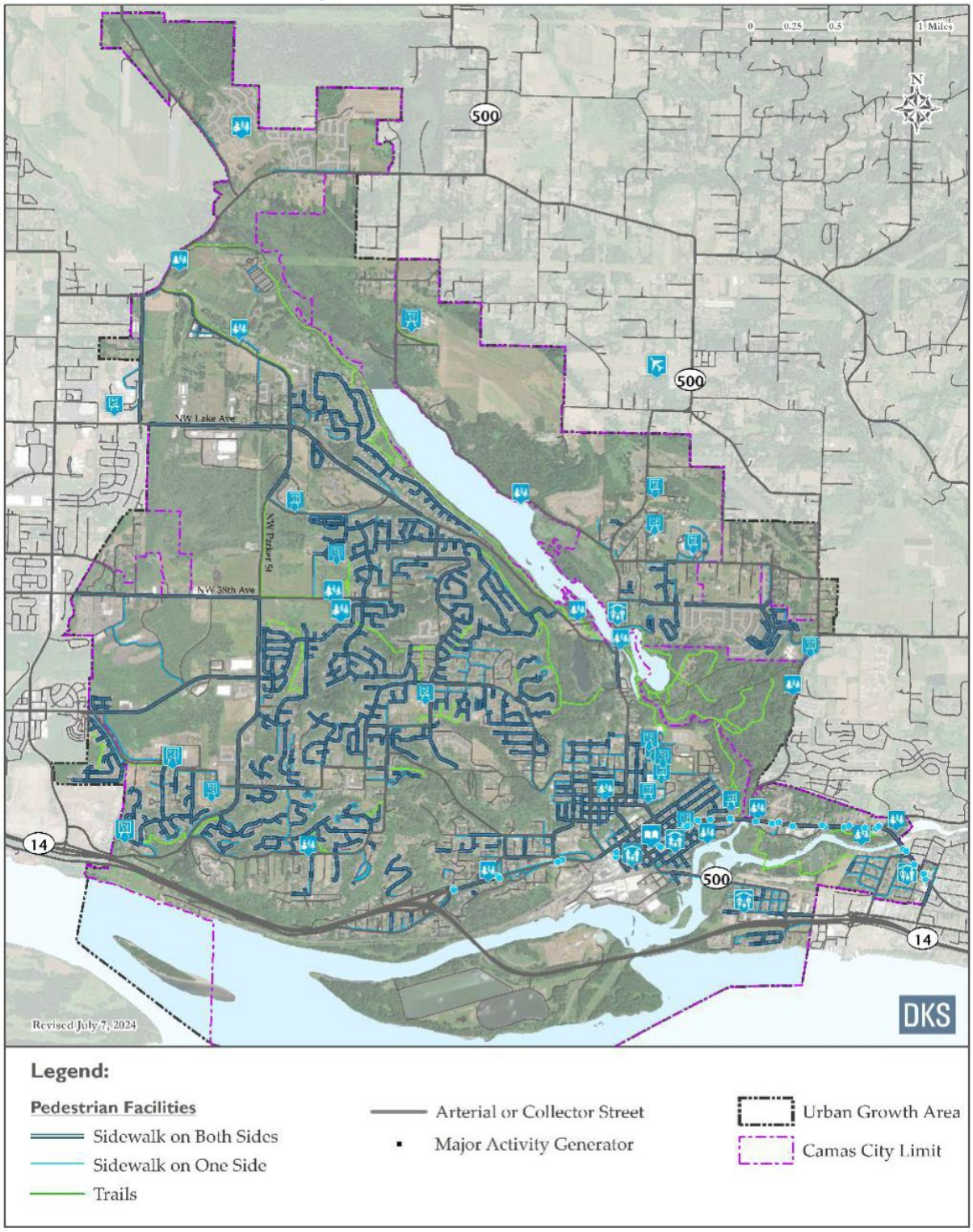


Figure 14 Street Network

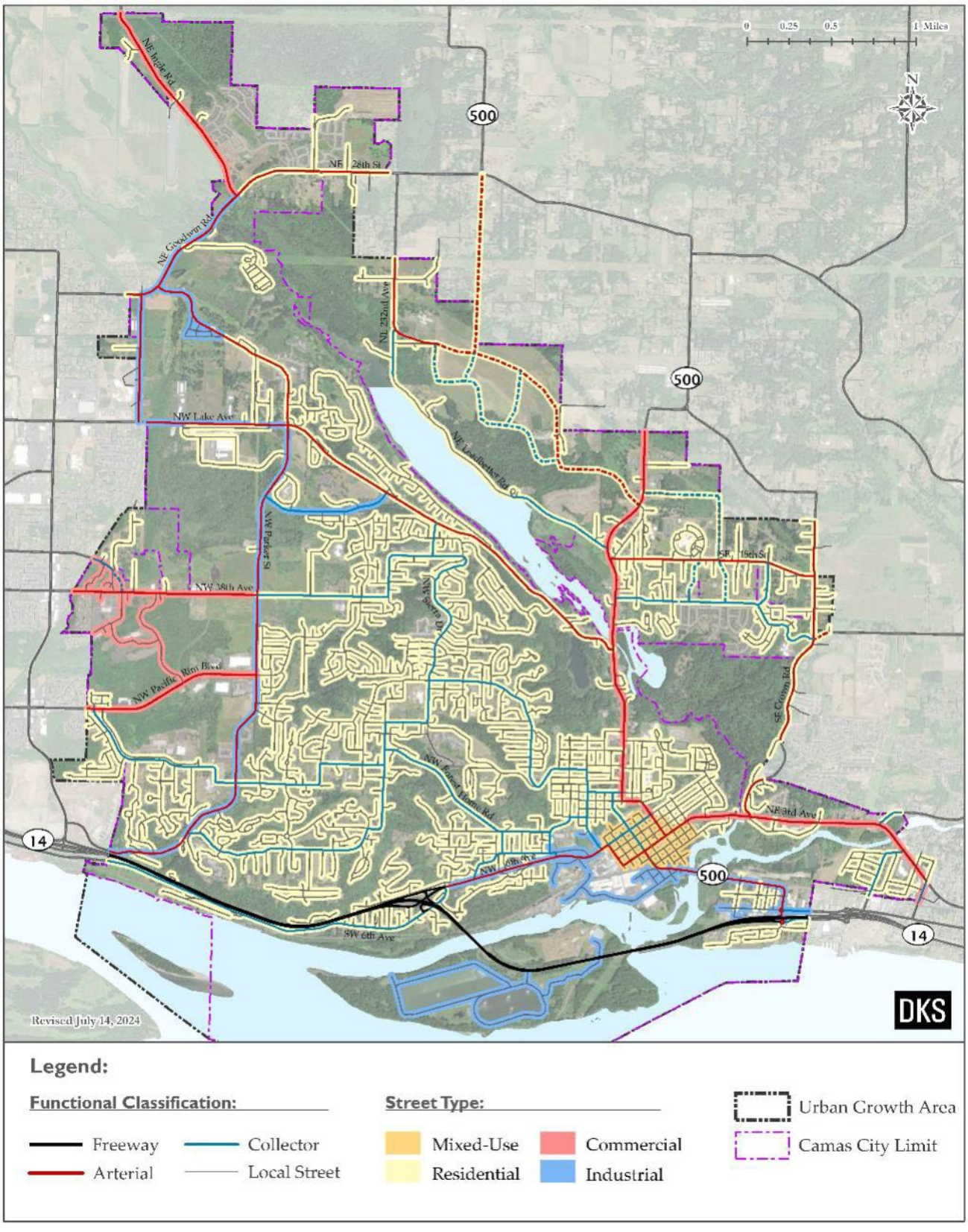
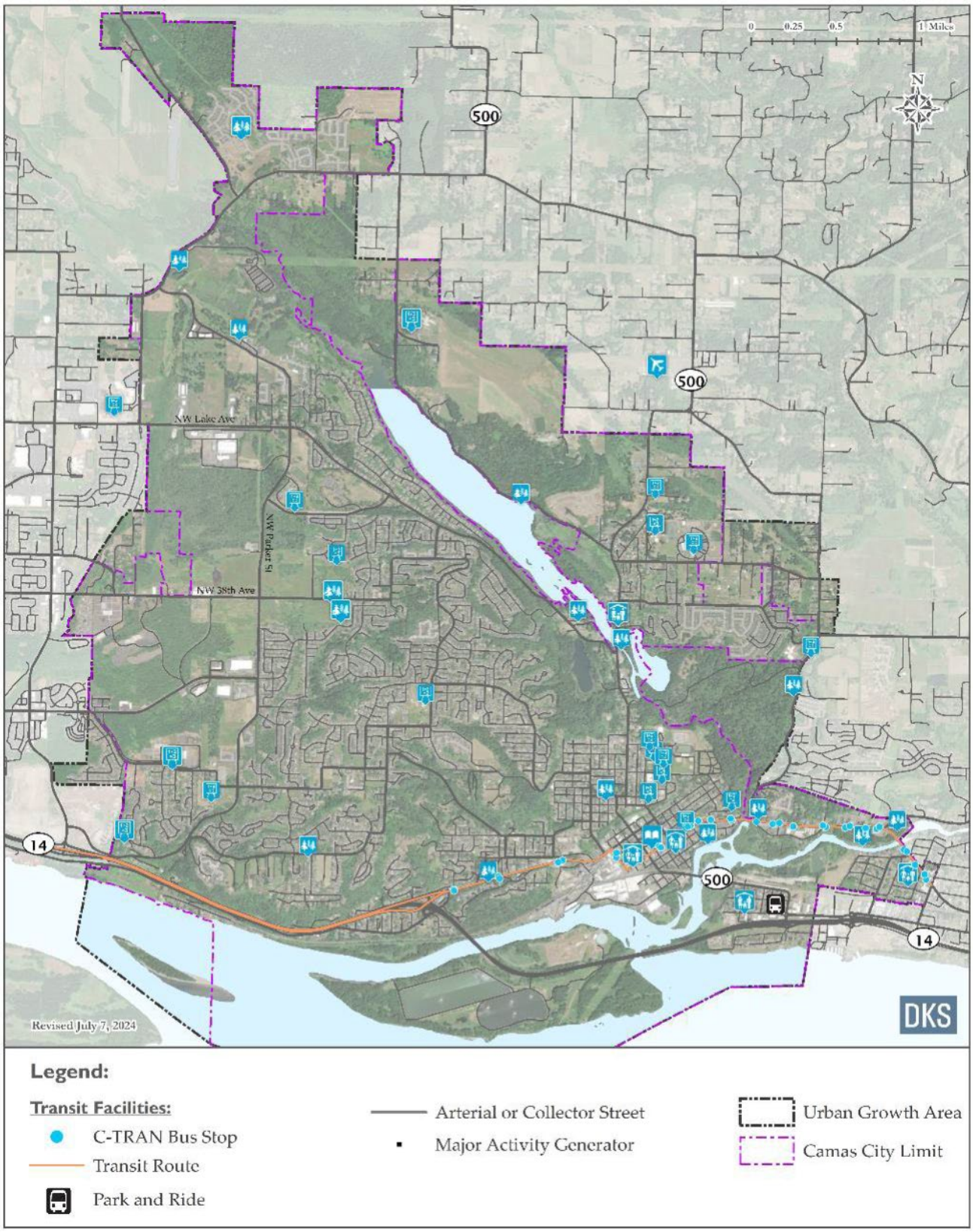


Figure 15 Transit Facilities



Transportation Goals and Policies

Goal TR-1 Complete Streets

Streets will function for all users of all abilities including bicyclists, pedestrians, transit users, and motorists.

Policy TR-1.1 Implement the Transportation System Plan (TSP) to maintain the livability of Camas and guide decision-making for transportation-related projects, policies, and design. Ensure consistency between the TSP, the Parks, Recreation and Open Space Plan and the 6-year street plan.

Policy TR-1.2 Maintain the transportation system to enhance safety and efficiency for all users, facility aesthetics, access management measures and the overall integrity of the system.

Policy TR-1.3 Construct streets that are interconnected and avoid long cul-de-sacs or dead ends. Block lengths should be less than 1,000 feet. Include pedestrian and bicycle linkages in the construction of cul-de-sacs and other forms of dead-end streets. Existing dead-end streets should be retrofitted to provide bicycle and pedestrian linkages as practicable.

Policy TR-1.4 Develop and implement design standards that provide attractive streetscapes, encourage appropriate traffic volumes and speeds, and support multi-modal safety. Include enhanced roadway features such as roundabouts, decorative lighting, and landscaping in gateways and design overlay areas.

Policy TR-1.5 Minimize access to new development and redevelopment along City arterials and consolidate access points when spacing is insufficient.

Policy TR-1.6 Provide routes designed for active transportation to encourage mode shift for short trips. Route planning should seek shortcuts and other opportunities that provide advantages to active transportation users. Public investments should support active transportation routes such as street lighting, safe crosswalks, and protected bike lanes.

Policy TR-1.7 Coordinate with Camas School District to implement a safe routes to school program to encourage the use of alternative and active transportation.

Policy TR-1.8 Develop and implement Complete Streets design in all new and retrofit street projects to support the use of alternative travel modes. Adopt engineering design standards consistent with Complete Streets goals.

Policy TR-1.9 Increase wayfinding signage for outdoor destinations throughout the City.

Policy TR-1.10 Inventory current bicycle and pedestrian networks to identify gaps in route coverage. Support filling in network gaps as new development and redevelopment occurs to create a bicycle and pedestrian network that is safe, comfortable, and accessible to people of all ages and abilities.

Policy TR-1.11 Minimize cut and fill roadway design and, where feasible, minimize restructuring the natural contours of the land.

Policy TR-1.12 Encourage the inclusion of low impact development (LID) design features (e.g. rain gardens, grass pavers, pervious pavement) in the design of road surfaces.

Policy TR-1.13 Require LED lights in new development and replace existing inventory that lack LED features.

Goal TR-2 Local and Regional Transit

Regional transit will provide safe, efficient, and dependable service to the Camas community for a variety of trips within and outside of the city.

Policy TR-2.1 Coordinate with local municipalities, Washington Department of Transportation, adjacent counties, and C-TRAN to ensure that minimum roadway and multi-modal design standards are consistent.

Policy TR-2.2 Partner with C-Tran to advocate for and develop transit options that are safe, convenient, frequent, and accessible for Camas residents.

Goal TR-3 Traffic Safety

Design and construct safe transportation facilities that meet applicable requirements.

Policy TR-3.1 Encourage traffic safety through education, enforcement, and engineering. Use traffic calming, traffic diversion, and other available tools such as landscaping, trees, and art to ensure a comfortable and safe environment for all users.

Policy TR-3.2 Provide adequate access for emergency vehicles throughout the city.

Policy TR-3.3 Develop safe pedestrian and bicycle routes between residential areas, schools, and public facilities.

Policy TR-3.4 Require new development to implement designs standards using the Neighborhood Traffic Management Plan.

Policy TR-3.5 Identify high accident areas and implement specific measures to reduce accident occurrences.

Goal TR-4 Transportation Demand Management

Transportation planning will achieve the efficient use of transportation infrastructure, increase its person carrying capacity, and accommodate and facilitate future growth consistent with land use objectives.

Policy TR-4.1 Require large employers to implement a commute trip reduction program for employees, as mandated by state law.

Policy TR-4.2 Support intergovernmental development review.

Policy TR-4.3 Support the Regional Transportation Council (RTC) with funding and staff participation to the extent possible.

Goal TR-5 Concurrency and Level of Service

The City will maintain the adopted LOS standards for all arterial streets and transit routes.

Policy TR-5.1 Encourage growth in areas with existing or planned infrastructure capacity.

Policy TR-5.2 Require new development to demonstrate that adequate person trips are available, or that multi-modal improvements to the transportation system will be made to accommodate the impacts concurrent with the development.

Policy TR-5.3 Utilize traffic impact fee studies, development traffic impact analyses, and corridor studies to identify deficiencies and plan improvements to maintain or improve LOS standards.

Policy TR-5.4 Take the following actions (in no priority order) if the probable funding falls short of meeting identified needs: 1) delay development until programs, facilities, or services can be funded; 2) obtain the revenue needed or revise the transportation plan to reflect known financial resources; or 3) change the transportation LOS standard, which is a last resort measure.

Goal TR-6 Transportation Revenue

Maximize the use of state and federal funds for transportation capital, operating, service, and demand improvements.

Policy TR-6.1 Maintain a capital improvement plan (CIP) that identifies construction and improvement priorities and funding.

Policy TR-6.2 Ensure that the transportation impact fee program responds to land use changes, supports connectivity, and requires new development to pay its proportionate share of needed capacity.

Policy TR-6.3 Support the Pavement Asset Management System and other maintenance programs to ensure cost-effective maintenance of transportation facilities and efficient use of public funds.

Policy TR-6.4 Develop equitable transportation impact fees to assess developers a fair-share contributions for any transportation improvements.

Policy TR-6.5 Prioritize transportation funding for multi-modal improvements that will enhance safety and access between infill areas, schools, and employment centers.

Policy TR-6.6 Focus transportation projects in economic development areas to act as catalysts for job growth.

ourCamas 2045



Public Facilities & Services

09

09. Public Facilities & Services

Purpose

Plan for adequate facilities that are consistent with the other elements, goals and policies of Our Camas 2045, can accommodate the projected population and employment growth and land use plan, and based on sound fiscal policies for the City.

Vision

In 2045, Camas residents enjoy the city's parks, trails, community centers, and other recreational opportunities. The school district draws families to the community and the library continues its vital role as a place of learning. Residents value accessible police, fire, and emergency response services. Proficient government agencies maintain existing City assets and coordinate future development.

Introduction

The City of Camas is a full-service community that offers a breadth of public facilities, services, and utilities. Public facilities include such things as City Hall, the Camas Public Library, the Public Works Operation Center, Lacamas Lodge, the Community Center, the Camas Police Department headquarters, and Fire Stations 41 and 42. The majority of the City's functions and services are carried out from these facilities.

General government services include such departments as Administration and Human Resources, Community Development, Finance, Information Technology, and the Camas Public Library. General services include but are not limited to utility billing, human resources, city clerk functions, building and engineering permits and inspection, and activities of the City Council and city boards and commissions.

Other city services include Fire and Emergency Medical Services (EMS), Police, and Parks and Recreation. Fire and EMS services are provided in Camas and, via intergovernmental agreements, beyond Camas city limits. The Camas Police Station dispatches law enforcement services throughout the community. Parks and Recreation services are housed in several facilities including Lacamas Lodge, the Community Center, and through a myriad of parks, trails, open spaces, and special use buildings.

Public utilities, administered by the Public Works Department, includes the city's sewer system, water system, and municipal stormwater system. These systems have a variety of assets that support them and are scattered throughout the city.

Public Works also operates solid waste service. Garbage trucks are dispatched from the Operations Center, the hub of Public Works' activities, and the solid waste is transported to an off-site transfer station and then to a landfill in eastern Washington. The City budgets money for capital equipment, however, the solid waste system does not require the same kinds of investments that the sewer, water, and stormwater systems require.

The public facilities and services element is divided into four sections:

- Public Facilities and Services including fire, emergency medical and police services, parks and open space, and City owned facilities
- Public and Franchise Utilities including water, sewer, stormwater, solid waste, electricity, natural gas, and telecommunications
- Capital Improvement Plan
- School Districts

Related to this element is the City's Capital Facilities Plan (CFP) (Appendix X), which provides a comprehensive project list and schedule guiding the investment of city resources in facilities and infrastructure. These resources are made up of local revenues as well as State, Federal and other sources. The CFP identifies those projects which have secured funding as well as a list of projects which have not yet been funded. The projects included in the overall CFP have largely been identified through other planning documents and efforts which are all incorporated into the City's comprehensive plan.

Level of Service (LOS) Standards

Under the GMA, adequate provisions for urban governmental services must be provided in the UGA. The goals and policies in this element are provided to address anticipated growth and maintain adopted LOS standards.

Public Facilities and Services

Many of the public facilities and services listed in this element have strategic plans and actions that guide maintenance and service improvements. The identified goals and policies were given consideration based on a framework of budgetary and operational guidelines as well as these strategic plans.

Fire Protection, Emergency Medical Services, and Police Protection

The city is served by the Camas-Washougal Fire Department (CWFD), which covers 20 square miles and 33,000 residents for fire protection and 80 square miles and 65,000 residents for emergency medical services. The Camas and Washougal fire departments consolidated in 2011 through a joint contract for service to improve efficiency and lower costs. CWFD averages approximately 5,000 fire and medical calls annually. The CWFD is the only fire department in

Clark County to provide ambulance transport services, which requires additional training for the firefighters in addition to fire suppression techniques.

Camas Fire and EMS operates out of two stations – Station 41 located in City Hall on NE Fourth Avenue and Station 42 located off NW Parker Street. Station 42 is relatively new, while Station 41 is many decades old.

Voters approved a capital construction bond in August of 2024 for a new downtown station and headquarters to replace Station 41. It will be located on the property occupied by the City Hall Annex building just west of City Hall on NE Fourth Avenue. When the new Station 41 is completed, there will be vacated space in the City Hall building. Future uses for the vacated space have not been determined.

A Facility Conditions Assessment (Appendix X) was completed in 2021 and lists some deficiencies in Station 42 in the form of HVAC, plumbing, electrical, and interior finishes that will be addressed with funding from a general obligation bond.

The Camas Police Department operates a full-service police department from one location near the downtown core. This 15,000 square-foot facility was built in 1998 and includes a 1,500 square-foot community/training room. Services include police response, community engagement, school resource officers, investigative follow-up, parking enforcement, code enforcement, and records services.

The City is currently investing over $400,000 in upgrades to the Camas Police Station by replacing end-of-life mechanical equipment. This investment will make it more cost-effective and environmentally resilient.

Parks, Trails, and Open Space

Camas' Comprehensive Parks, Recreation, and Open Space (PROS) plan , updated in March 2022, outlines a community vision for Camas that includes a high-quality park and recreation system, with a comprehensive open space and trail system linking all recreational sites to the regional trail network. The PROS plan is adopted by reference and included as Appendix X.

Parks and recreational opportunities in Camas include neighborhood parks that serve individual neighborhoods, natural open space areas that preserve resources throughout the community, and special use areas for specific recreation needs. Supplementing these are public and private sites and facilities, such as school sites, regional parks, and privately-owned recreation facilities.

In response to the community's feedback on the PROS plan, the City is currently working on a Parks and Open Space Management Plan (POSMP). The purpose of the POSMP is to maintain the existing facilities, fill gaps and improve trail connections, and develop and improve existing parks. The POSMP will outline a strategic vision for the thoughtful management of parks and open spaces within the city, ensuring that they continue to serve as resources for all users. The City will need to coordinate the POSMP with the comprehensive plan to ensure consistency.

During the City's review of land use designations, the PROS plan was reviewed to ensure that sufficient land is designated as Park, Open Space/Green Space, and NS-Parks/Open Space. Because the North Shore Subarea Plan was adopted after the last comprehensive plan update, this update includes revisions that incorporate the new NS-Parks/Open Space designation.

Camas receives impact fees paid by new development for park, trail, and open space improvements that increase the capacity of the system. The expenditure of the collected fees will be applied to the total costs of implementing projects that are identified in the PROS Plan project list, and as further refined by the City's Capital Improvements Plan.

City Facilities

The comprehensive FCA reviewed 17 publicly owned buildings located at 11 different sites. The total square footage of the surveyed buildings is just under 276,000 square feet.

The FCA report notes the total replacement value of all facilities at $61 million in 2022 dollars. The reported deficiencies for the years 2022-2027 total $17 million with the priority needs (life safety and code issue deficiencies) at $6.3 million. Long-term needs would require $18 million for major maintenance projects.

Recently, the City appropriated funding, through limited general obligation bonds, to pay for many of the items listed as priority needs in the FCA. This approximately $7 million has allowed the City to attend to some of the high priority deficiencies.

Noteworthy on the list is Station 41 and the City Hall Annex. With passage of a voter approved bond in 2024 specifically to replace Station 41, the City Hall Annex building will be demolished, and the site will house the new Station 41, which will also serve as the Fire Department's headquarters.

The Camas Public Library, located across the street from City Hall on NE Fourth Avenue, provides library services to the community at-large. According to the FCA, the library is in need of priority improvements to address immediate deficiencies. Since the date of the report, the City is funding a number of deficiencies through a general obligation bond.

City and Franchise Utilities

Water

The City owns and operates a multi-source municipal water system which includes supply, treatment, storage, and distribution of potable water to residential and commercial customers. The City currently obtains its water from ten groundwater wells and two surface water sources that are treated to provide high quality water to customers. The City owns over 143 miles of pipelines in its water transmission and distribution system. Service is provided to customers across five major pressure zones and 18 subzones. Eight booster pumping stations are used to move water between pressure zones. Seven storage facilities, with a combined total of 8.45 million gallons (MG), provide storage for normal and emergency conditions, such as fire

suppression. Additionally, distribution system includes numerous meters, isolation valves, and hydrants. Additional information regarding Camas Water Service, including capacity analysis, is available in Appendix X, Water System Plan (2019).

Sewer

The majority of the 7,700-acre UGA and the sewage collecting infrastructure inside the city limits is owned and operated by the City of Camas. The collecting system consists of traditional gravity sewers, pump stations, force mains, and septic tank effluent systems. The system includes 38,260 linear feet of force main, 29 lift stations, and 236,200 linear feet of gravity mains. Approximately half of the city is served by septic tank effluent systems and the other half by a traditional collection system. The City gathers, treats, and discharges wastewater into the Columbia River at the Camas Wastewater Treatment Plant (WWTP).

The City of Camas Sewer Division serves residences and commercial buildings, with approximately 8,500 customers, comprised of industrial, commercial, and residential users.

A collection system flow metering and projection was conducted in 2018/2019 to evaluate the collection system using the City's hydraulic model. The results of this analysis are available in Appendix X, General Sewer Plan (2022), which develops a management plan for the system over the next 20 years.

Stormwater

The stormwater runoff generated from approximately 7,500 acres across the city of Camas is managed through 75 miles of stormwater conveyance pipe and 1,800 stormwater inlets and catch basins. The stormwater conveyance system is owned and maintained by the City. The City also owns and maintains stormwater facilities, including underground treatment vaults, detention ponds, biofiltration swales, wet ponds, drainage ditches, and culverts. These have been geolocated on the City's Stormwater Management Action Plan (SMAP) Public Input Map. The SMAP identifies actions to protect and improve receiving waters' water quality. Commercial and residential stormwater facilities are privately owned and maintained per stormwater code CMC 14.02.200 Ownership and Maintenance. These privately owned facilities within the city are geolocated on the SMAP Public Input Map. Additional details on stormwater management in Camas can be found in Appendix X, Stormwater Management Program (2024).

Solid Waste

The City owns and operates its own solid waste utility which provides for the collection and transfer of solid waste refuse to the Clark County-owned Washougal Transfer Station. The City is responsible for managing garbage collection within the Camas boundaries. The City has established universal compulsory solid waste collection, requiring all residents and businesses to maintain solid waste service. The City contracts with Waste Connections of Washington to provide recycling and yard debris management, collection, and disposal. The City also contracts with Waste Connections to provide large container service (larger than 2 cubic yards) to those with greater solid waste handling needs.

All cities and towns in Clark County have delegated responsibility for solid waste transfer and disposal planning to the County, including Camas. The currently adopted Clark County Solid Waste Management Plan (CSWMP) of 2015 is undergoing updates and anticipated to be adopted by the end of 2025. Agreements between Clark County and its cities commit each to the plan and to the plan's waste disposal system.

Franchise Utilities

There are several other utilities, some of which are provided by public entities and others by private entities, that contribute to the functionality and prosperity of the community. The main utilities include electricity, natural gas, and telecommunications. Electricity is provided by Clark Public Utilities (CPU), a customer-owned public utility; natural gas is provided by Northwest Natural; and telecommunications, including high-speed internet, are provided by a variety of companies (e.g. Comcast, Verizon, Frontier, etc.). No detailed inventory regarding the capacity of these utilities is available.

Electrical

Clark Public Utilities (CPU) (https://www.clarkpublicutilities.com/) provides electricity to Camas and throughout Clark County. CPU balances strategic planning for the future with present rate and service stability in compliance with changing requirements at the local, state, and federal levels. CPU is led by an elected board to plan for integration of new technologies and has indicated there is ample capacity to meet existing demand for areas within both the incorporated City limits and the UGA. Power supplies are provided through a combination of power supply contracts and purchases from the generating system.

Natural Gas

Delivery of natural gas to Camas and its UGA is provided by Northwest Natural (https://www.nwnatural.com/). The delivery of natural gas is governed by the Federal Energy Regulatory Commission, the National Office of Pipeline Safety, and the Washington Utilities and Transportation Commission (WUTC). The City's regulations include safety and emergency provisions, LOS standards, and rate limitations. Northwest Natural provides natural gas service to all of Clark County. The alignment of the main pipeline crosses the Columbia River at the area of the Port of Camas-Washougal. Additionally, Northwest Natural is improving its backbone through the City with the installation of a large-diameter high-pressure gas main connecting Lake Road and Pacific Rim Boulevard.

Telecommunications

Verizon provides local telephone service to the City and its UGA. Many of the telecommunication facilities, including aerial and underground, are co-located with those of the electrical power provider. Frontier Communications also provides telecommunications to a large number of customers in the Camas area. Contact information for telecommunication utility providers is available on the City of Camas website (https://www.cityofcamas.us/utilities/page/new-resident-information).

Capital Improvement Plan

The 6-year Capital Improvement Plan (CIP) is a significant component of the financing plan and is adopted as part of the biennial budget. It includes a list of projects, project start dates, estimated cost, and funding. The CIP is a shorter term funding plan that directs available resources to specific projects including street preservation and improvements, fire and EMS, parks and recreation, stormwater, water, and sewer projects. The 2025-2026 CIP is included as Appendix X.

The first two years of the capital facilities plan are typically consistent with the adopted City budget. However, since capital expenditures often impact multiple years after funding has been committed, it is prudent to plan ahead for the expenditure of funds for at least four years or longer. Additionally, some of the City's adopted plans include longer term expenditure plans in which resources are actively being pursued when opportunities arise.

School Districts

Public schools are recognized as one of the largest public services within the community. Education serves one of the most important roles in community health as the quality of education today impacts the skill levels, employment rates, labor supply, and wages of tomorrow.

The Camas School District has the most, and some of largest, public facilities in the Camas Urban Growth Area. The UGA spans two school districts. Camas and Evergreen School Districts are responsible for facility planning and service levels of the districts and coordination with the city's overall development. Both school districts are currently evaluating school facilities and overall needs to serve the community.

The Camas School District has prepared a 2022 Capital Facilities Plan (CFP) to provide the County and the Cities with a schedule and financing program for capital improvement needs over a six year period (2022-2028) to ensure that adequate facilities are available to serve new growth and development.

The collection of school impact fees generates partial funding for construction of public facilities needed to accommodate new development. School impact fees are collected by the cities and County on behalf of the District at the time plats are approved or building permits are issued. Impact fees are calculated based on a formula, which includes the portion of District construction resulting in increased capacity in schools. The districts submit their capital facilities plans every other year, accompanied by impact fee calculations. The plans describe the existing and planned school facilities and services.

Anticipated property acquisition and new construction is based on the enrollment forecast, capacity, the District's educational standards and the community's support of finance tools to fund improvements.

Public Facilities and Services Goals and Policies

Goal PFS-1 Fire Protection, Emergency Medical Services, Police Protection

Provide fire protection, emergency medical services, and police protection to Camas and accommodate growth in the community.

Policy PFS-1.1 Plan for fire and emergency medical services to include adequate land, building, and equipment to effectively serve the geographic area of the city north of Lacamas Lake (North Shore).

Policy PFS-1.2 Assess the level of service needs and provide fire, advanced life support emergency medical, and police services that meet the community demand. Maintain service levels as growth occurs.Ensure

Policy PFS-1.3 Ensure the installation of commercial fire sprinklers where required by code and strongly encourage their use when installation is optional.Require

Policy PFS-1.4 Pursue funding to maintain fire facilities, including all fire apparatus at levels that best serve the community. Fire apparatus includes fire suppression equipment such as engine, water tenders, brush trucks and command officer vehicles.

Policy PFS-1.5 Require all new residences to install fire sprinkler systems.

Policy PFS-1.6 Plan police annex facilities at strategic locations throughout the City.

Goal PFS-2 Parks, Trails and Open Space

A network of parks, trails, and open space will connect neighborhoods, wildlife corridors, and natural resources and enhance the quality of life for residents and visitors. Refer to the Camas PROS plan for additional goals and policies.

Policy PFS-2.1 Provide and maintain an active transportation network to increase connectivity to natural areas, wildlife corridors, and other natural resources in Camas.

Policy PFS-2.2 Ensure every neighborhood has access to a park within a 15-minute walk or roll.

Policy PFS-2.3 Provide safe and maintained parks, natural areas, and other recreational spaces that are accessible for all ages and abilities.

Policy PFS-2.4 Provide a continuous trail network around Lacamas Lake with ample access points, prioritizing active transportation users. Consider new public access points through dedications, easements, and acquisitions. Partner with transit agencies to plan and implement transit service to Lacamas and Round Lake.X

Policy PFS-2.5 Explore the development of dog parks within special use park areas to balance the needs of pet owners and other park users.

Policy PFS-2.6 Encourage the development of parks and playgrounds that have ample facilities for all users.

Policy PFS-2.7 Work with the Camas Parks & Recreation Department to acquire land for parks, trails, recreational uses, and habitat conservation.

Policy PFS-2.8 Enhance water conservation methods and technologies in development of irrigation infrastructure within parks and recreation areas.

Goal PFS-3 City Facilities and Services

Provide facilities and services to support the functions of City government and the community, including cemetery, animal control, and the public library.

Policy PFS-3.1 Develop an expansion plan (e.g., new municipal facility, meeting space) to accommodate additional personnel.

Policy PFS-3.2 Ensure that the municipal building and primary services remain downtown.

Policy PFS-3.3 Incorporate sustainable and low climate impact design into city buildings. Promote LEED certification (or similar) for all publicly owned facilities.

Policy PFS-3.4 Utilize the City's capital improvement program to develop alternative transportation facilities and electric vehicle charging infrastructure for public facilities.

Policy PFS-3.5 Maximize the developed and undeveloped property for cemetery use to meet future burial needs and trends and meet residents' service expectations.

Policy PFS-3.6 Provide economic stability to the cemetery fund by reducing dependency on the general fund.

Policy PFS-3.7 Develop a strong volunteer and donation program for the cemetery.

Policy PFS-3.8 Continue animal control partnership with the City of Washougal.

Policy PFS-3.9 Maintain funding and support for library services that meet the demands of current and future residents.

Policy PFS-3.10 Assess need and solutions for additional library services throughout the growing City.

Goal PFS-4 City and Franchise Utilities

Provide utility services, including energy and communication facilities and their services, to all businesses, residents, and properties in the City limits.

General Utilities Policy

Policy PFS-4.1 Maintain and improve City utility systems through preventative maintenance and regular assessments and improvements to meet regulatory standards.

Policy PFS-4.2 Where service is available, require connection to public water for domestic and irrigation needs and connection to sewer systems. Promote connection to sewer and water before system failure of private well or septic.

Policy PFS-4.3 The City should be the sole provider of urban services, including water and sewer, within the UGA for sewer service and the Water Service Area for water. Require all new construction connect to city systems. Prohibit construction of new private wells and subsurface sewage disposal systems in new developments.

Policy PFS-4.4 Do not extend utilities without annexation or commitments for annexation. Exceptions may be made in cases where human

health is threatened. In areas where utilities presently extend beyond City limits, but are within UGAs, plan development jointly with the County. A joint development must be consistent with City standards.

Policy PFS-4.5 Coordinate plans for providing public utility services in UGAs and rural areas with plans for transitioning undeveloped land to urban uses.

Policy PFS-4.6 Plan public utility services so that service provision maximizes efficiency and cost effectiveness and ensures concurrency. Coordinate with other entities to provide services within the urban area.

Water Service Policy

Policy PFS-4.7 Extend adequate public water service throughout the City's urban areas that meets state requirements and provides minimum fire flow as required by the Fire Marshal.

Policy PFS-4.8 Conserve and protect groundwater resources to provide safe, clean, high quality drinking water to residents.

Policy PFS-4.9 Ensure water infrastructure is designed to City standards and is in place prior to land development.

Policy PFS-4.10 Coordinate with Clark County and other purveyors to eliminate private systems in accordance with the Clark County Coordinated Water System Plan.

Policy PFS-4.11 Coordinate with the County and the cities of Vancouver and Washougal to protect groundwater from contamination.

Policy PFS-4.12 Expand municipal reclaimed water systems and allow onsite non-potable water systems to reduce water demand in private-sector commercial and residential buildings.

Policy PFS-4.13 Eliminate the introduction of groundwater and surface water into the sewer system.

Sewer Services Policy

Policy PFS-4.14 Extend public sanitary sewer service, as required, throughout urban areas. Service may be provided outside urban areas to serve areas where imminent health hazards exist.

Policy PFS-4.15 Use traditional gravity sewer systems (in lieu of STEP systems) to serve future customers and reduce maintenance and power costs.

Policy PFS-4.16 Coordinate with Clark County to eliminate septic systems.

Stormwater Policy

Policy PFS-4.17 Provide a stable funding source to meet National Pollutant Discharge Elimination Systems (NPDES) Phase II requirements to manage and control stormwater runoff.

Policy PFS-4.18 Inspect homeowner association and other private facilities and provide directions and standards for repair.

Policy PFS-4.19 Meet water quality standards by providing best management practices for development activities.

Policy PFS-4.20 Establish baseline flows on each drainage basin or sub-basin for the analysis of deficiencies.

Policy PFS-4.21 Consider stormwater impacts during land use review processes and develop standards that would reduce the amount of impervious surface on existing and new development, including the creation and adoption of low-impact development standards and the use of green infrastructure, to address increased storm intensities and stormwater runoff.

Policy PFS-4.22 Require new development or redevelopment to comply with the Camas Stormwater Design Standards Manual and design criteria.

Policy PFS-4.23 Protect natural stream courses for water quality.

Policy PFS-4.24 Manage stormwater to safely pass surface water and maintain water quality of lakes, streams, and rivers.

Solid Waste Policy

Policy PFS-4.25 Provide for solid waste service throughout the City through continuance of self-collection of solid waste and contracting with private waste management companies to provide recycling and yard debris collection options.

Policy PFS-4.26 Continue a system of universal compulsory solid waste collection.

Policy PFS-4.27 Coordinate with the County to implement the Clark County Solid Waste Management Plan (CSWMP). Reduce the total production of waste, increase the recycling rate of waste that is produced, and properly manage and dispose of waste that is not recycled. Provide education and outreach to businesses and the public on benefits and opportunities for waste reduction and recycling. Focus on residential recycling rates to improve participation rates similar to the rest of the County.

Policy PFS-4.28 Work with solid waste utility companies to determine if household food waste/compost can be accommodated in yard waste bins.

Franchise Utility Policy

Policy PFS-4.29 Minimize the effects on adjacent properties, the environment, and the visual quality of the community of siting, developing, operating, and maintaining facilities.

Policy PFS-4.30 Coordinate to provide reliable service through partnerships and agreements with utility companies.

Policy PFS-4.31 Promote the conservation of energy resources through the adoption of appropriate energy codes and efficient land use and transportation systems.

Policy PFS-4.32 Work with energy utilities to improve the safety and reliability of infrastructure vulnerable to climate change (e.g., undergrounding transmission lines).

Goal PFS-5 Capital Improvement Plan

Maintain and implement the Capital Improvement Plan in coordination with the biennial budget.

Policy PFS-5.1 Update the capital improvement plan biannually and include a statement of projected costs and sources of revenue.

Policy PFS-5.2 Ensure capital improvements enhance the community and add physical value to the City.

Policy PFS-5.3 Apply earnings from bond proceeds toward the debt service fund reserved for the future repayment of debt directly for enhancement of the project.

Policy PFS-5.4 Dedicate all or a portion of the first year of property taxes generated from newly incorporated areas to the Capital Fund.

Policy PFS-5.5 Dedicated funds and bonds may be used to fund essential capital improvement projects such as police, fire, and general municipal structures.

Policy PFS-5.6 Use voted, general obligation debt for discretionary projects such as recreation and library facilities.

Policy PFS-5.7 Prioritize projects that support the core services provided by the City.

Policy PFS-5.8 Ensure consistency of capital improvement plans with the adopted comprehensive plan map and evaluate if funding is adequate to provide necessary public facilities and services to implement the plan.

Goal PFS-6 School Districts

Support access to quality education and public schools through partnerships and investments.

Policy PFS-6.1 Encourage the Camas School District, Clark County, and the City of Camas to invest in mutual use facilities that support intergenerational and intercultural use.

Policy PFS-6.2 Coordinate planning between the Camas School District and the City of Camas to reflect school facility needs in response to growth forecasts.

Policy PFS-6.3 Ensure equitable access to schools and educational programs, specifically considering those in underserved areas, where needs and abilities may differ.

ourCamas 2045



Economic Development

10

10. Economic Development

Boosting the Local Economy

The economic health and well-being of the City of Camas is supported by providing a wide range of employment opportunities throughout the community and a setting and quality of life that is attractive to businesses and residents.

Vision

In 2045, Camas has cultivated a diverse and thriving economy with stable employment opportunities and living-wage jobs across various sectors, including technology, healthcare, manufacturing, retail, recreation, and professional services. Camas residents have access to a wide range of services and amenities in their community, while benefiting from excellent regional connectivity and the city's proximity to Portland International Airport. Camas is a gateway to nature and recreational opportunities, supporting regional tourism in the area. Camas is home to a thriving economy and diverse businesses, affording residents ample employment opportunities. Neighborhood commercial hubs connect residents to daily services and amenities through a network of sidewalks and bike lanes, improving access and connectivity. Professional office, medical, and industrial uses typify western Camas, with retail businesses supporting these firms and nearby residents. The North Shore area will fulfill the employment and retail needs of the growing population on the northeast side, and reduce trips outside the city. Downtown Camas anchors the community with a dynamic economic landscape and retains its historic atmosphere as a walkable, attractive place to shop, dine, and gather. Inclusive housing options within the city's core contributes to a town center that supports local businesses.

Approach for Updating this Element

The approach for updating the economic development element for the 2025 to 2045 planning horizon was informed by community input (outlined below), state legislation requirements, priorities, and a comprehensive economic profile. This profile integrated the best available information from public and private data sources to assess the city's economic trajectory, opportunities, challenges, and economic conditions and competitiveness. These insights help build a factual basis for the updates.

Community Engagement Insights

Interactive open houses and interviews with stakeholders provided information about economic development strengths,

challenges, opportunities, and actions in Downtown Camas and other areas in the City. Engagement activities identified the following themes that could contribute to future decision-making related to economic development in Camas.

Economic Development

- **North Shore:** Need infill development.
- **Grass Valley:** Needs mixed/light industrial park with athlete fields/parks. Why no Grass Valley Subarea Plan? Be clear on what kinds of businesses would be most beneficial to Camas in Grass Valley to build awareness when talking with prospective businesses.
- **General:** Need more commercial space, more manufacturing jobs, and a dedicated economic development director or staff person (apply for grant), and plan. Focus on tourism and bring in money. Are there model cities Camas would strive to look like? (Lake Oswego, Bend, etc.) Compare plans with cities that have experienced similar growth? What did they do well?
- **Housing:** Allow work/live housing along and around UGA/schools and major transportation corridors. Ensure workforce housing is available for current and future workers. Having diverse housing options will lead to a more diverse city.

Downtown Strengths

- **Strong sense of place:** Downtown stakeholders feel supported by Camas community. They discussed the quaint, small-town character, with unique features attracting visitors and services and how the mix of new and old/established businesses contributes to vitality of Downtown.
- **Positive support for businesses**: Good interactions with the DCA, overall good experience working with the City and business owners cultivate a collaborative environment.
- **Increases in housing density seen as a positive direction:** New housing is opportunity for more amenities to support the growth and expansion of amenities can make Downtown more walkable.

Downtown Opportunities

- **Improvements to public realm** to increase / improve street lighting, address issues with street trees (some interfere with sidewalks, other infrastructure), improve the civic area of Fire Dept. plan, add connectivity to adjacent residential neighborhoods, and open spaces, and provide outdoor dining spilling out onto sidewalk.
- **Community gathering spaces**: Need more meeting places indoor/outdoor and outdoor spaces for children/families, should expand Downtown Core beyond 4th Ave, support redevelopment of underutilized land on 3rd and 5th Ave, and should create more spaces for retail that extends walkability of Downtown, cohesiveness.
- **Development potential:** Explore more ways to activate ground floors and embrace walkability / modern parking standards.

Downtown Challenges

- **Parking is a concern for some:** Two-hour duration (especially difficult for employees) and Mill property / parking lot.
- **Pace of development:** Concern over what new development will mean for current businesses and need for balance between new development and preserving historic structures in Downtown.
- **Growth opportunities are limited:** Need to expand the definition of Downtown (beyond just 4th Ave) to expand and provide more amenities. There is limited space on 4th Ave where businesses would like to locate.
- **Barriers to development and safety issues for pedestrians:** Height restrictions and fees are challenging, since rents are lower it is harder to make a project pencil, and need for safer crossings on 3rd Ave and difficult to cross 5th in some areas.

Public Engagement Findings Regarding Strategies

- **Need more responsive permitting and ongoing maintenance to the public realm** since this supports the success of Downtown.
- **More partnerships between City and Downtown businesses:** City can increase interaction and build relationships with business / property owners.
- **Identify ways to keep local presence and restore historic structures:** Some expressed concern over losing historic structures and asked for ways to balance preservation with new development. The City could provide incentives for existing business owners who would like to expand or stay in Downtown Camas as new development continues.
- **Explore ways to address underutilized property**: For example, opportunities at GP parking lot.
- **Pedestrian Safety and Connectivity:** Address 3rd and 5th Avenue pedestrian safety and improve connections to and from Downtown. Focus on pedestrian activation through plazas and public spaces. Address accessibility needs both with ADA and beyond.
- **Improvements:** Expand character of Downtown to the broader boundary defined in the plan. Accommodate a flexibility of spaces and variety of uses through use of public space (sidewalks, parking, etc.). Define the historic character of 4th Avenue through specific streetscape elements.

City of Camas Competitive Position

The city's competitive position can be summarized in terms of strengths, weaknesses, opportunities, and threats. These represent internal and external factors that can have positive or negative impacts on economic outcomes in Camas. Several ideas added to the summary below are based on feedback received through community engagement activities. Table 4 below outlines key findings associated with economic growth and development.

Table 4 Strengths, Weaknesses, Opportunities, and Threats Summary Analysis

STRENGTHS	WEAKNESSES
• High quality of life amenities like parks and recreation opportunities including new City investments in capital projects. • Downtown experiencing high visitation and high demand for retail spaces (increasing rents, low vacancy). • Responsive permitting, ongoing maintenance of the public realm. • No Washington State income tax. • Proximity to Portland International Airport. • Well regarded public schools. • The Downtown Camas Association is completing a comprehensive Downtown lighting plan with a state grant to support safety.	• Rising housing costs, purchasing a home is unaffordable for those under 120% AMI. • High industrial rents and very low industrial real estate vacancies. • Development standards related to height was cited as a barrier by stakeholders. • Need Downtown development to be feasible to build (pencil). • Highly constrained lands may be difficult to develop for commercial or industrial land uses (such as in Washougal).
OPPORTUNITIES	**THREATS**
• Attract highly skilled workers with locational flexibility. • Develop pathways for youth to gain skills and seek jobs in Camas. • Identify target industries for managing land capacity and expected growth. • Incentives for existing business owners, wishing to expand their operations. • Opportunities for Downtown redevelopment and partnerships with Downtown businesses and nonprofits (such as Downtown Camas Association, the Port, Chamber, Farmers Market, and more). • Develop mill ditch into a compelling, easy, and beautiful trail system that is clear to connect with from Downtown and improve the trails to encourage local resident activity and to attract visitors. • Need more hotels and conference space. • City should partner more with the Downtown Camas Association on incentive programs. • Improve pedestrian safety throughout downtown.	• Unequal rates of homeownership by race and ethnicity indicating unequal economic opportunities. • Disparities between remote and non-remote workers. • Anchor employer changes. • Safety threats that could be supported by better lighting, street tree improvements, safer crossings for pedestrians in the Downtown. • Need to balance preserving historic features with new development in Downtown.

Broad Planning Context

Comprehensive planning in Washington is guided by the Growth Management Act (GMA), a series of statutes first adopted in 1990 which requires cities and towns within the state's most populous counties to fully plan for future growth (RCW 36.70A) and develop mandatory comprehensive plan elements. State provisions set limits on what actions cities and counties can take to support economic development. Article 8, Section 7 of the state constitution specifies that "No county, city, town or other municipal corporation shall hereafter give any money, property, or loan its money, or credit to or in aid of any individual, association, company or corporation, except for the necessary support of the poor and infirm."[16] Given this limitation, cities generally cannot directly use public funds to attract private development and instead target policies that facilitate economic growth through land use, infrastructure, tourism, marketing, and partnerships with nonprofit community-based organizations.

Cities in Washington also coordinate with county-level Associate Development Organizations (ADOs) that represent each of Washington's counties, funded in part by the state Department of Commerce. The Columbia River Economic Development Council (CREDC) represents Clark County and presents a baseline of goals and objectives for the region. Their former 2018-2023 Comprehensive Economic Development Plan outlined goals and actions based on a vision and set of values and guiding principles identified through extensive engagement with local partners, which have carried through and expanded with the more recent 2024 Comprehensive Economic Development Plan with new supplemental actions to encourage economic development for communities within Clark County.

New objectives in CREDC's regional economic development plan expand on support for entrepreneurship, placemaking investments, fostering development and redevelopment projects, and expanding equitable employment opportunities. The Plan also recognizes the growing role of smaller cities like Camas outside of Vancouver which are seeing fast population growth and opportunities to develop their own employment bases.

[16] RCW 35.21.703 does allow cities to contract with nonprofit corporations to advance economic development.

Table 5 Goals and Objectives from 2018-2023 CREDC Comprehensive Economic Development Plan

Source: CREDC

	2018 Plan Objectives	2024 Update Objectives
Expand the Existing Base	• Become Industry Experts • Strategically Market Industry Clusters • Build a Start-Up Ecosystem	• Reduce Site Infrastructure Hurdles • Grow Start-Up Ecosystem • Support Permitting Consistency • Explore Commercial Code Flexibility • Foster Small Business Networking
Support People	• Foster Skills Development • Prepare Youth for Economic Opportunity • Launch a Brain Gain Initiative	• Align Workforce with Employer Needs • Enhance Access to Career Pathways • Support Talent Retention
Create Place	• Each Community Creates a Placemaking Strategy • Embrace Economic Opportunity in Urban Center • CREDC Tells the Story of Place • Make Areas Desired by Industry Clusters Shovel-Ready • Determine All Transportation Needs on a Regional Level	• Leverage Placemaking Investments • Encourage Infrastructure Investments That Cross Municipal Boundaries

The Clark Countywide Planning Policies provide guidance on economic development across incorporated and unincorporated areas of the County (the County also distinguishes policies specifically for unincorporated areas, but not for jurisdictions and their UGAs). These policies (adopted in 2015) are currently being updated. The updated version will be reviewed as a part of the policy and goal development stage of the Comprehensive Plan update.

Buildable Land Capacity and Employment Capacity

Cities fully planning for adequate land capacity to meet the needs of the community must understand their current employment base, development trends, workforce housing availability, income segments of the population, and future projections. To fully plan for growth and meet community needs in compliance with state provisions, more suburban cities like Camas that are

growing in terms of employment must understand the dynamics of the local and regional economy, consider where employment is concentrated and how residents and workers access employment opportunities, what industries are growing or declining, and whether there is sufficient space to fulfill anticipated employment land needs alongside other uses.

Washington's Review and Evaluation Program (the Buildable Lands Program, RCW 36.70A.215) requires certain counties, including Clark County, to establish their own buildable lands programs and review past development and density patterns to see if local policies are effective and prepare to plan for the next 20 years of growth, through a "Buildable Lands Report" released before a Comprehensive Plan update.

Clark County has updated its Vacant Buildable Lands Model (VBLM) as a part of their 2025 periodic update of their Comprehensive Plan. This VBLM provides a basis for the available employment capacity in the City of Camas based on available buildable land (including both vacant and underutilized land), current zoning, and market and employment density assumptions. Table 6 below shows the County's current allocation of jobs for the City of Camas and the Camas Urban Growth Area (UGA) and the 2023 Vacant Buildable Lands Model (VBLM) capacity and yield calculations.[17]

This analysis shows that the City of Camas has a job target of 13,658 jobs, with a preliminary estimated capacity showing availability for 11,363 jobs, as well as additional assumptions for work from home, construction, and government jobs which have specific land need considerations documented in Clark County's 2025 Population, Housing and Employment Allocation memorandum.[18]

Evaluating employment capacity is necessary to determine whether the job growth allocation (determined by the county) can be accommodated within the City of Camas and Camas UGA(s). Sufficient capacity is available if employment growth capacity is equal to or greater than the City's allocation. If sufficient capacity is not available, the shortfall must be addressed by rezoning, or revising allowable density, or by modifying or creating a new UGA or annexed area to provide additional area for employment growth capacity. To help provide geographic context for this analysis, a map of the City of Camas and its existing and proposed Urban Growth Areas was created see Figure 16.

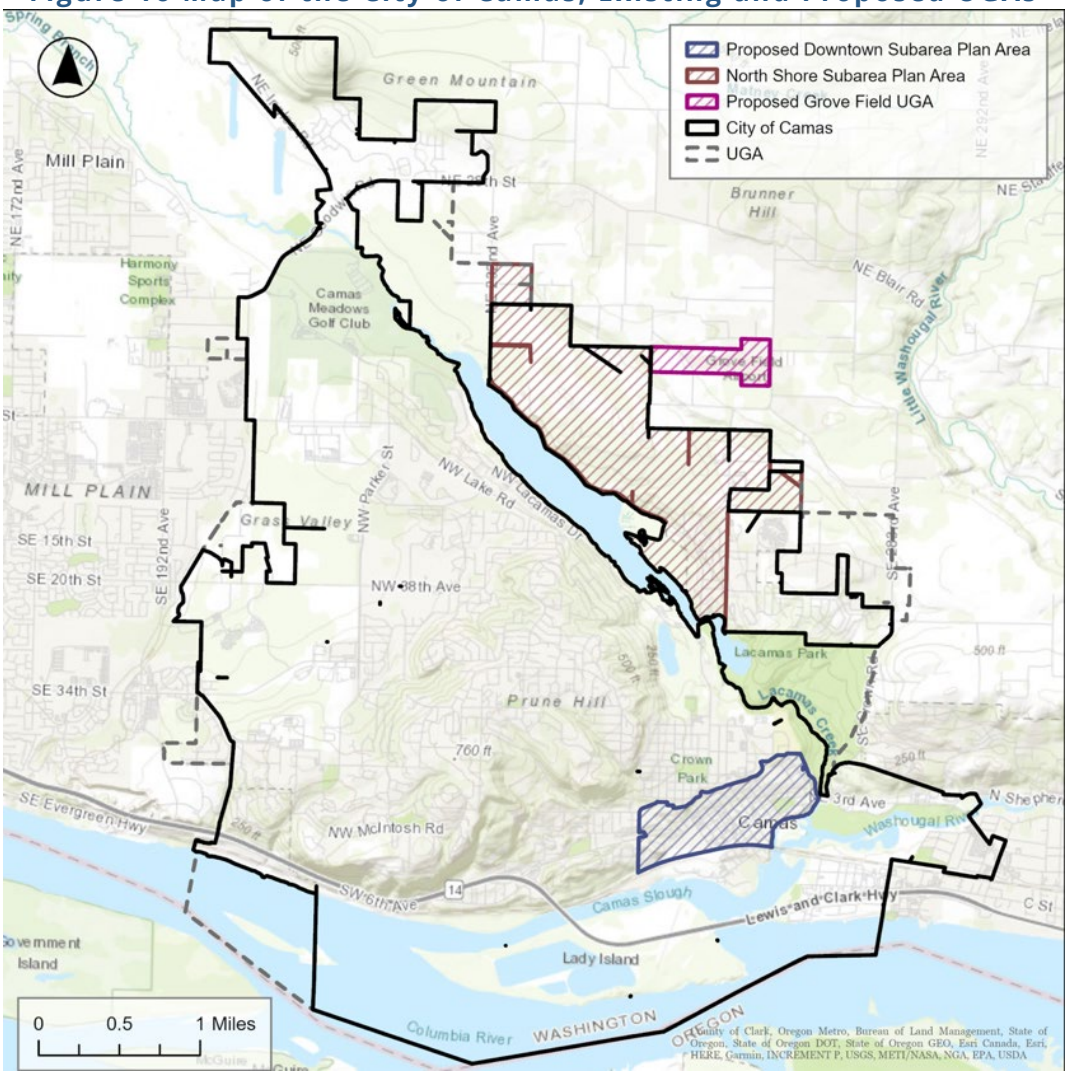
[17] This has been modified since the County's 2020 Buildable Lands Report, which identified 963 net buildable acres (296 on commercial land, 667 on industrial land) in the Camas UGA (Clark County Buildable Lands Report, 2023).
[18] Clark County Community Planning, 'Clark County Comprehensive Plan 2025 Update 2025 Population, Housing and Employment Allocation – Issue Paper 5,' April 2024, https://clark.wa.gov/sites/default/files/media/document/2024-04/issue_paper_5_pop-emp_alloc_4_17_24.pdf.

Table 6 Employment Capacity and Allocation by UGA, Clark County

Source: VBLM 2023, Capacity and Yield by Jurisdiction. Note: The County total estimate is 88,100 jobs accounting for government, construction, rural, and work from home jobs.

Jurisdiction	2023-2045 Employment Allocation	2023 VBLM Capacity	Assumptions		
			Work from Home	Construction	Government
City of Camas and Camas UGA	**13,658 jobs**	**11,363 jobs**	615 jobs	879 jobs	549 jobs
Total Clark County UGAs and Cities	**83,695 jobs**	65,091 jobs	3,524 jobs	5,038 jobs	8,600 jobs

Figure 16 Map of the City of Camas, Existing and Proposed UGAs



Additional analysis refining the employment capacity is underway that is based on key City of Camas zoning and UGA modifications. The City of Camas is proposing zoning modifications and the addition of a new UGA that would allow for additional employment capacity. According to these refined employment capacity estimates, Camas would have capacity for 12,273 jobs which would almost meet the 2045 employment target of 13,658 jobs. The finalized estimates will depend on the final preferred alternative.

CLARK COUNTY'S BUILDABLE LANDS REPORT, 2023, KEY FINDINGS

Clark County's Buildable Lands Report was adopted in June 2022 to update the methodology and Vacant Buildable Lands Model (VBLM) and updated with 2023 data.

- The Clark County Buildable Lands Report and employment allocations and City of Camas estimates indicate that there is sufficient employment capacity for employment growth in the county through 2045.
- Camas has the second largest share of total projected jobs in Clark County (17.5%) after the City of Vancouver and the Vancouver Unincorporated Urban Area (U). The City of Camas is expected to have capacity to accommodate 11,363 jobs, with about half (55%) of new employment on commercial land and half on industrial (45%).

City of Camas Profile

More than 10,000 years ago, Native Americans occupied the Columbia River Valley in the area where Camas is now situated. Before Camas was incorporated, a paper mill owned by the LaCamas Colony Company was established in 1883 to help supply newsprint for The Oregonian. Shortly thereafter, the City of Camas became an incorporated city in 1906. The City is named after the camas lily, a deep blue flowered plant with edible onion-like bulbs valued by various Columbia river Native American Tribes.[19] The paper mill expanded in the early 20th Century playing an important role in the local economy and grew to become Clark County's largest manufacturing company with 2,700 employees by 1971.[20] Located in the western edge of Downtown Camas along the Columbia River, the mill then experienced a downturn beginning in the 1980s that continued into the 21st Century, resulting in a reduced workforce. More recently, in 2018, the mill now owned by Georgia-Pacific, shut down several facilities and all but one of its paper machines and downsized its workforce to roughly 150 workers. In 2024, the mill continues to operate with a reduced workforce.

[19] City of Camas history: https://www.cityofcamas.us/community/page/camas-history
[20] Source: https://www.camaspostrecord.com/news/2023/sep/07/camas-mill-celebrates-its-140th-birthday/#:~:text=An%20entire%20wall%20of%20photos,built%20the%20mill%20to%20produce

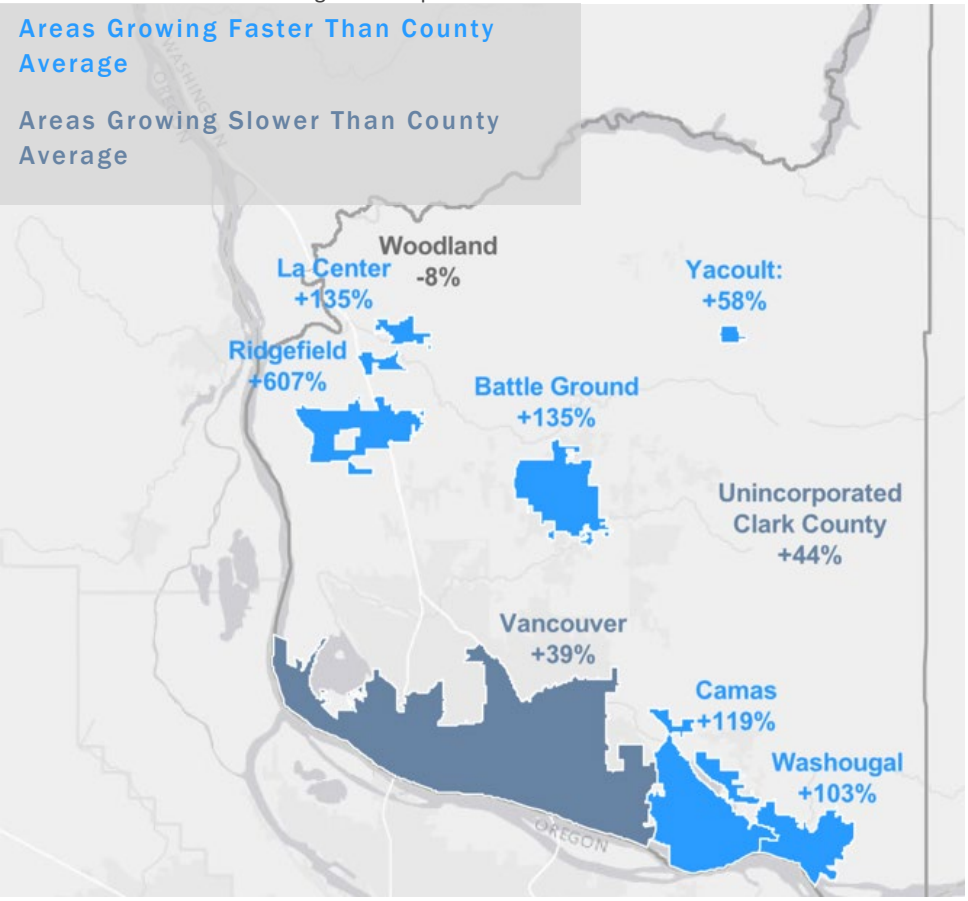
The early economy in Camas was at first dominated by manufacturing but has shifted and diversified over time. The 2015 Comp Plan describes a transition where the City's past economic health was closely tied to the paper mill and then shifted to become more diversified supporting many technology and manufacturing firms, as well as a growing school system and professional offices. In the last four decades, the family-friendly City with close ties to the Portland Metropolitan Region has continued to attract more residents especially from 1990 to 2000 by almost doubling in size to almost 13,000 people, increasing to a little over 19,000 people in 2010, and then reaching 27,420 people by 2023. Similar to the City of Vancouver, Camas has experienced high population growth over the last two decades, with an average annual growth rate of 5.2% which is double the rate in Clark County and Washington State.

Today, the City of Camas is a highly desirable place to live, offering a prime location nearby the growing cities and employment centers of Vancouver and Portland, and the smaller cities of Washougal and Battle Ground in south Clark County. The City of Camas is sandwiched between the City of Vancouver (sharing a border on the west side of Camas) to the west and the City of Washougal to the east. At a regional level, the City is interconnected to the Portland Metropolitan region, located northeast of Portland (see map below).

Camas has been working to advance its economic development goals in recent years while investing in quality-of-life amenities that make it as competitive location for attracting workers and residents. Recently, the City adopted a North Shore subarea plan (2022) to support community vibrancy and economic development strategies and the City is working to adopt a new Downtown subarea plan as a part of the 2025 Comprehensive Plan periodic update project. The City has also been expanding its inventory of parks space by leveraging the County's Legacy Lands program to expand its offerings of natural areas and recreation facilities. As larger economic trends increase locational flexibility (especially for professional services and traditionally office-based jobs), these types of investments will be critical for cities in the region to continue drawing in and retaining a residential base and workforce. The Port of Camas-Washougal manages an airport that is outside City limits, but most of the developable land in the North Shore area is within the airport influence area.

Figure 17 Camas Compared to Clark County Cities

Source: Office of Financial Management Population Estimates



Economic Development Overview

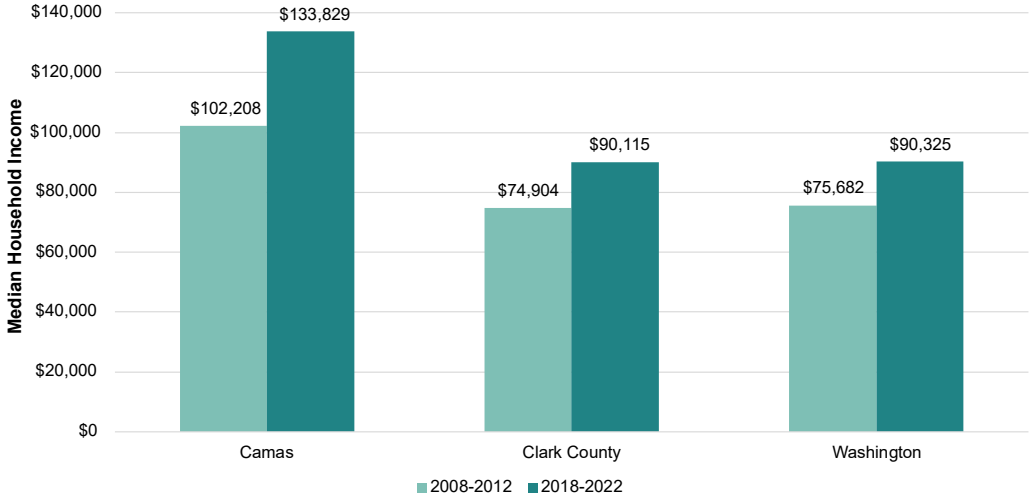
Economic development for the City of Camas is the creation and sustenance of a diverse array of employment opportunities, ensuring the tax base currently enjoyed by the City endures and is strengthened. The economic health and well-being of the City are tied to commitments to promote a wide range of employment opportunities for the citizens of the community and to provide a setting and quality of life that attract businesses and residents.

Planning a diverse and vibrant economy must start by understanding current economic conditions in the City and Clark County. While the City's past economic health was closely tied to the paper mill, in more recent years, the City's economy has diversified and now supports many technology and manufacturing firms, as well as a growing school system and professional offices. The figures below compare the median household income for Camas, Clark County, and Washington as well as employment and related trends over time.

As illustrated in Figure 18 when compared with Clark County, wages in Camas are higher and have grown over the last decade. Higher wages can have positive impacts on other aspects of the economy, and community members have expressed their desire to support living-wage jobs, particularly in healthcare and high technology.

Figure 18 Median Household Income, Camas, Clark County, and Washington

Source: U.S. Census Bureau, 2008-2012 and 2018-2022 ACS 5-Year Estimates
Note: 2008-2012 values are adjusted for inflation. Median household incomes are shown in 2022 $.



Growth in employment, population, and housing are interconnected. In general, communities with a high ratio of population to jobs can be characterized as "bedroom" or commuter communities, where there are fewer jobs than residents in the city. In Camas, there are roughly three residents for every one employee, indicating a continued trend from the past decade.

The ratio of jobs to housing has slightly increased from 0.9 to 1.0, indicating a healthy balance of housing units in comparison with employment and meeting the jobs-to-housing ratio of 1:1 adopted by Clark County (Resolution 2016-03-01). As the City grows, maintaining this trend can help to ensure there is adequate housing for those who work in Camas.

Table 7 Population, Employment, and Jobs Comparison Ratios, Camas, 2010-2021

Source: OFM, LEHD-LODES. Note: Employment data is currently only available at the City level through 2021.

	Trends			Ratios	
	Population	Employment	Housing Units	Population : Jobs	Jobs : Housing
2010	19,355	6,508	7,072	3.0	0.9
2021	26,870	9,558	9,586	2.8	**1.0**

Overall, Clark County has seen fluctuations in employment since 2000, with the most notable decline in employment in the wake of the 2008 recession and at the onset of the COVID-19 in 2020. However, the County has also seen a rapid rebound from pandemic trends, with sharp employment growth after 2020. The City has generally seen positive growth in employment over the last two decades. The City saw less of a decrease during 2020 compared to Clark County overall, which may reflect Camas' growth in remote workers during this period (Figure 19).

Figure 19 Total Covered Employment Change YOY, Clark County (2001-2022)

Source: Washington Employment Security Department

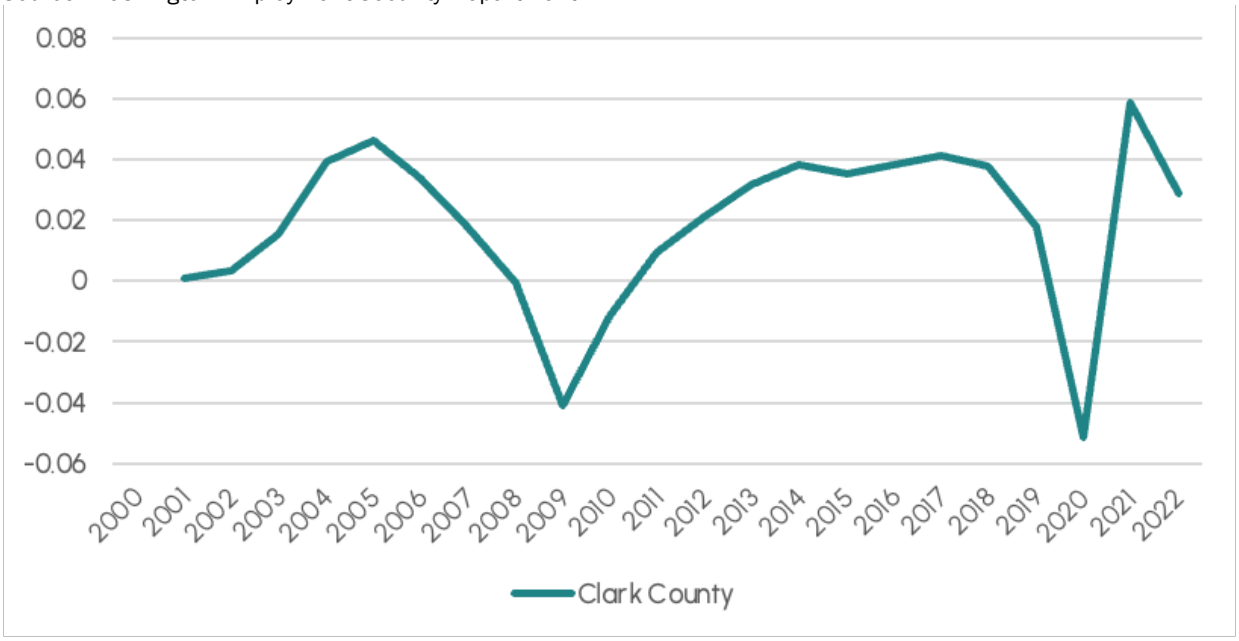
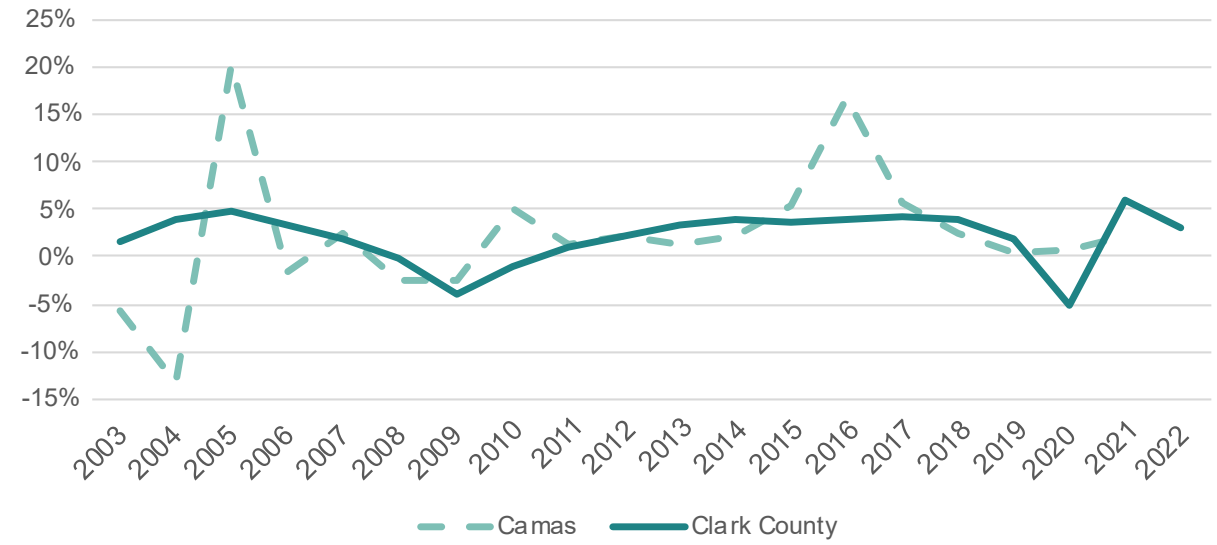


Figure 20 Total Employment Change YOY (Primary Jobs), Camas and Clark County

Source: Washington Employment Security Department, LEHD-LODES. Note: LEHD-LODES data for the City of Camas only available through 2021



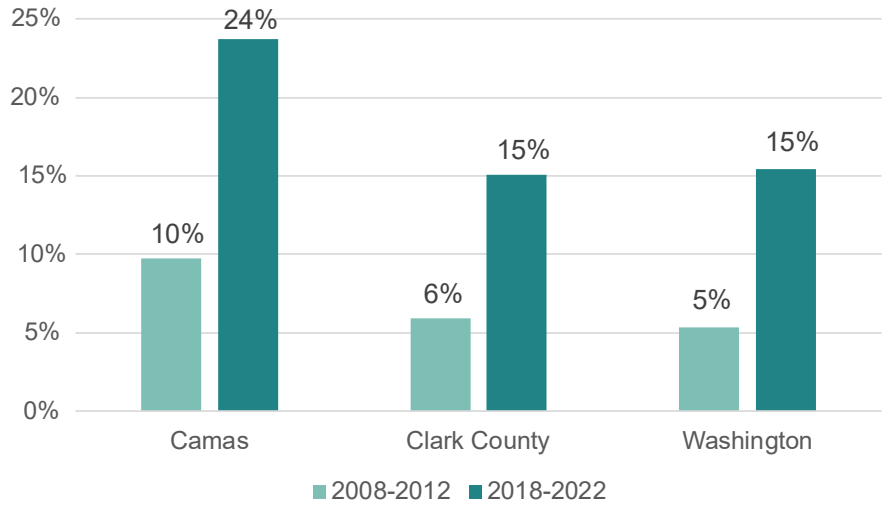
The Economic Development Element establishes goals and policies that seek to maintain the diversification of employment opportunities and support the continued growth of the Camas economy and attainment of the jobs target by 2045.

The City is targeting businesses that provide a greater proportion of living-wage jobs. Increasing retail services in support of residential, industrial, and professional business growth

is highly desirable. Camas is also seeing an increasing share of remote workers at a higher rate than the County or State, with nearly a quarter of workers falling into this category in 2022.

Figure 21 Share of Remote Workers, Camas, Clark County, and Washington, 2012-2022

Source: ACS, 2008-2012, 2018-2022



Summary of Demographic and Economic Trends

A summary of key findings from this Economic Development Element analysis is provided below to help describe key insights regarding the economic context, economic opportunities and challenges informing plan updates (Technical Appendix provides the full findings).

- **Camas has an aging population with a median age of 40 years in 2022 and a growing share of residents aged 60 years and over.** This group typically represents late-career workers or retirees. Median age in Camas is higher than Clark County overall and quickly growing since 2012, likely indicating a combination of natural growth and in-migration of older adults.
- **Camas has a higher share of residents 25 or older with at least a college level bachelor degree compared to Clark County or Washington State**, with 79% of residents holding these degrees in 2022. This share of residents rose quickly from only 37% in 2012.
- **Median household income for all households in Camas was nearly $134,000 in 2022, higher than Clark County or Washington State.** Since 2012, median income for residents of Camas increased by about 30% (in nominal dollars, not adjusted for inflation), more than either the County or State.
- **The City of Camas has seen generally positive trends in employment growth over the last two decades,** with notable increases in the number of workers in 2005, 2010, and 2016. The City of Camas employment grew from approximately 6,584 to 9,558 between 2011 and 2021.

- **The current employment to housing ratio in Camas was 1.0 in 2021, meaning that there is about one employee working in the City for every housing unit.** This ratio indicates that Camas has a well-balanced housing stock to accommodate workers in the City.
- **In 2021, the top five industries by employment in Camas were Finance and Insurance; Manufacturing; Educational Services; Professional, Scientific, and Technical Services; and Wholesale Trade.** Four of these five top industries paid above average wages (all except Educational Services paid below average wages). Finance and Insurance was the City's fastest growing industry (with an average annual growth rate of about 33%).
- **Top employers also reflect many of the County's largest industries, including professional services like finance and insurance, technology, manufacturing, and health care. Four of the City's top ten employers were in the manufacturing industry as of 2020.** Within Camas, employment has concentrated at two nodes, including the Downtown area to the southeast and corporate campuses in the Grass Valley near the border with the City of Vancouver.
- **Camas is part of an interconnected region, with more residents commuting out of Camas for work (8,159) than employees commuting in (6,982) as of 2021. Approximately 9,102 people are employed in Camas and among this total nearly 90% live in Camas (8,159) but work outside of the city and the remaining 10% live and work in Camas (943 people).** Top commuting destinations for Camas residents are primarily nearby, larger cities with employment hubs like Vancouver and Portland, while only 10% remained in the City. Nearly 59% commute less than 10 miles. The fourth most common destination for residents was Seattle, likely indicating remote workers at companies based in the Puget Sound area. Workers commuting to Camas originated from similar destinations, with one quarter coming from Vancouver.
- **Washington State Employment Security Department projections for future employment growth estimated that the Southwest Washington region will grow by about 19% overall by 2031.** The sectors expected to see the greatest increase in their share of employment are Professional/ Business Services, Leisure/ Hospitality, Education/ Health Services, Information, and Other Services.
- **Camas has a larger share of remote workers compared with Clark County and Washington State.** In 2022 one in four workers in Camas was a remote employee, compared to 15% in both the County and State overall. The share of remote workers in Camas has grown since 2012.
- **Since 2020, the City has issued 8,652 new business permits, with the largest volume of new permits in 2020 and a decreasing amount annually after 2020.** General business establishments accounted for the largest portion of these permits (74%), followed by home occupations (25%), and nonprofits (1%).
- **Camas' taxable retail sales were higher than those in most comparable jurisdictions in Clark County over the past decade**, competing primarily with the City of Battle

Ground for the highest annual sales. In 2022, total taxable retail sales reached an all-time high of over $600 million.

- **Retail rents in Camas had slight upward growth since 2014 while vacancies trended downward, indicating increasing demand for retail. Industrial real estate in the City of Camas is also performing well compared to Clark County in 2024.** The City is home to only about 3.9% of Clark County's industrial real estate in square footage but saw a sharp increase of industrial rents PSF in 2022, growing by over 200% year-over-year (YOY) to $23. Vacancy rates for industrial real estate were also extremely low in Camas in 2024 YTD at 1.7%, indicating high demand in the industrial market.

Implementation Tools and Strategies

Realizing the City of Camas economic development goals requires building on the City's potential while overcoming existing constraints. The following implementation strategies will generate positive momentum toward creating a more balanced and healthy economy.

Programmatic Strategies

- **Economic Development Committee:** Establish a mayor-appointed committee to help refine and implement Camas' economic development goals and strategies. The committee will:
  - Convene government, private sector, and nonprofit partners to leverage resources or secure financial support for economic development initiatives that benefit Camas and the broader region. In addition, this committee would help provide input on the Economic Development Strategy.
- **Economic Development Strategy**: Create an Economic Development Strategic Plan involving the Economic Development Committee, local businesses, community groups, school districts, and city leadership that further identifies priorities for job creation in targeted industries, infrastructure needs, reducing regulatory barriers, and incentives to attract needed and desired businesses.
  - Promote the development of an economic development strategy that will capitalize on the creation and retention of industries that provide living-wage jobs.
  - Future economic development strategy planning should capitalize on existing facilities and infrastructure and include a mix of uses that are trail- and transit-oriented and designed with high-quality streetscape appeal.
  - Lead an economic development strategy update every 1 to 3 years.

Financial Strategies

- **Leverage Grant Dollars**: Utilize federal, state, and county grants to support the establishment and expansion of small local businesses and infrastructure improvements benefiting economic development areas.
- **Incentives**: Explore incentives to encourage mixed-use development and provide affordable housing options (such as TIF, LID, MFTE changes).

- **Partnership**: Coordinate with the Columbia River Economic Development Council (CREDC) or other relevant organizations, to explore collaborative opportunities in promoting regional workforce development.
- **Opportunity Site Inventory**: Identify sites where the city can participate in cost-sharing mechanisms for infrastructure development.
    - Establish a policy that prioritizes capital investments to or on opportunities sites or other capital projects that better connect commercial nodes. This could include sidewalks, trails, bike paths, etc.

Regulatory Strategies

- **Code Audit**: Ensure the zoning code supports/incentivizes a broad range of needed and desired businesses in various zones.
    - **Study Allowed Uses:** Ensure needed and desired businesses are allowed in certain zones, including accessory uses which can support home-based businesses.
    - **Design standards**: Consider revisiting existing design standards to ensure they adequately support efforts to maintain and enhance existing character without compromising development feasibility.
    - **Flexible parking standards:** Develop flexible parking standards that can respond to site conditions.
    - **Revised Gateway Corridor Design Standards:** Update the design standards and allowed uses for gateway corridors to enhance its natural beauty but deemphasize its auto-oriented environment.

Procedural Strategies

- **Capacity Building**: Leverage increased tax revenue from population growth to support Camas' economic development strategy.
- **Clear and Objective Development Standards**: Establish clear and objective development standards for all development types, reducing the need for conditional use processes or other discretionary review processes.
- **Monitoring**: Monitor the performance of economic development such as with business retention and attrition, changes in tax revenues, and permitting of employment facilities. Monitor the financial impact of new programs, policies, and regulatory requirements on development feasibility by providing a report update every 1-3 years describing key metrics such as development changes and infrastructure projects.

Economic Development Goals and Policies

Goal ED-1 Citywide Economic Development

Maintain a diverse range of employment opportunities to support all residents, provide sufficient land supporting employment needs, and provide a setting and quality of life that attract and retain living-wage jobs[21] throughout the community.

Policy ED-1.1 Work with partners to identify strategies to proactively recruit businesses and ensure that tools and incentives are in place to attract sustainable and innovative industries to expand and provide stable living-wage employment.

Policy ED-1.2 Work with partners (such as the Chamber of Commerce, education programs, Workforce SW WA, CREDC) to provide apprenticeships, internships, vocational training schools, entrepreneurship programs, equitable opportunities, and on-the-job training in targeted industry sectors.

Policy ED-1.3 Encourage appropriate reuse, environmental cleanup, and redevelopment of older and deteriorating commercial areas and industrial brownfield sites. Identify opportunities to support place-based economic development, provide connections to the waterfront, diversify the economy, and support mixed-use development.

Policy ED-1.4 Foster and expand year-round recreational services, lodging, conference spaces, dining, and retail options to support tourism, benefit residents and employers, leverage Camas' strong parks and open space assets, and connect to the waterfront.

Policy ED-1.5 Participate in regional recruitment organizations to ensure the availability of an adequate supply of commercial and industrial employment land to support the City's economic development goals. Evaluate city resources to support economic development

[21] A living-wage job is one that pays an income sufficient to cover basic living expenses without financial hardship, allowing an individual or family to afford essential needs such as housing, food, healthcare, transportation, childcare, and other necessities without relying on public assistance. MIT Living wage calculation (2024): https://livingwage.mit.edu/counties/53053.

planning and implementation by designating a point-of-contact for economic development programs and serving as a liaison to the business community.

Policy ED-1.6 Support and encourage employees to use the Commute Trip Reduction Program. Encourage businesses to support remote work to reduce trips and implement a trip reduction program with incentives for carpooling, transit ridership, and other options beyond single-occupancy vehicles.

Policy ED-1.7 Encourage mixed-use development and complementary businesses throughout the City to support industry clusters and leverage resources.

Policy ED-1.8 Review regulatory design standards and planning procedures for industrial and commercial facilities and provide economic incentives to promote private investment in start-ups, incubator businesses, and businesses relocating to Camas.

Policy ED-1.9 Coordinate with Clark County and evaluate adding a Grove Field Urban Growth Area (UGA) for employment purposes to support employment targets.

Policy ED-1.10 Explore ways to support remote workers such as community hubs and third places and code revisions for co-working spaces.

Policy ED-1.11 Implement the Downtown Camas subarea plan and the associated goals and actions (see downtown subarea element).

Policy ED-1.12 Promote the growth of residential development in the North Shore as described in the Camas North Shore Subarea Plan.

Goal ED-2 Local Business Development

Promote business creation, expansion, retention, and diversification throughout the community to create a consistent and reliable tax base and a healthy, diversified local economy.

Policy ED-2.1 Identify and plan for infrastructure (such as the capital facilities plan) to nurture and incubate new businesses. Explore financing tools such as tax increment financing to fund infrastructure to support development and investment in targeted areas.

Policy ED-2.2 Support retention, expansion, and recruitment of local businesses in Camas.

Policy ED-2.3 Support development standards that promote high-quality building and site design, encourage businesses to operate in a sustainable and environmentally responsible manner and integrate energy efficient design features.

Policy ED-2.4 Collaborate with partners and agencies (such as CREDC and the Port of Camas Washougal) to develop economic strategies that promote diversification of business and industry in the city and facilitate opportunities for entrepreneurship.

Policy ED-2.5 Work with partners to proactively recruit and promote the growth of businesses and industries that provide, at a minimum, cost-of-living wages and economic diversity in alignment with the CREDC regional economic development plan.

Policy ED-2.6 Explore the creation of an economic development grant program for local businesses in connection with local partners.

Policy ED-2.7 Facilitate an environment for the success and growth of small businesses to maintain a strong, diverse, and resilient local economy.

Policy ED-2.8 Encourage investments and programs that provide resources and support to minority-owned and woman-owned businesses.

Policy ED-2.9 Increase the number of neighborhood business districts to expand local access to goods and services. Consider expanding mixed-use zoning options with ground floor commercial uses that allow residents to walk or roll from home.

Policy ED-2.10 Encourage shopping local to support Camas businesses.

Goal ED-3 Mixed Use and Commercial Areas

Encourage efficient and innovative development that thoughtfully mixes commercial and residential land uses that are pedestrian-friendly and consider the context of the surrounding area.

Policy ED-3.1 Develop commercial and mixed-use areas that are safe, comfortable, and attractive to pedestrians.

Policy ED-3.2 Encourage efficient land use in the mixed-use land use designation by facilitating compact, high-density development and minimizing the amount of land that is needed for surface parking.

Policy ED-3.3 Promote the growth of businesses such as grocery stores, medical offices, and restaurants that meet the retail and service needs of the community.

Policy ED-3.4 Encourage new developments to provide neighborhood parks and shared use paths to encourage greater physical activity and connect residential areas to commercial centers, public transit, and community facilities.

Goal ED-4 Mixed Employment and Industrial Areas

Providing a mix of traditional industrial and non-industrial land uses to maximize opportunities and partnerships and facilitate employers to remain, expand, or locate in Camas.

Policy ED-4.1 Evaluate the costs and benefits associated with adding the Grove Field Urban Growth Area to the North Shore Subarea Plan.

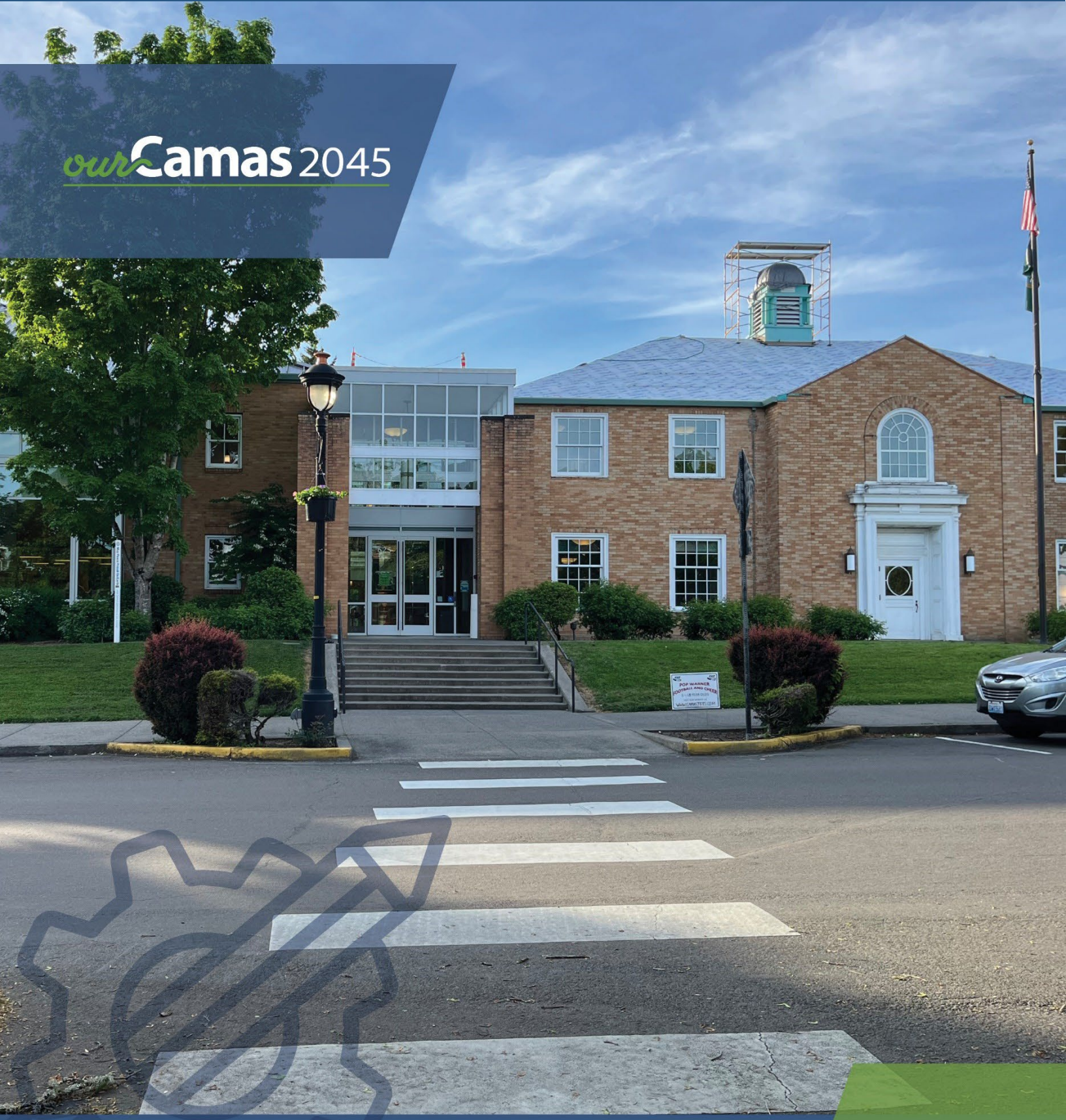
Policy ED-4.2 Preserve large tracts of land for large industry and master-planned commercial development within mixed employment land use areas.

Policy ED-4.3 Support a mix of light industrial, research and development, manufacturing, and office spaces through flexible zoning that allows for evolving business needs.

Policy ED-4.4 Support the development of business parks, incubators, and innovation hubs that integrate industrial and high-tech employment uses.

Policy ED-4.5 Ensure zoning and development regulations support both large-scale employers and small businesses, including start-ups and maker spaces.

ourCamas 2045



Technical Appendices

11

11. Technical Appendices

[Appendices to be included in future draft]

2025-2026 Capital Improvement Project List

6-Year Street Plan

Camas General Sewer Plan (2022)

Camas School District Capital Facilities Plan (2022)

Camas Stormwater Management Plan (2024)

Camas Water System Plan (2019)

Capital Facilities Plan

Clark County Comprehensive Plan (2025)

Economic Opportunity Analysis (2024)

Engagement Summary

Facility Conditions Assessment, Volumes 1 and 2

Housing Action Plan (2021)

Housing Needs Assessment (2024)

Parks and Open Space Management Plan (POSMP) (2025)

Parks, Recreation & Open Space Plan (2022)

Transportation System Plan (2025)

ATTACHMENT D

RDII PARAMETERS

RDII PARAMETERS

Table D.1 Connected Basin Area

Basin	Area (acres)	Connected Impervious (acres)	Connected Pervious (acres)	Total Connected (acres)	Total Connected (%)
4-1-3	92.8	82.4	9.1	82.4	88.8%
5-1-2	1,898.2	1,067.4	18.7	1,067.4	56.2%
5-2-1	958.8	199.6	17.6	199.6	20.8%
8-1-2	220.7	120.7	5.2	120.7	54.7%
STEP/WWTF	3,868.3	2,011.1	99.3	2,011.1	52.0%
Goodwin Road	637.8	89.3	0.0	89.3	14.0%
Leadbetter Road	1,076.9	85.1	15.8	85.1	7.9%

Table D.2 Model A Parameters

Basin	Impervious (%)	Time of Concentration (min)	Reduction Factor	Initial Loss (ft)
4-1-3	5	7	0.9	0.00196
5-1-2	0.25	7	0.9	0.00196
5-2-1	0.6	7	0.9	0.00196
8-1-2	0.6	7	0.9	0.00196
STEP/WWTF	0.1	7	0.9	0.00196
Goodwin Road	1	7	0.9	0.00196
Leadbetter Road	2	7	0.9	0.00196

Table D.3 RDI Parameters

Basin	Percent RDI Area (%)	Surface Storage (Umax)	Root Zone Storage (Lmax)	Overland Coefficient (Cqof)	Groundwater Coefficient (Carea)	TC Overland Flow (CKof)	TC Interflow (CKif)	TC Baseflow (CKbf)	Overland Flow Threshold (Tof)	Interflow Threshold (Tif)	Groundwater Threshold (Tg)	Initial Surface Storage (U)	Initial Root Zone Moisture (L)	Initial Groundwater Depth (GWL)	Initial Overland Flow (OF)	Initial Interflow (IF)	Specific Yield (Sy)	Minimum Groundwater Depth (GWLmin)	Max GW depth causing Baseflow (GWLbf0)	GW Depth for Unit Capillary flux (GWLfl1)
8-1-2	0.5	0.0328	0.328	0.30	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0
5-1-2	8.0	0.0328	0.50	0.53	1	5	55	500	0	0	0	0	0.16	32.8084	0	0	0.1	0	32.808399	0
5-2-1	8.0	0.0328	0.328	0.30	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0
4-1-3	62.0	0.0328	0.50	0.75	1	4.5	10	100	0	0	0	0	0.28	32.8084	0	0	0.1	0	32.808399	0
STEP/WWTF	18.0	0.0328	0.328	0.20	1	20	500	2000	0	0	0	0	0.20	32.8084	0	0	0.1	0	32.808399	0
Goodwin Road	4.0	0.0328	0.328	0.30	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0
Leadbetter Road	7.0	0.0328	0.328	0.90	1	20	500	2000	0	0	0	0	0	32.8084	0	0	0.1	0	32.808399	0

ATTACHMENT E

DRY WEATHER CALIBRATION RESULTS

DRY WEATHER CALIBRATION RESULTS

Table E.1 Dry Weather Flow Calibration Results

Meter Number	Pipe Diameter (inches)	Weekday Dry Weather Flow			Weekend Dry Weather Flow			Average Dry Weather Flow[4]		
		Percent Error[3]			Percent Error[3]			Measured ADWF (mgd)	Modeled ADWF (mgd)	Percent Difference (%)
		Average Flow (%)	Peak Flow (%)	Max Level Difference (inches)	Average Flow (%)	Peak Flow (%)	Max Level Difference (inches)			
Meter 4-1-3	12	-2.6%	0.7%	2.07	-1.1%	-0.4%	2.01	0.24	0.24	-2.2%
Meter 5-1-2	21	1.3%	-1.9%	1.35	0.9%	0.9%	1.32	0.85	0.86	1.2%
Meter 5-2-1	18	0.4%	-7.8%	0.21	-3.9%	3.0%	0.32	0.20	0.20	-0.9%
Meter 8-1-2	12	0.4%	-1.7%	0.37	4.1%	2.0%	0.30	0.12	0.12	1.4%
WWTF/STEP		2.2%	-0.4%		1.0%	-1.2%		2.80	2.86	1.8%
Leadbetter Rd	18	10.0%	0.7%		-1.3%	-5.6%		0.13	0.14	6.5%
Goodwin Rd	18	4.0%	2.8%		-3.3%	-4.2%		0.09	0.10	1.8%

Notes:
(1) Source: City of Camas Temporary Flow Monitoring Program dated May 28, 2025, ADS.
(2) Average flow, level, and velocity are calculated from weekday/weekend dry weather flow monitoring data. Maximum flow values are hourly peaks corresponding to either weekend or weekday conditions, as appropriate.
(3) Percent Difference = (Modeled - Measured)/Measured*100.
(4) Average Dry Weather Flow = (5*Weekday Dry Weather Flow + 2*Weekend Dry Weather Flow)/7.

Table E.2 Meter 4-1-3

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.20	2.47	1.79	0.23	4.46	1.42	0.82	0.46
	1	0.18	2.36	1.74	0.16	4.04	1.33	0.76	0.53
	2	0.15	2.12	1.64	0.14	3.38	1.21	0.61	0.46
	3	0.15	2.10	1.62	0.13	3.14	1.15	0.60	0.50
	4	0.14	2.07	1.64	0.13	3.04	1.13	0.58	0.57
	5	0.14	2.09	1.66	0.13	3.02	1.15	0.59	0.71
	6	0.19	2.41	1.79	0.15	3.11	1.14	0.79	0.79
	7	0.26	2.84	1.94	0.23	3.24	1.16	1.06	1.09
	8	0.30	3.10	2.01	0.28	4.06	1.33	1.22	1.28
	9	0.29	3.06	2.01	0.29	4.46	1.42	1.19	1.33
	10	0.28	3.01	1.99	0.28	4.59	1.44	1.15	1.31
	11	0.28	3.04	1.98	0.28	4.50	1.42	1.17	1.28
	12	0.26	2.91	1.95	0.27	4.46	1.42	1.09	1.23
	13	0.26	2.89	1.97	0.26	4.43	1.41	1.09	1.14
	14	0.25	2.83	1.94	0.24	4.32	1.39	1.04	1.09
	15	0.25	2.82	1.93	0.24	4.19	1.36	1.04	1.09
	16	0.24	2.77	1.92	0.25	4.19	1.36	1.00	1.12
	17	0.27	2.96	1.96	0.26	4.22	1.36	1.13	1.18
	18	0.29	3.06	1.99	0.27	4.35	1.39	1.19	1.33
	19	0.31	3.19	2.03	0.28	4.40	1.41	1.28	1.38
	20	0.31	3.21	2.04	0.29	4.52	1.43	1.30	1.28
	21	0.31	3.20	2.03	0.31	4.57	1.44	1.29	1.13
	22	0.28	3.02	1.99	0.32	4.73	1.47	1.17	0.94
	23	0.23	2.69	1.89	0.28	4.76	1.47	0.96	0.79
Weekend	24	0.19	2.44	1.78	0.23	4.45	1.41	0.81	0.51
	25	0.18	2.37	1.74	0.16	4.04	1.34	0.77	0.53
	26	0.16	2.20	1.65	0.14	3.40	1.21	0.67	0.46
	27	0.13	2.03	1.59	0.13	3.18	1.16	0.56	0.54
	28	0.14	2.03	1.56	0.13	3.07	1.14	0.58	0.71
	29	0.12	1.96	1.55	0.12	3.03	1.12	0.51	0.71
	30	0.14	2.09	1.64	0.11	2.97	1.12	0.60	1.22
	31	0.18	2.33	1.74	0.14	2.79	1.07	0.75	1.31
	32	0.23	2.67	1.87	0.22	3.29	1.18	0.96	1.25
	33	0.30	3.11	2.01	0.26	3.94	1.31	1.25	1.14
	34	0.33	3.29	2.06	0.31	4.34	1.39	1.37	1.17
	35	0.33	3.31	2.05	0.33	4.69	1.46	1.38	1.16
	36	0.30	3.16	1.99	0.32	4.84	1.49	1.27	1.12
	37	0.29	3.09	1.98	0.32	4.81	1.48	1.22	0.97
	38	0.28	3.03	1.97	0.29	4.76	1.47	1.19	1.04
	39	0.27	2.92	1.93	0.28	4.60	1.45	1.12	1.09
	40	0.25	2.85	1.91	0.26	4.50	1.43	1.07	1.14
	41	0.27	2.98	1.94	0.26	4.30	1.39	1.15	1.19
	42	0.28	2.99	1.94	0.27	4.29	1.39	1.16	1.19
	43	0.30	3.13	1.99	0.28	4.39	1.40	1.26	1.01
	44	0.30	3.13	1.99	0.30	4.46	1.42	1.25	1.05
	45	0.28	3.04	1.97	0.30	4.62	1.45	1.19	1.12
	46	0.27	2.94	1.93	0.27	4.64	1.46	1.14	1.16
	47	0.22	2.59	1.83	0.25	4.43	1.42	0.91	1.08
Average									
Weekday		**0.24**	**2.76**	**1.89**	**0.24**	**4.09**	**1.34**	**1.0**	**0.98**
Weekend		**0.24**	**2.74**	**1.86**	**0.24**	**4.08**	**1.34**	**1.0**	**1.05**
ADWF(1)		**0.24**	**2.75**	**1.88**	**0.24**	**4.08**	**1.34**	**1.0**	**1.00**
% Error									
Weekday					**-2.6%**	**48.2%**	**-29.1%**		
Weekend					**-1.1%**	**48.9%**	**-28.0%**		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.3 Meter 5-1-2

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Curve
Weekday	0	0.65	5.52	1.95	0.75	6.87	1.98	-8.3%	0.65
	1	0.55	5.17	1.82	0.58	6.28	1.90	-8.8%	0.55
	2	0.49	4.89	1.72	0.50	5.40	1.83	-8.3%	0.53
	3	0.47	4.81	1.69	0.42	4.89	1.70	-8.8%	0.50
	4	0.48	4.83	1.71	0.46	4.50	1.69	-8.3%	0.50
	5	0.50	4.95	1.74	0.53	4.70	1.65	-8.8%	0.56
	6	0.66	5.58	1.96	0.70	5.12	1.75	-8.3%	0.69
	7	0.88	6.39	2.20	0.88	5.95	1.89	-8.8%	1.15
	8	1.04	6.92	2.35	1.08	6.87	2.03	-8.3%	1.21
	9	1.06	6.97	2.37	1.05	7.72	2.11	-8.8%	1.39
	10	1.02	6.86	2.35	1.04	7.62	2.11	-8.3%	1.39
	11	1.01	6.82	2.34	1.09	7.59	2.10	-8.8%	1.39
	12	0.97	6.68	2.30	1.01	7.76	2.10	-8.3%	1.39
	13	0.94	6.57	2.28	1.02	7.42	2.10	-8.8%	1.34
	14	0.92	6.52	2.26	0.97	7.49	2.08	-8.3%	1.26
	15	0.90	6.46	2.24	0.95	7.27	2.05	-8.8%	1.14
	16	0.92	6.50	2.26	0.92	7.16	2.06	-8.3%	1.11
	17	0.95	6.62	2.29	0.96	7.05	2.03	-8.8%	1.14
	18	1.01	6.81	2.34	0.92	7.20	2.04	-8.3%	1.19
	19	1.07	7.02	2.39	1.00	7.02	2.05	-8.8%	1.22
	20	1.11	7.13	2.42	0.98	7.43	2.05	-8.3%	1.10
	21	1.06	6.98	2.38	1.04	7.28	2.08	-8.8%	0.99
	22	0.94	6.59	2.28	0.91	7.59	2.09	-8.3%	0.83
	23	0.82	6.16	2.16	0.91	7.01	2.04	-8.8%	0.81
Weekend	24	0.69	5.71	2.02	0.75	6.99	2.00	-8.3%	0.53
	25	0.59	5.34	1.89	0.64	6.26	1.91	-8.8%	0.50
	26	0.50	4.98	1.77	0.55	5.73	1.83	-8.3%	0.50
	27	0.48	4.89	1.73	0.44	5.23	1.76	-8.8%	0.56
	28	0.45	4.74	1.67	0.49	4.59	1.67	-8.3%	0.69
	29	0.45	4.76	1.69	0.40	4.87	1.70	-8.8%	1.03
	30	0.51	5.02	1.79	0.51	4.34	1.65	-8.3%	1.26
	31	0.63	5.47	1.94	0.51	4.99	1.71	-8.8%	1.26
	32	0.85	6.28	2.18	0.80	4.96	1.77	-8.3%	1.26
	33	1.05	6.97	2.36	0.97	6.44	1.95	-8.8%	1.26
	34	1.17	7.35	2.46	1.15	7.24	2.06	-8.3%	1.23
	35	1.19	7.39	2.49	1.16	8.00	2.14	-8.8%	1.22
	36	1.12	7.15	2.44	1.20	8.09	2.17	-8.3%	1.20
	37	1.08	7.03	2.40	1.19	8.24	2.17	-8.8%	1.17
	38	1.03	6.87	2.37	1.14	8.17	2.17	-8.3%	1.10
	39	0.98	6.71	2.33	1.05	7.97	2.15	-8.8%	1.08
	40	0.98	6.70	2.32	1.02	7.64	2.11	-8.3%	1.06
	41	0.97	6.68	2.32	0.92	7.47	2.06	-8.8%	1.09
	42	1.00	6.77	2.34	0.98	7.07	2.04	-8.3%	1.15
	43	1.04	6.92	2.37	0.98	7.30	2.05	-8.8%	1.18
	44	1.07	7.03	2.39	1.06	7.30	2.08	-8.3%	1.08
	45	0.99	6.73	2.34	0.99	7.65	2.10	-8.8%	0.99
	46	0.90	6.43	2.25	0.94	7.36	2.06	-8.3%	0.82
	47	0.75	5.93	2.10	0.79	7.16	2.06	-8.8%	0.80
Average									
Weekday		**0.85**	**6.24**	**2.16**	**0.86**	**6.72**	**1.98**	1.98	**1.00**
Weekend		**0.85**	**6.24**	**2.17**	**0.86**	**6.71**	**1.97**	1.97	**1.00**
ADWF(1)		**0.85**	**6.24**	**2.16**	**0.86**	**6.71**	**1.98**	1.98	**1.00**
% Error									
Weekday					**1.3%**	7.6%	-8.3%		
Weekend					**0.9%**	7.5%	-8.8%		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.4 Meter 5-2-1

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.15	1.37	2.75	0.12	1.50	3.41	0.74	0.51
	1	0.11	1.23	2.30	0.13	1.22	3.13	0.57	0.45
	2	0.09	1.12	1.98	0.09	1.25	3.27	0.44	0.51
	3	0.08	1.09	1.83	0.10	1.09	2.56	0.41	0.53
	4	0.10	1.14	2.01	0.08	1.18	2.96	0.48	0.61
	5	0.10	1.18	2.10	0.16	1.04	2.75	0.52	0.71
	6	0.14	1.30	2.35	0.17	1.38	3.28	0.70	1.07
	7	0.22	1.61	3.23	0.23	1.47	3.43	1.08	1.12
	8	0.25	1.76	3.62	0.20	1.69	3.73	1.27	1.12
	9	0.25	1.74	3.63	0.26	1.66	3.73	1.23	1.28
	10	0.24	1.72	3.61	0.22	1.82	3.96	1.22	1.31
	11	0.23	1.69	3.57	0.23	1.70	3.80	1.17	1.31
	12	0.23	1.65	3.53	0.22	1.74	3.82	1.13	1.28
	13	0.22	1.64	3.48	0.21	1.65	3.72	1.10	1.07
	14	0.21	1.59	3.42	0.20	1.66	3.75	1.04	1.12
	15	0.20	1.57	3.34	0.24	1.58	3.61	1.01	1.17
	16	0.21	1.60	3.38	0.21	1.81	3.95	1.05	1.30
	17	0.23	1.67	3.52	0.25	1.64	3.68	1.15	1.29
	18	0.25	1.76	3.69	0.26	1.84	3.99	1.28	1.45
	19	0.25	1.76	3.75	0.25	1.81	3.94	1.27	1.36
	20	0.28	1.86	3.83	0.26	1.80	3.92	1.42	1.20
	21	0.27	1.81	3.73	0.26	1.84	3.97	1.34	0.97
	22	0.24	1.70	3.50	0.19	1.82	3.97	1.18	0.75
	23	0.19	1.53	3.14	0.23	1.56	3.56	0.95	0.58
Weekend	24	0.16	1.41	2.93	0.15	1.74	3.84	0.76	0.45
	25	0.13	1.28	2.46	0.07	1.32	3.19	0.61	0.42
	26	0.12	1.27	2.43	0.10	0.98	2.67	0.60	0.53
	27	0.06	1.02	1.68	0.13	1.12	2.86	0.31	0.52
	28	0.08	1.08	1.85	0.07	1.30	3.21	0.40	0.65
	29	0.08	1.08	1.84	0.14	0.87	2.42	0.38	1.09
	30	0.10	1.17	2.13	0.12	1.36	3.29	0.48	1.09
	31	0.15	1.35	2.62	0.19	1.26	3.11	0.70	1.19
	32	0.20	1.53	3.19	0.21	1.54	3.53	0.95	1.23
	33	0.24	1.72	3.62	0.23	1.67	3.78	1.17	1.19
	34	0.27	1.83	3.87	0.23	1.70	3.78	1.33	1.14
	35	0.29	1.88	3.85	0.27	1.75	3.87	1.39	1.12
	36	0.28	1.88	4.02	0.27	1.88	4.02	1.37	1.09
	37	0.26	1.79	3.77	0.23	1.85	3.96	1.26	1.02
	38	0.27	1.82	3.75	0.23	1.75	3.85	1.30	1.06
	39	0.25	1.76	3.65	0.19	1.74	3.85	1.21	1.16
	40	0.25	1.75	3.62	0.25	1.59	3.63	1.19	1.29
	41	0.26	1.78	3.62	0.25	1.81	3.98	1.25	1.28
	42	0.26	1.80	3.64	0.25	1.79	3.86	1.25	1.43
	43	0.26	1.80	3.69	0.30	1.81	3.93	1.27	1.35
	44	0.28	1.86	3.86	0.28	1.98	4.18	1.34	1.19
	45	0.27	1.83	3.63	0.24	1.91	4.05	1.32	1.06
	46	0.22	1.67	3.45	0.19	1.79	3.94	1.08	0.87
	47	0.17	1.48	2.98	0.14	1.56	3.53	0.87	0.61
Average									
Weekday		**0.20**	**1.55**	**3.14**	**0.20**	**1.57**	**3.58**	**1.00**	**1.00**
Weekend		**0.21**	**1.58**	**3.17**	**0.20**	**1.59**	**3.60**	**1.00**	**1.00**
ADWF(1)		**0.20**	**1.55**	**3.15**	**0.20**	**1.58**	**3.58**	**1.00**	**1.00**
% Error									
Weekday					**0.4%**	**1.8%**	**14.1%**		
Weekend					**-3.9%**	**0.7%**	**13.5%**		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.5 Meter 8-1-2

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.08	1.80	1.65	0.09	1.99	1.60	0.69	0.47
	1	0.07	1.69	1.47	0.06	1.78	1.50	0.58	0.45
	2	0.05	1.56	1.32	0.06	1.53	1.38	0.46	0.45
	3	0.05	1.52	1.30	0.05	1.46	1.33	0.44	0.47
	4	0.06	1.55	1.36	0.06	1.33	1.28	0.48	0.49
	5	0.06	1.63	1.47	0.05	1.44	1.32	0.54	0.55
	6	0.08	1.78	1.65	0.08	1.40	1.32	0.68	0.69
	7	0.11	2.07	1.93	0.12	1.71	1.46	0.99	1.23
	8	0.14	2.25	2.11	0.15	2.15	1.68	1.21	1.30
	9	0.15	2.34	2.13	0.15	2.34	1.77	1.28	1.27
	10	0.15	2.34	2.09	0.15	2.37	1.78	1.25	1.33
	11	0.15	2.36	2.15	0.15	2.39	1.79	1.31	1.37
	12	0.16	2.40	2.15	0.15	2.39	1.79	1.35	1.34
	13	0.15	2.40	2.11	0.15	2.40	1.79	1.32	1.33
	14	0.15	2.46	2.04	0.15	2.40	1.79	1.31	1.26
	15	0.14	2.38	2.00	0.14	2.37	1.78	1.24	1.18
	16	0.13	2.26	2.01	0.14	2.32	1.75	1.16	1.19
	17	0.14	2.25	2.06	0.14	2.25	1.73	1.17	1.27
	18	0.14	2.31	2.11	0.14	2.26	1.73	1.25	1.27
	19	0.15	2.31	2.12	0.14	2.29	1.74	1.25	1.22
	20	0.14	2.28	2.07	0.14	2.31	1.75	1.20	1.18
	21	0.13	2.25	2.05	0.13	2.28	1.74	1.16	1.08
	22	0.12	2.15	1.99	0.12	2.22	1.71	1.06	0.88
	23	0.10	1.97	1.84	0.10	2.14	1.67	0.87	0.74
Weekend	24	0.08	1.76	1.73	0.09	1.98	1.59	0.73	0.47
	25	0.07	1.66	1.59	0.07	1.81	1.52	0.62	0.45
	26	0.06	1.58	1.48	0.05	1.56	1.39	0.54	0.45
	27	0.06	1.54	1.41	0.06	1.41	1.30	0.50	0.47
	28	0.05	1.50	1.39	0.05	1.43	1.33	0.48	0.49
	29	0.05	1.46	1.37	0.06	1.38	1.28	0.46	0.55
	30	0.06	1.55	1.52	0.06	1.48	1.35	0.54	0.69
	31	0.09	1.75	1.80	0.08	1.50	1.36	0.77	1.26
	32	0.12	1.99	2.08	0.13	1.76	1.49	1.05	1.30
	33	0.14	2.13	2.20	0.15	2.17	1.69	1.22	1.33
	34	0.15	2.22	2.28	0.15	2.36	1.77	1.33	1.33
	35	0.16	2.26	2.33	0.15	2.38	1.78	1.39	1.37
	36	0.16	2.27	2.32	0.16	2.41	1.80	1.40	1.34
	37	0.15	2.24	2.29	0.16	2.45	1.81	1.35	1.33
	38	0.14	2.17	2.26	0.16	2.44	1.81	1.28	1.25
	39	0.14	2.15	2.18	0.15	2.42	1.80	1.22	1.17
	40	0.13	2.10	2.17	0.14	2.36	1.77	1.17	1.18
	41	0.14	2.13	2.19	0.14	2.31	1.75	1.21	1.26
	42	0.14	2.15	2.19	0.15	2.30	1.75	1.22	1.26
	43	0.14	2.20	2.24	0.15	2.35	1.77	1.29	1.21
	44	0.14	2.19	2.21	0.15	2.35	1.77	1.27	1.17
	45	0.13	2.13	2.19	0.14	2.33	1.76	1.20	1.07
	46	0.12	2.06	2.11	0.13	2.27	1.73	1.11	0.88
	47	0.10	1.88	1.93	0.11	2.18	1.69	0.89	0.74
Average									
Weekday		**0.117**	**2.10**	**1.88**	**0.118**	**2.06**	**1.63**	**1.00**	**1.00**
Weekend		**0.113**	**1.96**	**1.98**	**0.118**	**2.06**	**1.63**	**1.00**	**1.00**
ADWF(1)		**0.116**	**2.06**	**1.91**	**0.118**	**2.06**	**1.63**	**1.00**	**1.00**
% Error									
Weekday					**0.4%**	**-1.5%**	**-13.2%**		
Weekend					**4.1%**	**4.9%**	**-17.6%**		

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.6 Meter WWTF/STEP

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	3.18	-	-	3.06	-	-	1.13	1.13
	1	2.84	-	-	2.67	-	-	1.01	1.01
	2	2.46	-	-	2.43	-	-	0.88	0.88
	3	2.16	-	-	2.02	-	-	0.77	0.77
	4	2.01	-	-	2.16	-	-	0.72	0.72
	5	1.84	-	-	2.09	-	-	0.66	0.66
	6	1.85	-	-	2.22	-	-	0.66	0.66
	7	1.93	-	-	2.31	-	-	0.69	0.69
	8	2.21	-	-	2.36	-	-	0.79	0.79
	9	2.92	-	-	2.99	-	-	1.04	1.04
	10	3.33	-	-	2.97	-	-	1.19	1.19
	11	3.22	-	-	3.01	-	-	1.15	1.15
	12	3.08	-	-	3.19	-	-	1.10	1.10
	13	3.06	-	-	3.33	-	-	1.09	1.09
	14	3.06	-	-	3.32	-	-	1.09	1.09
	15	3.12	-	-	3.34	-	-	1.11	1.11
	16	2.97	-	-	3.10	-	-	1.06	1.06
	17	2.91	-	-	2.95	-	-	1.04	1.04
	18	2.91	-	-	3.38	-	-	1.04	1.04
	19	3.06	-	-	2.68	-	-	1.09	1.09
	20	3.12	-	-	3.39	-	-	1.11	1.11
	21	3.33	-	-	3.26	-	-	1.19	1.19
	22	3.43	-	-	3.42	-	-	1.23	1.23
	23	3.41	-	-	3.24	-	-	1.22	1.22
Weekend	24	3.08	-	-	2.93	-	-	1.10	1.13
	25	2.75	-	-	2.72	-	-	0.98	1.01
	26	2.46	-	-	2.42	-	-	0.88	0.88
	27	2.19	-	-	2.19	-	-	0.78	0.77
	28	2.09	-	-	2.09	-	-	0.74	0.72
	29	1.98	-	-	1.93	-	-	0.71	0.66
	30	1.78	-	-	1.84	-	-	0.63	0.66
	31	1.79	-	-	1.99	-	-	0.64	0.69
	32	1.96	-	-	2.05	-	-	0.70	0.79
	33	2.19	-	-	2.22	-	-	0.78	1.04
	34	2.65	-	-	2.90	-	-	0.94	1.19
	35	3.21	-	-	3.35	-	-	1.14	1.15
	36	3.45	-	-	3.47	-	-	1.23	1.10
	37	3.54	-	-	3.50	-	-	1.26	1.09
	38	3.55	-	-	3.20	-	-	1.27	1.09
	39	3.29	-	-	2.99	-	-	1.18	1.11
	40	3.12	-	-	3.03	-	-	1.11	1.06
	41	3.05	-	-	3.51	-	-	1.09	1.04
	42	3.05	-	-	3.23	-	-	1.09	1.04
	43	3.00	-	-	2.94	-	-	1.07	1.09
	44	3.23	-	-	3.30	-	-	1.15	1.11
	45	3.11	-	-	3.23	-	-	1.11	1.19
	46	3.21	-	-	3.30	-	-	1.15	1.23
	47	3.16	-	-	3.28	-	-	1.13	1.22
Average									
Weekday		**2.81**	**-**	**-**	**2.87**	**-**	**-**	**1.00**	**1.00**
Weekend		**2.79**	**-**	**-**	**2.82**	**-**	**-**	**0.99**	**1.00**
ADWF(1)		**2.80**	**-**	**-**	**2.86**	**-**	**-**	**1.00**	**1.00**
% Error									
Weekday					**2.2%**				
Weekend					**1.0%**				

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.7 Meter Goodwin Road LS

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.08	-	-	0.08	-	-	0.80	0.61
	1	0.06	-	-	0.06	-	-	0.61	0.49
	2	0.05	-	-	0.05	-	-	0.49	0.41
	3	0.04	-	-	0.04	-	-	0.41	0.38
	4	0.04	-	-	0.04	-	-	0.38	0.43
	5	0.04	-	-	0.04	-	-	0.43	0.66
	6	0.06	-	-	0.07	-	-	0.66	1.12
	7	0.11	-	-	0.11	-	-	1.12	1.37
	8	0.13	-	-	0.13	-	-	1.37	1.24
	9	0.12	-	-	0.12	-	-	1.24	1.15
	10	0.11	-	-	0.11	-	-	1.15	1.10
	11	0.10	-	-	0.11	-	-	1.10	1.03
	12	0.10	-	-	0.10	-	-	1.03	0.99
	13	0.09	-	-	0.10	-	-	0.99	0.96
	14	0.09	-	-	0.09	-	-	0.96	0.95
	15	0.09	-	-	0.09	-	-	0.95	0.95
	16	0.09	-	-	0.10	-	-	0.95	1.04
	17	0.10	-	-	0.10	-	-	1.04	1.17
	18	0.11	-	-	0.12	-	-	1.17	1.32
	19	0.13	-	-	0.13	-	-	1.32	1.42
	20	0.13	-	-	0.14	-	-	1.42	1.44
	21	0.14	-	-	0.14	-	-	1.44	1.38
	22	0.13	-	-	0.13	-	-	1.38	1.08
	23	0.10	-	-	0.10	-	-	1.08	0.78
Weekend	24	0.07	-	-	0.08	-	-	0.78	0.75
	25	0.07	-	-	0.07	-	-	0.75	0.48
	26	0.05	-	-	0.05	-	-	0.48	0.46
	27	0.04	-	-	0.04	-	-	0.46	0.33
	28	0.03	-	-	0.03	-	-	0.33	0.30
	29	0.03	-	-	0.03	-	-	0.30	0.35
	30	0.03	-	-	0.03	-	-	0.35	0.51
	31	0.05	-	-	0.05	-	-	0.51	1.02
	32	0.10	-	-	0.09	-	-	1.02	1.39
	33	0.13	-	-	0.13	-	-	1.39	1.51
	34	0.14	-	-	0.14	-	-	1.51	1.52
	35	0.14	-	-	0.14	-	-	1.52	1.49
	36	0.14	-	-	0.13	-	-	1.49	1.31
	37	0.12	-	-	0.12	-	-	1.31	1.37
	38	0.13	-	-	0.12	-	-	1.37	1.22
	39	0.12	-	-	0.11	-	-	1.22	1.28
	40	0.12	-	-	0.12	-	-	1.28	1.28
	41	0.12	-	-	0.12	-	-	1.28	1.20
	42	0.11	-	-	0.11	-	-	1.20	1.43
	43	0.14	-	-	0.13	-	-	1.43	1.45
	44	0.14	-	-	0.13	-	-	1.45	1.44
	45	0.14	-	-	0.13	-	-	1.44	1.33
	46	0.13	-	-	0.12	-	-	1.33	1.11
	47	0.10	-	-	0.10	-	-	1.11	0.80
Average									
Weekday		**0.093**	**-**	**-**	**0.096**	**-**	**-**	**0.98**	**1.00**
Weekend		**0.100**	**-**	**-**	**0.096**	**-**	**-**	**0.98**	**1.00**
ADWF(1)		**0.095**	**-**	**-**	**0.096**	**-**	**-**	**0.98**	**1.00**
% Error									
Weekday					**4.0%**				
Weekend					**-3.3%**				

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

Table E.8 Meter Leadbetter Road LS

Hour		Measured Data			Modeled Data			Diurnal	
		Flow	Level	Velocity	Flow	Level	Velocity	Initial	Calibrated
		(mgd)	(inches)	(ft/s)	(mgd)	(inches)	(ft/s)	Curve	Diurnal
Weekday	0	0.10	-	-	0.13	-	-	0.79	0.40
	1	0.07	-	-	0.09	-	-	0.57	0.19
	2	0.06	-	-	0.07	-	-	0.48	0.35
	3	0.05	-	-	0.06	-	-	0.36	0.08
	4	0.05	-	-	0.05	-	-	0.40	0.15
	5	0.04	-	-	0.06	-	-	0.32	0.48
	6	0.07	-	-	0.09	-	-	0.51	0.45
	7	0.12	-	-	0.13	-	-	0.92	0.91
	8	0.17	-	-	0.16	-	-	1.30	1.28
	9	0.17	-	-	0.18	-	-	1.30	1.28
	10	0.15	-	-	0.16	-	-	1.19	1.57
	11	0.14	-	-	0.16	-	-	1.06	1.47
	12	0.14	-	-	0.15	-	-	1.09	1.36
	13	0.13	-	-	0.14	-	-	1.00	1.25
	14	0.14	-	-	0.14	-	-	1.09	1.24
	15	0.13	-	-	0.14	-	-	0.98	1.11
	16	0.12	-	-	0.15	-	-	0.94	1.23
	17	0.14	-	-	0.15	-	-	1.09	1.12
	18	0.15	-	-	0.16	-	-	1.12	1.42
	19	0.18	-	-	0.19	-	-	1.35	1.32
	20	0.20	-	-	0.20	-	-	1.52	1.50
	21	0.19	-	-	0.20	-	-	1.44	1.46
	22	0.18	-	-	0.19	-	-	1.37	1.24
	23	0.14	-	-	0.17	-	-	1.11	1.18
Weekend	24	0.11	-	-	0.13	-	-	0.80	0.34
	25	0.07	-	-	0.10	-	-	0.49	0.22
	26	0.08	-	-	0.07	-	-	0.56	0.26
	27	0.05	-	-	0.06	-	-	0.31	0.18
	28	0.07	-	-	0.05	-	-	0.50	0.36
	29	0.03	-	-	0.04	-	-	0.19	0.73
	30	0.04	-	-	0.05	-	-	0.28	1.18
	31	0.09	-	-	0.07	-	-	0.64	1.40
	32	0.09	-	-	0.10	-	-	0.62	1.26
	33	0.16	-	-	0.15	-	-	1.13	1.13
	34	0.21	-	-	0.18	-	-	1.43	1.16
	35	0.19	-	-	0.19	-	-	1.35	1.07
	36	0.19	-	-	0.19	-	-	1.34	1.01
	37	0.19	-	-	0.18	-	-	1.30	1.05
	38	0.18	-	-	0.17	-	-	1.25	1.01
	39	0.16	-	-	0.17	-	-	1.14	1.01
	40	0.17	-	-	0.16	-	-	1.19	1.16
	41	0.16	-	-	0.17	-	-	1.14	1.19
	42	0.18	-	-	0.16	-	-	1.28	1.62
	43	0.18	-	-	0.17	-	-	1.25	1.54
	44	0.20	-	-	0.19	-	-	1.39	1.54
	45	0.20	-	-	0.19	-	-	1.36	1.47
	46	0.18	-	-	0.18	-	-	1.23	1.18
	47	0.16	-	-	0.17	-	-	1.11	0.93
Average									
Weekday		**0.126**	**-**	**-**	**0.139**	**-**	**-**	**0.97**	**1.00**
Weekend		**0.140**	**-**	**-**	**0.138**	**-**	**-**	**0.97**	**1.00**
ADWF(1)		**0.130**	**-**	**-**	**0.139**	**-**	**-**	**0.97**	**1.00**
% Error									
Weekday					**10.0%**				
Weekend					**-1.3%**				

Notes:
(1) ADWF = (5xWeekday Average + 2xWeekend Average)/7

ATTACHMENT F

WET WEATHER CALIBRATION RESULTS

WET WEATHER CALIBRATION RESULTS

Table F.1 Wet Weather Flow Calibration

Meter Number	Pipe Diameter (inches)	Storm 1 (03/12/2025-03/18/2025)			Storm 2 (03/20/2025-04/01/2025)			Storm 3 (04/05/2025-04/09/2025)		
		Percent Error[3]			Percent Error[3]			Percent Error[3]		
		Total Volume Flow (%)	Peak Flow (%)	Max Level Difference (inches)	Total Volume Flow (%)	Peak Flow (%)	Max Level Difference (inches)	Total Volume Flow (%)	Peak Flow (%)	Max Level Difference (inches)
4-1-3	12	8.0%	13.0%	2.5	6.1%	12.0%	2.5	28.2%	81.1%	3.7
5-1-2	20	-4.2%	-4.6%	2.4	6.0%	12.8%	4.0	33.7%	74.8%	6.1
5-2-1	18	-18.9%	-49.3%	-0.3	-9.4%	-11.7%	1.3	1.9%	3.1%	1.1
8-1-2	12	6.5%	-1.8%	0.2	6.8%	3.3%	0.1	11.5%	13.4%	0.1
WWTP/STEP[4][5]	-	5.2%	0.8%		19.6%	13.0%		39.8%	53.5%	
Leadbetter Rd[4]	18	-8.2%	-28.3%		4.1%	-10.1%		6.2%	-4.6%	
Goodwin Rd[4]	18	-6.4%	-9.1%		3.2%	20.8%		7.1%	38.3%	

Notes:
(1) Source: City of Camas Flow Monitoring Report 2025 dated May 28, 2025 by ADS
(2) Average flows are computed from hydraulic modeling results. Maximum flow values are hourly peaks
(3) Percent Difference = (Modeled – Measured)/Measured*100.
(4) Flow meter information was provided by the City
(5) No upstream pipe ID information was available for the STEP basin. Flow for this area was therefore estimated using GIS-derived upstream drainage data and a mass balance approach to represent inflows to the WWTF.

Location: 1724 NE Franklin
Site Name: CAM_100290
Pipeline diameter: 18"
City Manhole ID: MH100290

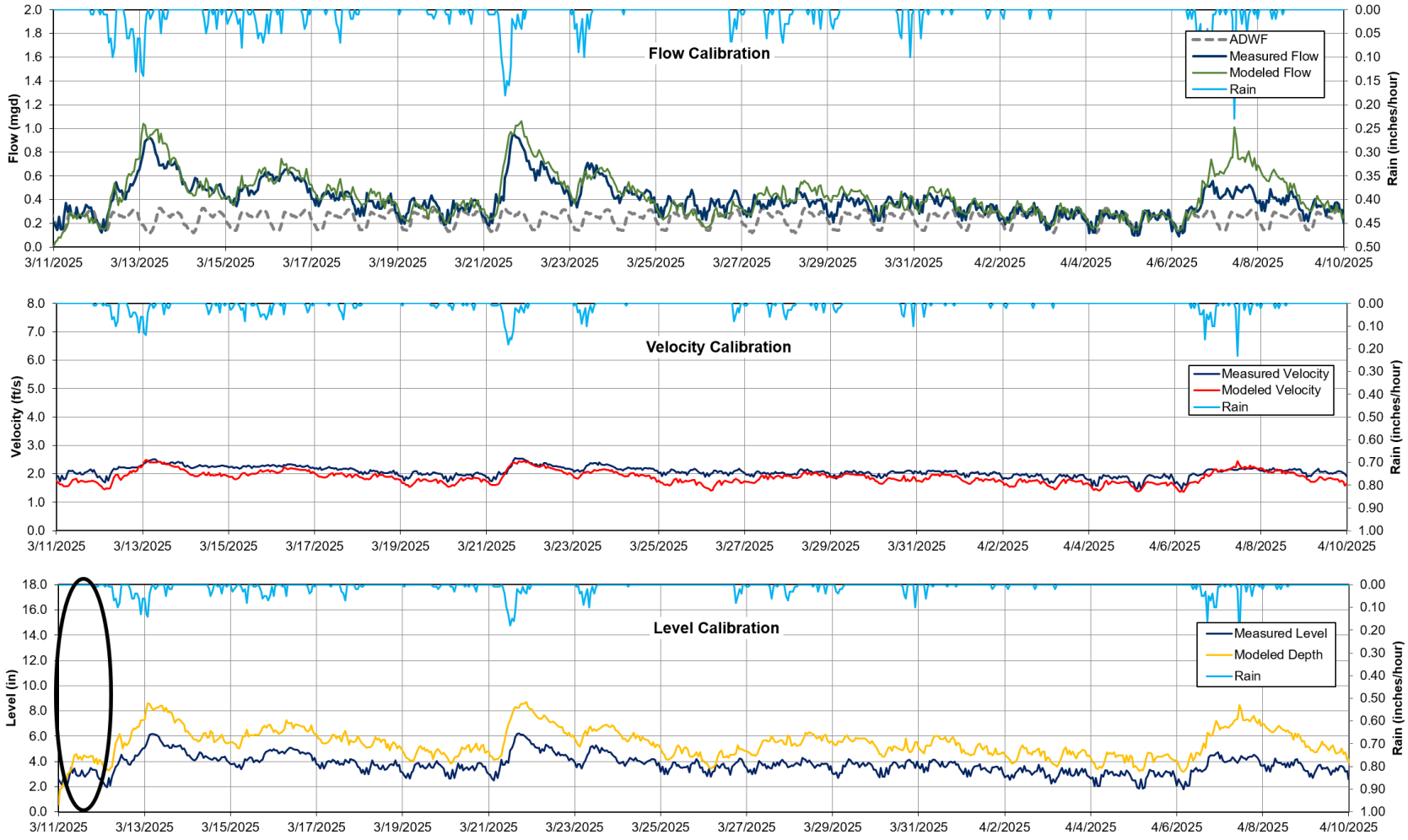


Figure F.1 Flow Monitoring Meter 4-1-3 Wet Weather Flow Calibration

Location: SE Cedar St and SE 3rd Ave
Site Name: CAM_51123
Pipeline diameter: 20"
City Manhole ID: MH100271

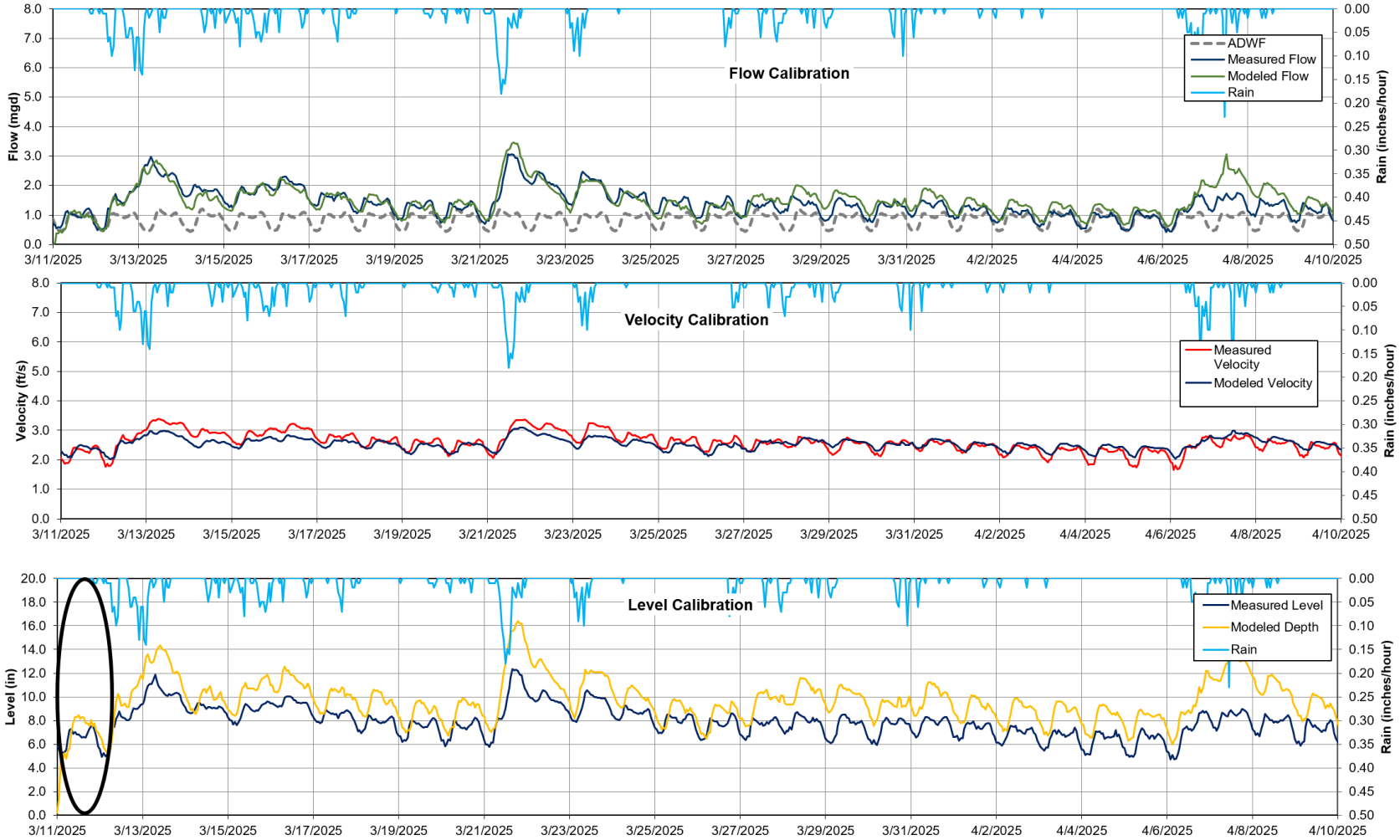


Figure F.2 Flow Monitoring Meter 5-1-2 Wet Weather Flow Calibration

Location: SE Dallas St and SE 3rd Av
Site Name: CAM_52167
Pipeline diameter: 18"
City Manhole ID: MH100270

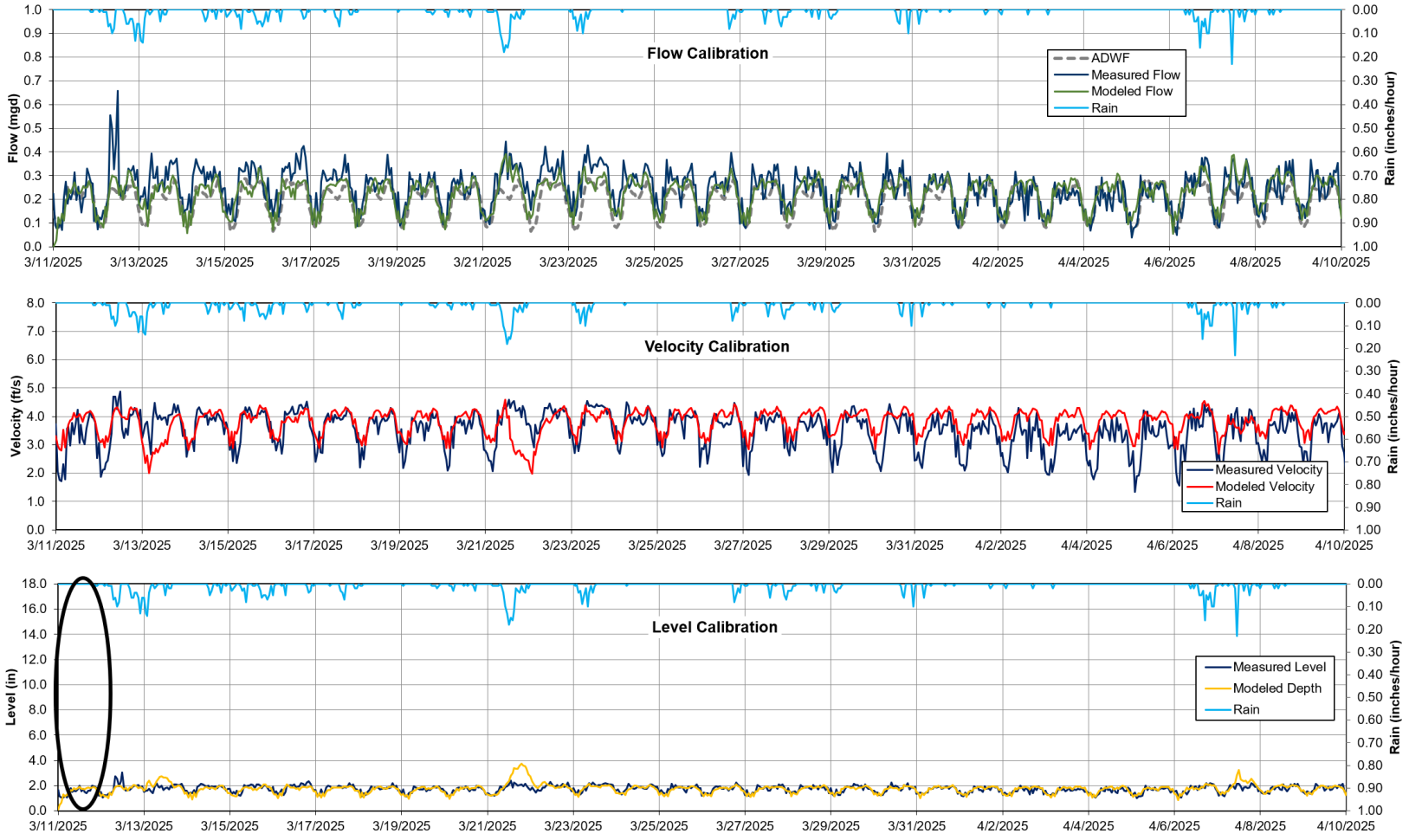


Figure F.3 Flow Monitoring Meter 5-2-1 Wet Weather Flow Calibration

Location: 820 SE Polk St
Site Name: CAM_81189
Pipeline diameter: 12"
City Manhole ID: MH100081

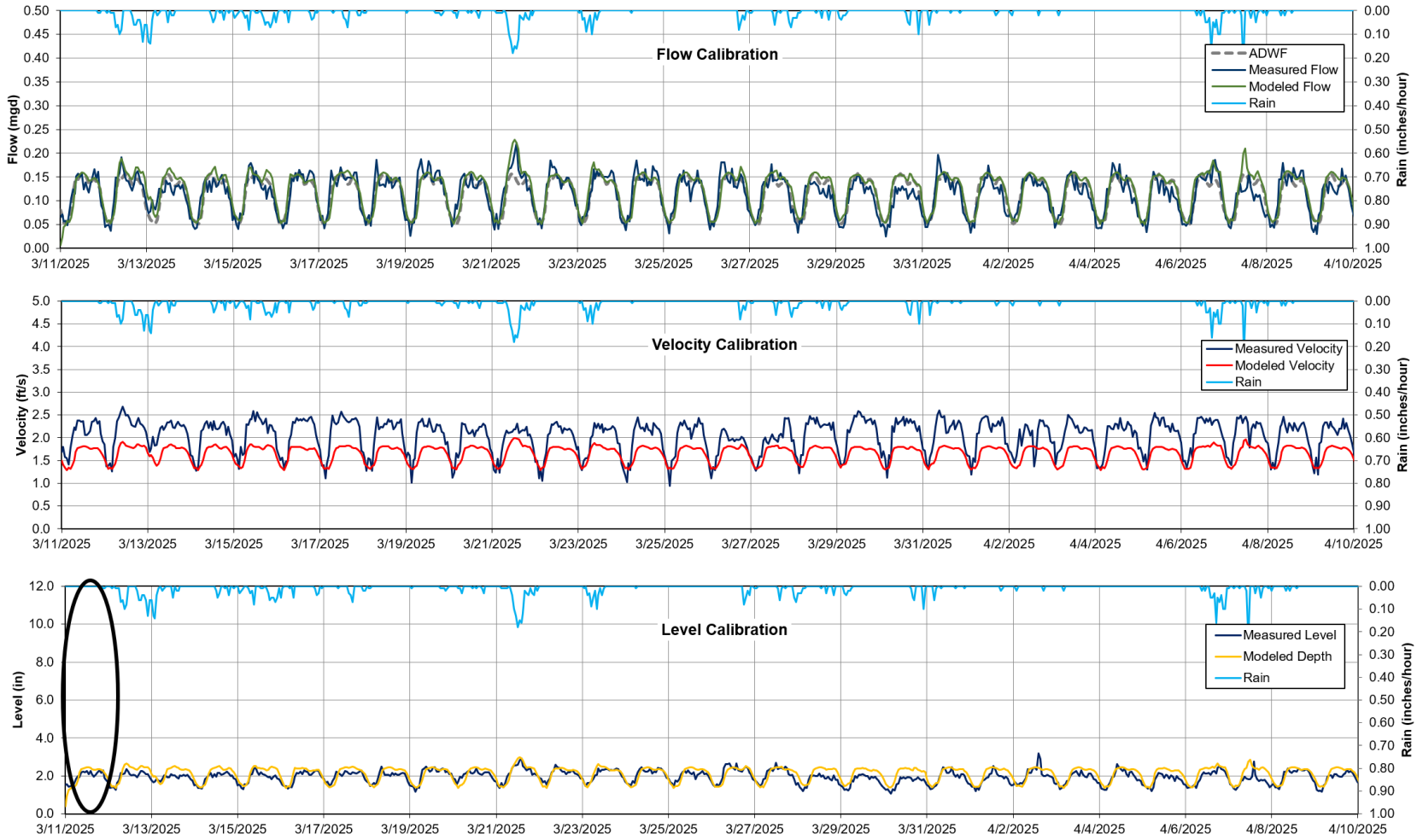


Figure F.4 Flow Monitoring Meter 8-1-2 Wet Weather Flow Calibration

Location: WWTF	
Site Name: -	
Pipeline diameter: "	
City Manhole ID: -	

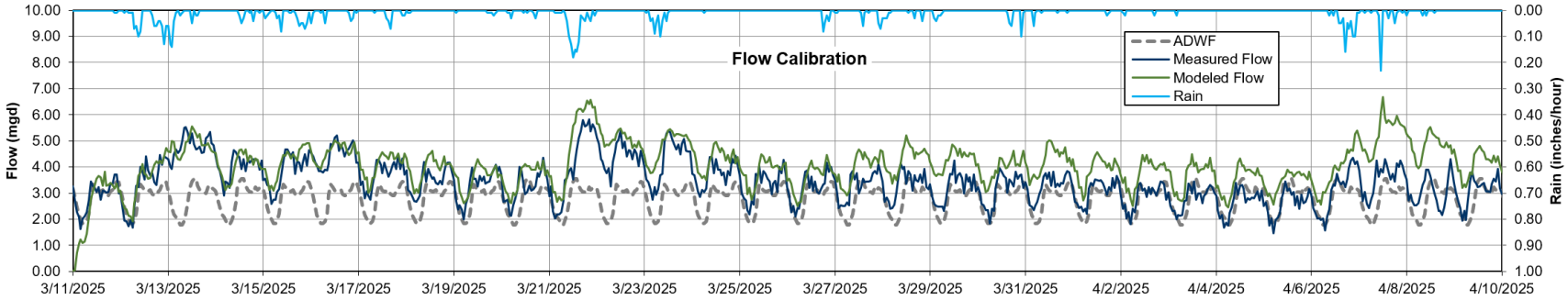


Figure F.5 Flow Monitoring Meter WWTF/STEP Wet Weather Flow Calibration

Location: Leadbetter Rd LS		
Site Name: -		
Pipeline diameter: 18"		
City Manhole ID: -		

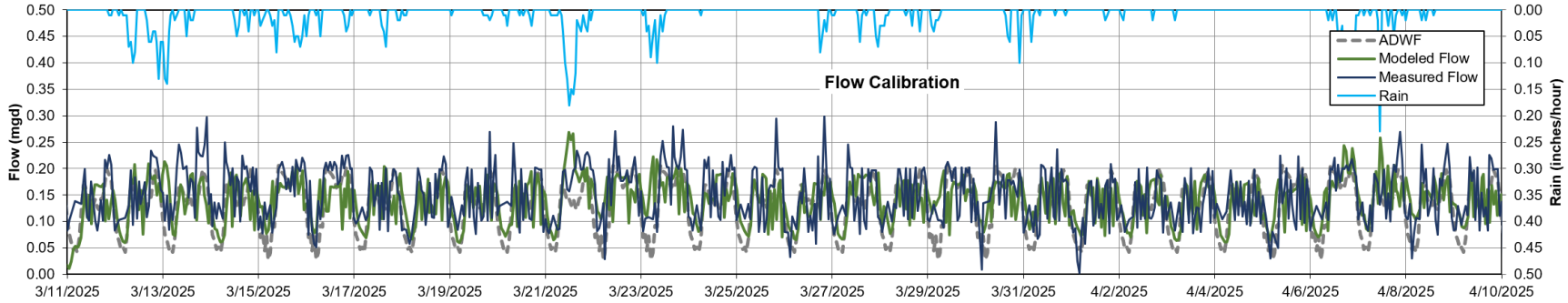


Figure F.6 Flow Monitoring Meter Leadbetter Rd LS Wet Weather Flow Calibration

Location: Goodwin Rd LS	
Site Name: -	
Pipeline diameter: 18"	
City Manhole ID: -	

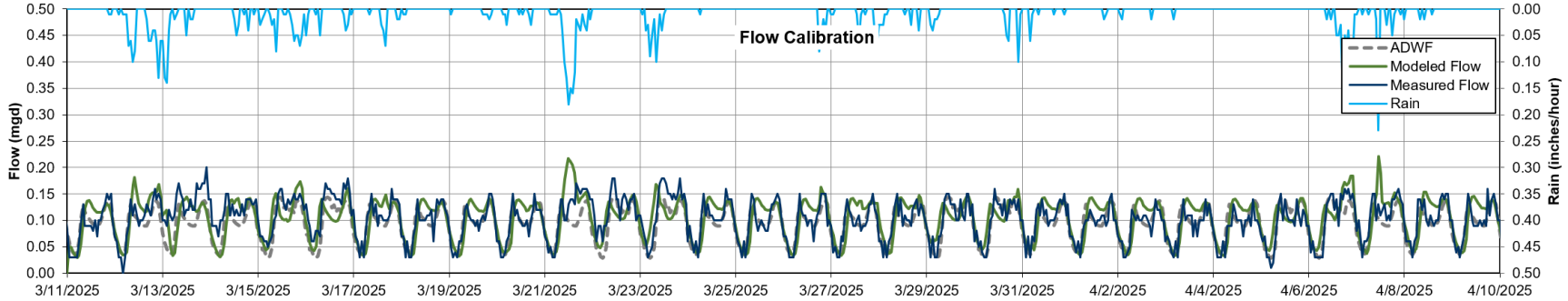


Figure F.7 Flow Monitoring Meter Goodwin Rd LS Wet Weather Flow Calibration

APPENDIX F

I/I PROGRAM REPORTS

City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 15, 2019

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2018 – April 2019 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements and to provide documentation of the City of Camas' ongoing inflow reduction effort, as detailed in Gray & Osborne's June 2016 Infiltration and Inflow Study (indicated hereafter as the "2016 I/I Study").

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

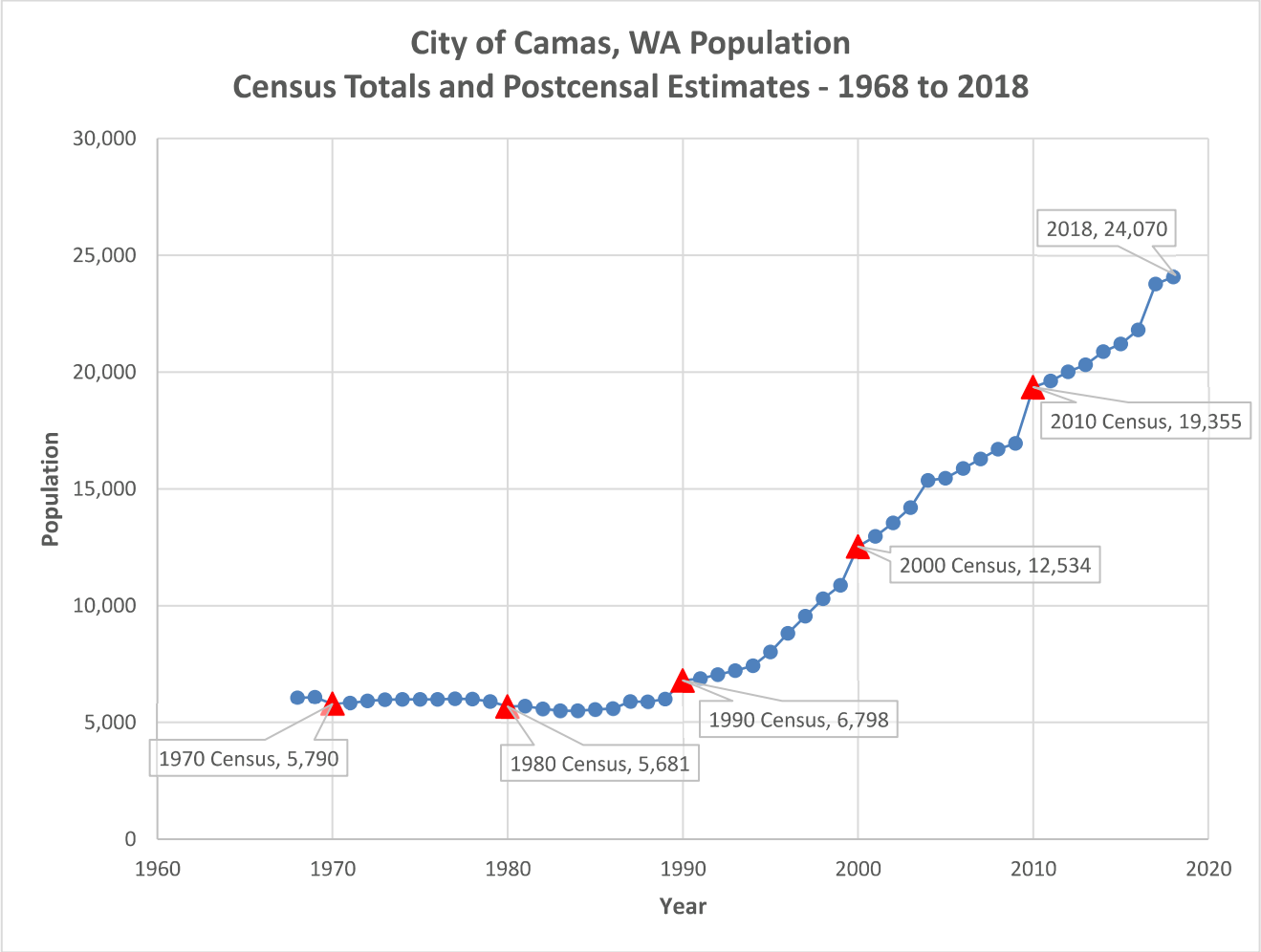
For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

From analysis of the historical data, May 2011-April 2012 continues to best represent an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report. For the twenty-year period of May 1, 1999 to April 30, 2019, the average 12-month rainfall in Camas was 45.18 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, which is approximately the 50th percentile of all twenty 12-month totals and only 2.42 inches more than the twenty-year average.

TABLE 1 - 12-Month May Through April Rainfall Totals, 1999-2018

	Average	Minimum	50th Percentile	Maximum
Annual Total Rainfall (in.)	45.18	31.44 (May 2018 – April 2019)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(http://www.ofm.wa.gov/pop/april1/hseries/default.asp)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 1999 to April 2019:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
1999	1.047	17%	-30%	37.30
2000	1.587	26%	+52%	31.46
2001	1.260	21%	-21%	42.63
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
Average	**1.399**	**23%**	**18%**	**45.18**

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According the City of Camas' General Sewer/Wastewater Facility Plan, last updated in November 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 133,000 linear feet of sewer line has been added, giving Camas approximately 595,000 linear feet (113 miles) of sewer line, as of the end of 2018.

In 2018, the nearly twelve miles of new sanitary sewer line and three, new sanitary lift stations were added to the City of Camas sanitary collection system. The three new lift stations and the majority of the new sewer line were related to the City's North Shore Sewer Transmission System (NSSTS) project. The NSSTS project provided HDPE gravity sewer mains to support current and future development in the City's northern urban growth boundary, located East of Lacamas Lake.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 27 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

Summary of I/I Reduction Projects

Please see Attachment D for a copy of "Table 7-6, Project Schedule" from the 2016 I/I Study. This table is the full list of I/I reduction projects that were proposed by the study, scheduled by year. Projects that are underway or have been competed are highlighted as indicated. Project completion date(s) are noted.

Mill Ditch Sewer Main Replacement

In the previous reporting period, the City completed the "Mill Ditch Sewer Main Replacement" project, which took place between the intersections of NE 1th & Adams St. to the intersection of NE 1th Ave. and Everett St., along the Georgia-Pacific Mill Ditch. The project replaced approximately 900 linear feet of deteriorated 15" concrete sewer pipe and 5 manhole structures. The 15" concrete main was replaced with 21" HDPE pipe.

The following is a summary of the work:

Project Name: Mill Ditch Sewer Main Replacement
Collection System Basin: 3s
Project Started: 10/16/2017
Project Competed: 04/16/2018
Total Funds Expended: $417,105.25
Total Sewer Line Replaced: 900
Total Manholes Replaced: 5

Due to the timing of the project's completion and the unseasonably dry spring our area experienced last year, flow monitoring to document I/I removal could not be conducted until after last year's I/I report was submitted. Therefore, we are providing those results and the I/I removal evaluation now.

Table 3 below summarizes the Basin 3s flows measured at Manhole 5-8-1, prior to and after the Mill Ditch sewer replacement project. Calculations for flows prior to the project were documented in our 2016 I/I Study, and were based on flow measurements from February 5, 2016 to February 23, 2016. Calculations for flows after the project are based on data collected by a flow meter placed in manhole 5-8-1 from March 19, 2019 to June 4, 2019.

As established in the 2016 I/I Study, inflow calculations assume a Winter Dry Weather Flow of 0.21521 MGD for combined Basins 3n, 3s and 4 measured at manhole 5-8-1, and 2.20 MGD for the entire city. Also, only measurements on peak influent flow days for the WWTP (those exceeding 3.6 MGD) were considered for inflow calculations. Table 4 summarizes the WWTP influent flow and rainfall for the two measurement periods.

TABLE 3 – Estimated Inflow Rates Before and After the Mill Ditch Sewer Replacement Work

Manhole	Basin Measured	Flow Meter Installed	Flow Meter Removed	Parameter	Daily Flows (MGD)		
					Min.	Ave.	Max.
MH 5-8-1 Before Project	3n, 3s, 4	2/5/2016	2/23/2016	Flow (MGD)	0.352	0.909	1.969
				Inflow (MGD)	0.680	1.114	1.617
				% of Total Camas Inflow	43.7%	**67.2%**	100%
MH 5-8-1 After Project	3n, 3s, 4	3/19/2019	6/4/2019	Flow (MGD)	0.460	0.795	2.496
				Inflow (MGD)	0.245	0.580	2.280
				% of Total Camas Inflow	79.2%	**85.1%**	91.6%

TABLE 4 – WWTP Influent Flow and Rainfall During Flow Measurement at Manhole 5-8-1

	Measurement Period	Daily Average WWTP Influent Flow (MGD)	Highest Daily WWTP Influent Flow (MGD)	Total Rainfall (in.)	Average Daily Rainfall (in.)
Before Project	2/5/16 – 2/23/16	3.370	4.882	3.74	0.197
After Project	3/19/19 - 6/4/19	2.277	5.008	6.38	0.082

Based upon the above inflow calculations, it appears that the I/I contribution from basins, 3n, 3s and 4 has actually increased since the Mill Ditch Sewer Replacement Project.

During flow monitoring in 2016, prior to the Mill Ditch project, Basins 3n, 3s and 4 contributed an average of 67.2% of the city's total inflow. Though the City's overall, calculated I/I has decreased since 2016, this year's flow monitoring conducted at manhole 5-8-1 indicates that the inflow contribution from basins 3n, 3s and 4 has increased to 85.1%. Therefore, the repairs to the Mill Ditch Sewer line do not appear to have resulted in a measurable reduction in the total I/I from sewer basins 3n, 3s and 4.

Though the reason for the increase is not immediately apparent, it seems it may be related to the size of the rain events captured in each monitoring period. We hope that this result will be clarified during our upcoming follow-up to the 2016 I/I Study, which will be submitted to Ecology in 2020.

View Ridge Court Sewer Replacement

On June 18, 2019, the City of Camas awarded a project to replace approximately 800 linear feet of existing 8" diameter concrete sewer pipe with new 8" PVC and 10" HDPE sewer pipe, between NW View Ridge Court and NW View Ridge Street. The work is also to include the replacement of four existing manholes and the replacement of all affected sewer laterals.

The following is a summary of the work:

Project Name: View Ridge Court Sewer Replacement
Collection System Basin: 10
Scheduled Project Start Date: 8/5/2019
Estimated Project Completion Date: 10/7/2019
Project Bid Amount: $369,709.04
Total Sewer Line to be Replaced (feet): 800
Total Manholes to be Replaced: 4

Though it was not mentioned in the 2016 I/I Study, this section of sewer pipe has since been identified as being badly deteriorated and is likely a major contributor of I&I into the City's sewer Basin 10. In the 2016 study, our South Prune Hill and West Camas pump stations were both identified as exceeding the 3.4:1 peaking factor criterion. Both of these pump stations are downstream of the sewer segment being repaired.

Flow monitoring of the View Ridge Court Sewer repair project will be conducted before and after the piping replacement occurs, and the results of which will be included in the 2019 I/I report that will be submitted in July of 2020.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact me at (360) 834-3263 or via email at bbusch@cityofcamas.us.

Best Regards

Bob Busch
Wastewater Operations Supervisor

Cc: Sam Adams
Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 1999 to APRIL 30, 2019

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	AVG
May	1.694	1.490	1.413	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	**2.087**
June	1.678	1.410	1.423	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	**2.020**
July	1.619	1.471	1.358	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	**1.889**
August	1.618	1.364	1.334	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	**1.924**
September	1.598	1.449	1.336	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	**1.961**
October	1.588	1.930	1.486	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	**2.138**
November	2.396	2.951	2.014	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	**2.600**
December	2.008	1.972	2.594	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	**2.772**
January	2.273	1.653	2.399	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	**2.857**
February	2.162	1.673	2.128	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	**2.557**
March	1.831	1.751	2.199	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	**2.654**
April	1.349	1.689	1.770	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	**2.272**
AVG	**1.818**	**1.734**	**1.788**	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.311**
MAX	**2.396**	**2.951**	**2.594**	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.229**
MIN	**1.349**	**1.364**	**1.334**	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.830**
Annual I/I	**1.047**	**1.587**	**1.260**	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.399**
% of MMAD Flow	17%	26%	21%	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	23%
% +/- vs Prior Year	11%	52%	-21%	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 1999 to APRIL 30, 2019

Month	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	AVG
May	2.61	3.65	1.58	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	**2.88**
June	3.09	1.27	2.97	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	**2.21**
July	1.05	0.06	0.66	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	**0.45**
August	1.24	0.17	1.23	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	**0.71**
September	0.12	3.71	0.80	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	**1.92**
October	2.66	4.12	2.40	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	**4.55**
November	6.96	3.51	7.51	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	**6.64**
December	4.77	3.34	6.34	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	**6.92**
January	6.99	2.27	6.94	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	**5.73**
February	4.15	1.60	3.65	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	**4.14**
March	0.88	4.73	4.93	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	**5.17**
April	2.78	3.03	3.62	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	**3.87**
TOTAL	**37.30**	**31.46**	**42.63**	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**45.18**
AVG	**3.11**	**2.62**	**3.55**	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**3.76**
MAX	**6.99**	**4.73**	**7.51**	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**9.01**
MIN	**0.12**	**0.06**	**0.66**	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.20**

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	**45.18**	
20-Year Maximum Annual Rainfal (in.):	**73.36**	(2010)
20-Year Minimum Annual Rainfall (in.):	**31.44**	(2018)

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2016 to April 2019

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

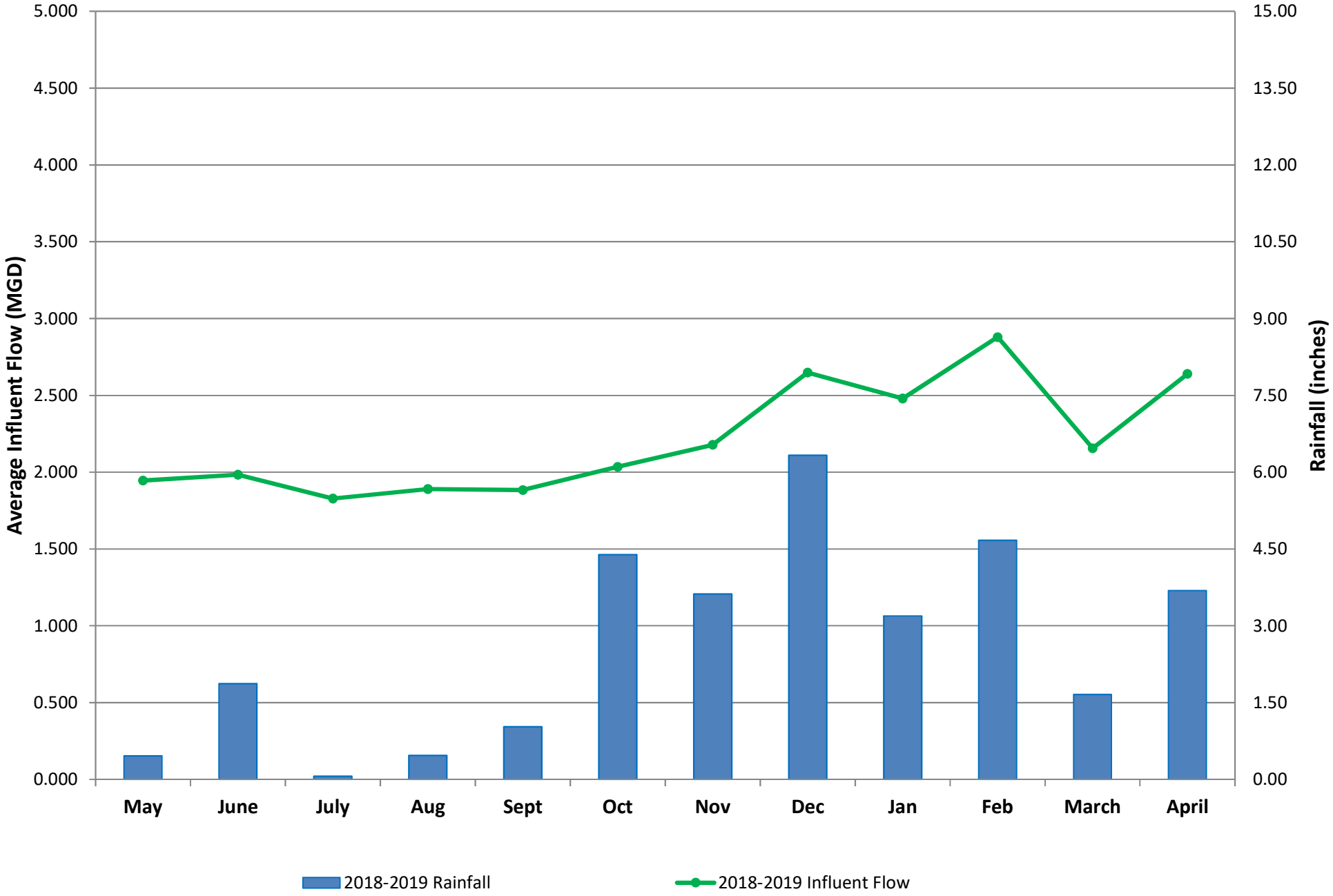
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**
May	2.259	2.263	1.946	2.10	3.13	0.46	21,810	23,080	23,770	3,609	0	1,871
June	2.244	2.019	1.983	2.06	1.74	1.87	21,810	23,080	23,770	5,307	0	45,563
July	2.135	1.831	1.828	1.17	0.00	0.06	21,810	23,080	23,770	2,576	11,060	1,311
Aug	2.112	1.881	1.890	0.15	0.27	0.47	21,810	23,080	23,770	0	0	0
Sept	2.169	1.985	1.884	1.76	2.66	1.03	21,810	23,080	23,770	837	0	2,395
Oct	3.185	2.262	2.035	**10.43**	5.13	4.39	21,810	23,080	23,770	0	0	0
Nov	3.312	2.764	2.178	6.39	**7.21**	3.62	21,810	23,080	23,770	0	0	8,728
Dec	3.191	2.465	2.648	4.24	3.21	**6.33**	21,810	23,080	23,770	622	0	1,679
Jan	2.988	**2.852**	2.480	3.64	6.15	3.19	22,085	23,770	24,070	0	0	0
Feb	**4.031**	2.405	**2.880**	9.68	3.05	4.67	22,085	23,770	24,070	819	0	0
March	3.442	2.552	2.156	9.85	3.49	1.66	22,085	23,770	24,070	0	4,663	0
April	2.643	2.710	2.639	5.59	4.70	3.69	22,085	23,770	24,070	0	0	0
Period Total:	33.710	27.989	26.546	57.06	40.74	31.44				**Total Added (feet):**	13,770	15,723	61,547
Low Month:	2.112	1.831	1.828	0.15	0.00	0.06				**Total Added (miles):**	2.61	2.98	11.66
High Month:	**4.031**	**2.852**	**2.880**	**10.43**	**7.21**	**6.33**							
Annual Average:	2.809	2.332	2.212	4.76	3.40	2.62							
Period I/I:	1.920	1.021	1.052										

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2016-2017	1.920	27%	131%	31%	48.17
2017-2018	1.021	-32%	-47%	17%	57.06
2018-2019	1.052	-30%	3%	17%	40.74

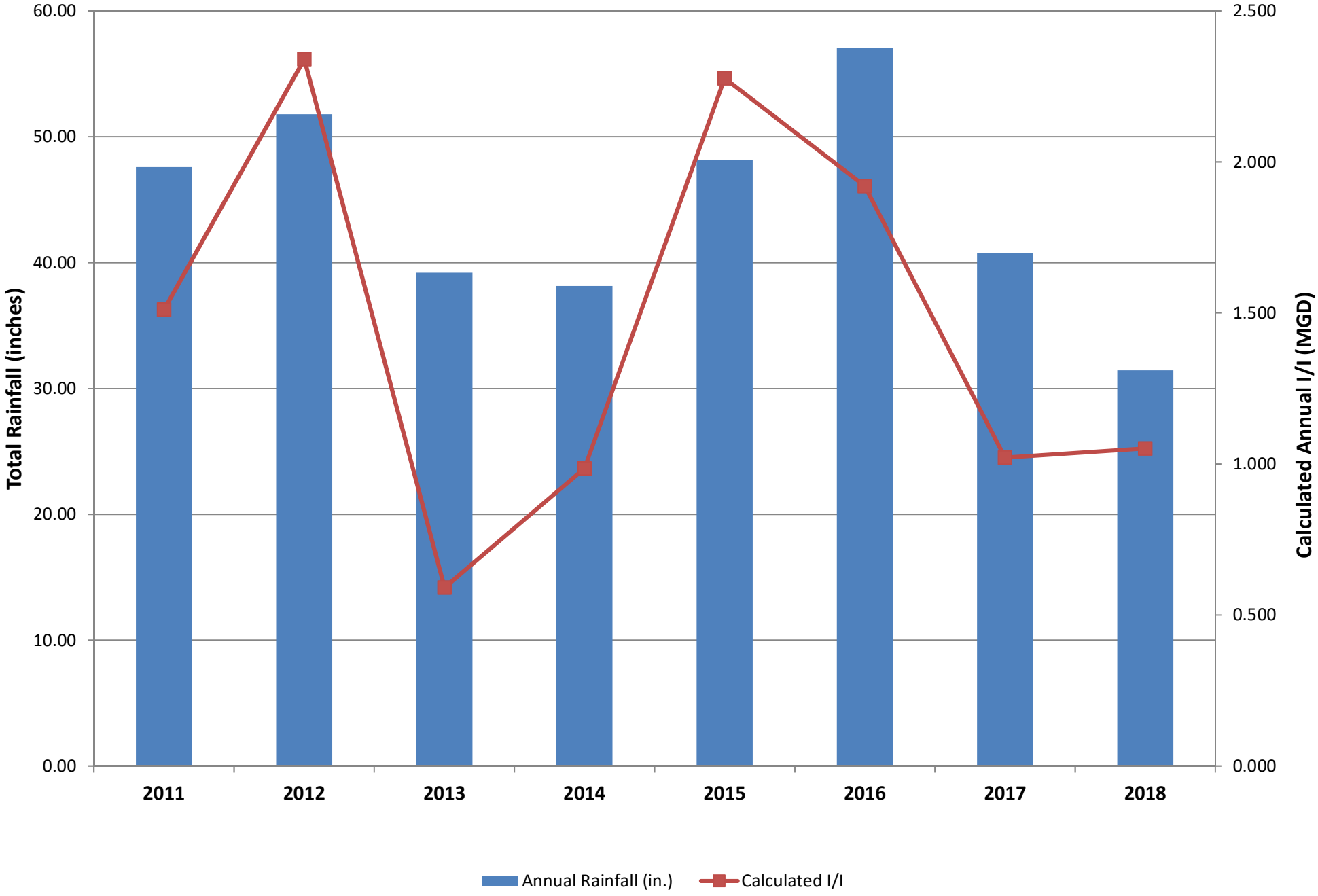
ATTACHMENT C, CHART I

May 2018 - April 2019 Monthly Average Influent Flow and Monthly Total Rainfall



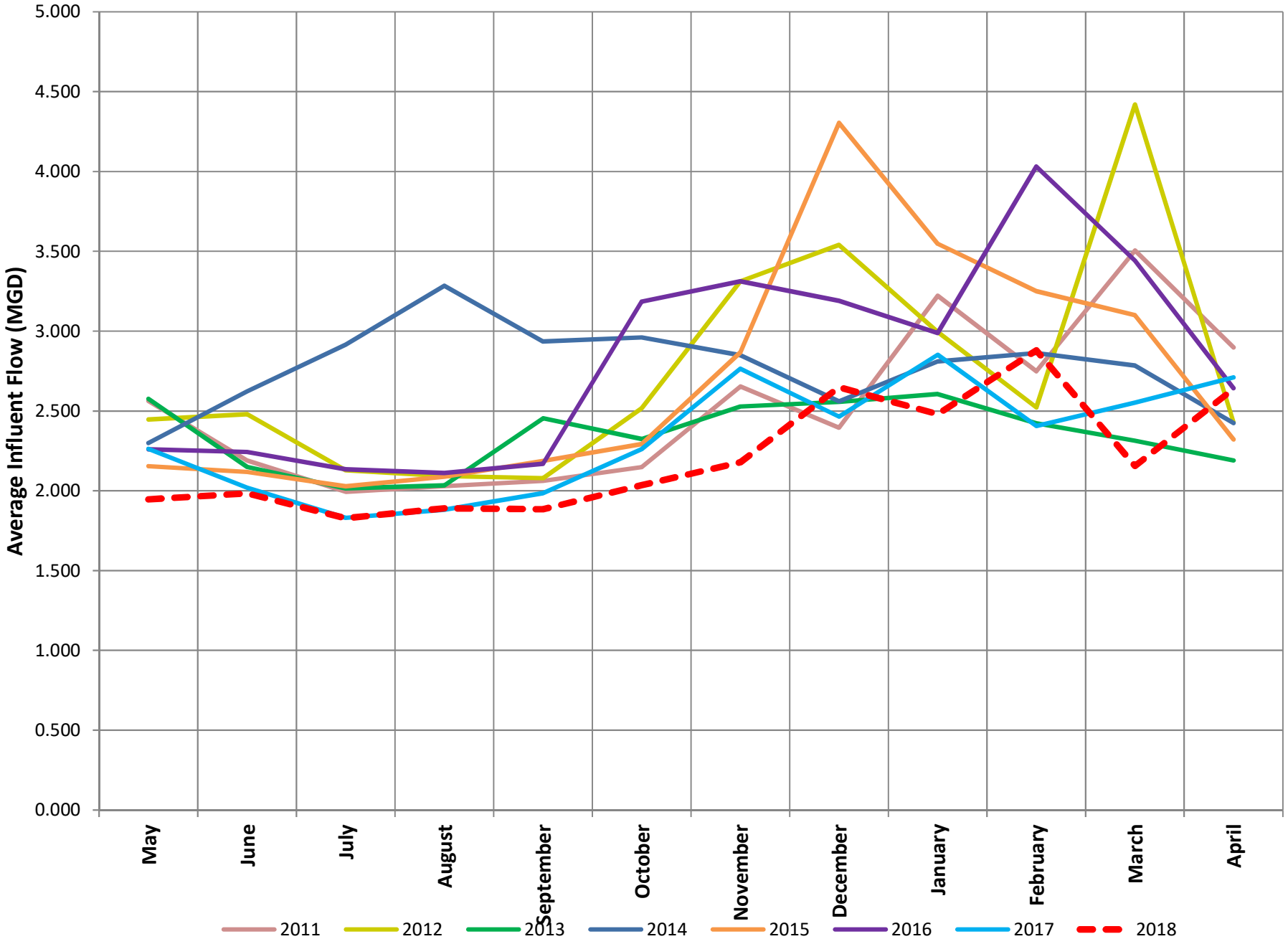
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



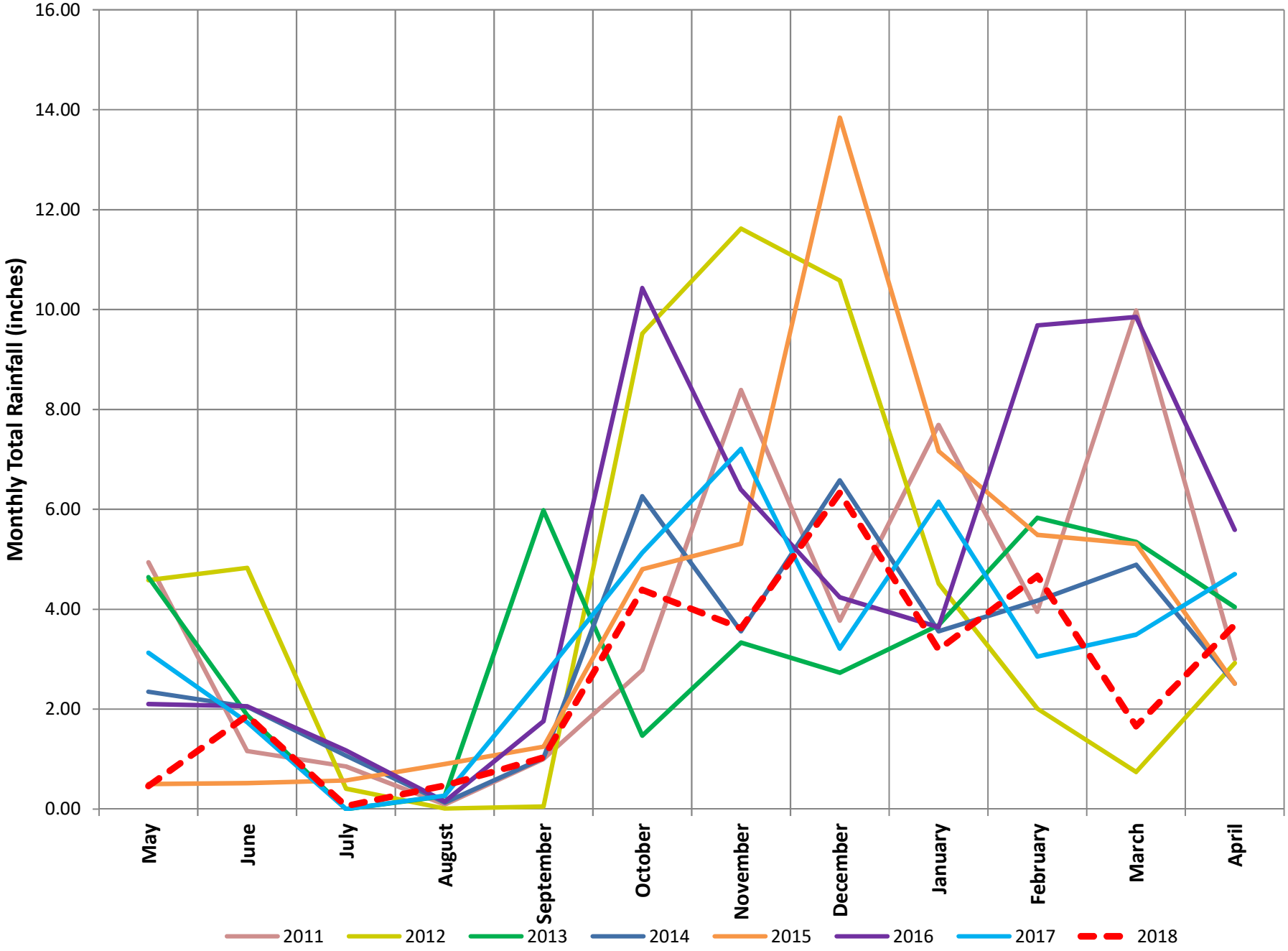
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



ATTACHMENT D - Project Schedule from June 2016 I/I Study

TABLE 7-6

Project Schedule[1]

COMPLETED	Year	Basin(s)	Location	Description	Cost
10/2016	2016	4	NE Franklin Street	Replace sewer line between MH 4-1-1 and MH 4-1-4	$250,000
03/2014	2016	3n	Basin 3n	Clean and Video All Sewer Lines in Basin 3n, begin Basin 3s (Note: Crown View Lift Station subbasin, 13,500 feet, was video inspected for the I/I study in the Spring, the remainder of Basin 3n will be cleaned/videoed in the fall of 2016)	$50,000
02/2018	2016	3s	Mill Ditch	Replaced section of sewer line between Dallas Street and Birch Street	$78,000
	2016	**Total Inflow Removal Projects (does not include cleaning and video inspection work)**			**$328,000**
02/2018	2017	3s	Mill Ditch	Rehabilitate or replace 15-inch CONC from MH 3-2-6 to 3-1-1 (1,370 ft).	$180,000
	2017	4	NE 23rd Avenue	Replace existing sewerline between Everett and Birch	$110,000
	2017	1, 2, 3n	Various (see Table 7-2)	Repair cleanouts /or replace missing/broken caps as needed at 13 locations.	$13,500
	2017	3n, 3s, 4, 5, 6	Various (see Table 7-2)	Disconnect Roof Drains at five residences.	$2,500
	2017	4, 5, 6, 10	Various (see Table 7-3)	Disconnect Stormwater Catch Basins from Sanitary Sewer at five locations.	$74,000
03/2014	2017	4, 3s	Basins 4 and 3s	Clean and Video Remaining Sewer Lines in Basin 3s and All Lines in Basin 4, begin video inspection of Basin 5.	$50,000
	2017	**Total Inflow Removal Projects (does not include cleaning and video inspection work)**			**$380,000**
	2018	4	Everett and 19th Avenue	Replace 1,140 feet of existing sewer line and manholes	$240,000
	2018	5	SE Adams Street	Slipline 18-inch CONC from MH 3-1-1 to 5-8-1 (446 ft).	$60,000
	2018	5	Various (see Table 7-3)	Replace three manholes (MHs 5-1-13, 5-1-15, 5-7-3).	$75,000
	2018	4, 5, 7	Various (see Table 7-3)	Modify below grade manhole lids (MHs 4-1-1, 4-1-12, 5-7-3, 7-3A-1).	$16,000
	2018	3s, 3n, 5	Various (see Table 7-4)	Seal leaks around pipes and regrout joints (MH 3-1-6, 3-6-4, 3-22-9, 3-1-44, 3-22-8, 3-221-3, 3-22B-2, 3-22C-2, 5-6-1).	$24,000
	2018	2	NW Drake Street	Fix sag in 8-inch HDPE between MH 2-3-5 and 2-3-3.	$20,000
	2018	3n	NW Kent Street	Repair broken 8-inch CONC pipe between MH3-21A-1 and 3-21-4.	$15,000
	2018	3s	NE Adams Street	Repair cracks, debris, holes in the 8-inch CONC pipe and laterals between MH 3-3-2 and 3-3-1.	$15,000
	2018	3s	NE Adams Street	Repair separated and offset joints, and broken pipe and check for return of roots in the 8-inch CONC pipe between MH 3-3-1 and 3-1-1.	$15,000

TABLE 7-6 – (continued)

Project Schedule[(1)]

Year	Basin(s)	Location	Description	Cost
2018	5	NE 5th Avenue	Repair cracks and separated and offset joints in the 8-inch VCP pipe between MH 5-7-3 and 5-7-2.	$20,000
2018	5, 6	Basins 5 and 6	Video and Clean Remainder of Basin 5, video inspection all of Basin 6 and begin video inspection of Basin 7.	$50,000
2018	**Total Inflow Removal Projects (completes all High Priority projects does not include I/I Report or Video Work)**			**$500,000**
2019	5	NE 6th Avenue	Repair cracks and offset joints in the 8-inch VCP pipe between MH 5-1-15 and 5-1-14	$20,000
2019	5	NE 6th Avenue	Repair broken lateral in the 8-inch VCP pipe between MH 5-1-13 and 5-1-12.	$15,000
2019	5	NE 6th Avenue	Repair broken pipe and voids in the 8-inch PVC pipe between MH 5-1-20 and 5-1-19. (265')	$15,000
2019	8	SE Russell Street	Fix lateral connection problems, and check for grease sags in 8-inch CONC pipe between MH 8-4-1 and 8-1-4.	$20,000
2019	10	NW 6th Avenue	Repair void and collapsed section of pipe in the 10-inch CONC pipe between MH 10-1-3 and 10-1-2.	$30,000
2019	10	NW 11th Avenue	Repair broken 8-inch CONC pipe between MH 10-1-31 and 10-1-30.	$15,000
2019	10	NW McIntosh Road	Slip line the 8-inch CONC pipe between MH 10-1-27 and 10-1-26.	$15,000
2019	N/A	N/A	I/I Report	$100,000
2019	7, 8, 9	Basins 7, 8, 9	Clean and Video Remainder of Basin 7 and All of Basins 8, 9 and 10.	$50,000
2019	**Total Inflow Removal Projects (completes all Medium High Priority projects does not include I/I Report or Video Work)**			**$130,000**
2020	3n	NW 29th Avenue	Repair broken 8-inch CONC pipe between MH 3-20B-1 and 3-20-6.	$15,000
2020	3n	NW 29th Circle	Repair cracked 8-inch CONC pipe between MH 3-1-60 and 3-1-59.	$15,000
2020	3n	NW 30th Avenue	Repair broken 8-inch CONC pipe between MH 3-21-7 and 3-21-4.	$15,000
2020	3n	NW 30th Avenue	Repair broken 8-inch CONC pipe between MH 3-21-4 and 3-21-3.	$15,000
2020	3n	NW 32nd Avenue	Repair separated and offset joints in the 8-inch CONC pipe between MH 3-1-43 and 3-1-42.	$15,000
2020	3n	NW 32nd Avenue	Repair cracked 8-inch CONC pipe between MH 3-1-41 and 3-1-39.	$15,000
2020	3n	NW Logan Street	Repair broken pipe in the 8-inch CONC pipe between MH 3-21-5 and 3-21-4.	$15,000

TABLE 7-6 – (continued)

Project Schedule[(1)]

Year	Basin(s)	Location	Description	Cost
2020	3n	NW Norwood Circle	Repair cracks in the 8-inch CONC pipe between CO – Norwood Cir A and CO – Norwood Cir B. (508')	$15,000
2020	3n	NW Sierra Drive	Repair cracks in the 8-inch CONC pipe between MH 3-22-7 and 3-22-6.	$15,000
2020	3n	NW Quartz Place	Repair cracks in the 8-inch CONC pipe between MH 3-22A-1 and 3-22-6.	$15,000
2020	**Total Inflow Removal Projects**			**$150,000**
2021	3n	NW Quartz Place	Remove roots in the 8-inch PVC pipe between MH 3-22-6 and 3-22-4 and repair pipe as needed.	$15,000
2021	3n	NW Norwood Circle	Repair cracks in the 8-inch CONC pipe between CO – Norwood Cir A and CO – Norwood Cir B.	$15,000
2021	3n	NW Sierra Drive	Repair cracks in the 8-inch CONC pipe between MH 3-22-7 and 3-22-6.	$15,000
2021	3n	NW Quartz Place	Repair cracks in the 8-inch CONC pipe between MH 3-22A-1 and 3-22-6.	$15,000
2021	3n	NW Quartz Place	Remove roots in the 8-inch PVC pipe between MH 3-22-6 and 3-22-4 and repair pipe as needed.	$15,000
2021	3s	NW 15th Avenue	Repair broken pipe, cracks and check for regrown roots in 8-inch CONC pipe between MH 3-4-8 and MH 3-4-7.	$15,000
2021	3s	NW 15th Avenue	Repair cracks and check for regrown roots in 8-inch CONC pipe between MH 3-4-7 and MH 3-4-6.	$15,000
2021	3s	NW 16th Avenue	Fix sag in 8-inch HDPE pipe between MH 3-6-2 and 3-6-1.	$20,000
2021	**Total Inflow Removal Projects**			**$135,000**
2022	3s	NW Ash Street	Fix sags in the 8-inch CONC pipe between MH 3-4A-4 and 3-4A-2.	$20,000
2022	3s	NW Ash Street	Fix sags in 8-inch HDPE pipe between MH 3-4A-4 and 3-4A-2.	$20,000
2022	3s	NW Ash Street	Repair broken pipe in the 8-inch HDPE pipe between MH 3-4A-2 and 3-4A-1.	$15,000
2022	3s	NW Benton Street	Repair broken pipe, cracks, and check for roots in 8-inch CONC pipe between MH 3-4-3 and MH 3-4-2.	$15,000
2022	3s	NE Birch Street	Repair separated and offset joints in the 8-inch CONC pipe between MH 3-2A-4 and 3-2A-3.	$20,000
2022	3s	NE Birch Street	Repair cracks and check for roots in the 8-inch CONC pipe between MH 3-2A-3 and 3-2A-2.	$15,000

TABLE 7-6 – (continued)

Project Schedule[(1)]

Year	Basin(s)	Location	Description	Cost
2022	3s	NE Birch Street	Repair broken pipe, fix sag and check for roots and in the 8-inch CONC pipe between MH 3-2A-2 and 3-2A-1.	$20,000
2022	3s	NE Birch Street	Repair separated and offset joints, and cracks and check for roots in the 8-inch CONC pipe between MH 3-2A-1 and 3-2-1.	$15,000
2022	**Total Inflow Removal Projects**			**$150,000**
2023	3s	NE Birch Street	Repair broken pipe, fix sag and check for roots and in the 8-inch CONC pipe between MH 3-2A-2 and 3-2A-1.	$15,000
2023	3s	NE Birch Street	Repair separated and offset joints, and cracks and check for roots in the 8-inch CONC pipe between MH 3-2A-1 and 3-2-1.	$15,000
2023	3s	NW Drake Way	Repair cracks in the 8-inch CONC pipe between MH 3-4B-4 and 3-4B-3.	$15,000
2023	3s	NW Drake Way	Repair broken pipe, cracks in the 8-inch CONC pipe between MH 3-4B-3 and 3-4B-2.	$15,000
2023	4	NW 19th Avenue	Repair cracks in the 8-inch VCP pipe between MH 4-7-8 and 4-7-7.	$15,000
2023	4	NW 19th Avenue	Repair cracks in the 8-inch PVC pipe between MH 4-7-7 and 4-7-6.	$15,000
2023	4	NW 19th Avenue	Repair cracks in the 8-inch VCP pipe between MH 4-7-6 and 4-7-5.	$15,000
2023	4	NE 19th Avenue	Repair broken pipe and cracks in the 8-inch VCP pipe between MH 4-7-3 and 4-7-2.	$15,000
2023	4	NE 19th Avenue	Repair cracks, check for roots, fix sag in the 8-inch VCP pipe between MH 4-7-2 and 4-7-1.	$15,000
2023	4	NW 21st Avenue	Repair broken 8-inch CONC pipe between MH 4-9-6 and 4-9-5.	$15,000
2023	**Total Inflow Removal Projects**			**$150,000**
2024	4	NW 21st Avenue	Repair broken 8-inch CONC pip and check for return of roots between MH 4-9-4 and 4-9-3.	$15,000
2024	4	NW 21st Avenue	Repair broken 8-inch CONC pipe between MH 4-9-3 and 4-9-2.	$15,000
2024	5	NE 4th Avenue	Fix sag and check for regrown roots in joints and laterals in the 8-inch VCP pipe between MH 5-6-3 and 5-6-2.	$20,000
2024	8	SE 7th Avenue	Fix lateral connection problems and sags and investigate signs of debris, in the 8 inch CONC pipe between MH 8-3A-1 and 8-3-1.	$20,000

TABLE 7-6 – (continued)

Project Schedule[(1)]

Year	Basin(s)	Location	Description	Cost
2024	8	SE 7th Avenue	Fix sags and check for debris and in the 8-inch CONC pipe between MH 8-3B-1 and 8-3-1.	$20,000
2024	8	SE 9th Avenue	Fix sags and check for debris in 12" CONC pipe between MH 8-1-4 and 8-1-3.	$20,000
2024	9	SE James Street	Repair cracks, check for debris and regrown roots in laterals, and fix sag in the 8 inch CONC pipe between MH 9-1-8 and 9-1-7. (440')	$20,000
2024	9	SE Whitney Street	Fix sag in the 8-inch CONC pipe between MH 9-4-3 and 9-4-2.	$20,000
2024	**Total Inflow Removal Projects**			**$150,000**
2025	9	SE Whitney Street	Fix sag in the 8-inch CONC pipe between MH 9-4-3 and 9-4-2.	$20,000
2025	10	NW 6th Avenue	Repair cracks and separated joints in the 10-inch PVC pipe between MH 10-1-2 and 10-1-1. (304')	$15,000
2025	10	NW Fremont Street	Repair cracks in the 8-inch CONC pipe between MH 10-8-1 and 10-1-22.	$15,000
2025	**Total Inflow Removal Projects (completes Medium Priority projects)**			**$50,000**
2026-2028	1	NW 8th Avenue	Repair crack in 8-inch PVC pipe between the cleanout and MH 1-3A-9. (350')	$15,000
2026-2028	2	NW 10th Avenue	Repair offset joint and sag in the 8-inch HDPE pipe between MH 2-3-7 and 2-3-6. (265')	$15,000
2026-2028	5	NE 4th Avenue	Repair cracks and check for return of roots in joints in the 8-inch VCP pipe between MH 5-6-1 and 5-1-10. (289')	$15,000
2026-2028	5	NE 6th Avenue	Repair broken pipe, offset joints, and check for regrown roots in the 6-inch VCP pipe and 6-inch DI pipe between MH 5-13-1 and 5-1-20. (369')	$20,000
2026-2028	6	SE 1st Avenue	Repair offset joint in the 8-inch pipe between MH 6-5-3 and 6-5-2.	$15,000
2026-2028	6	NE 4th Avenue	Repair offset joints in the 8-inch VCP pipe between MH 6-8-3 and 6-8-2.	$15,000
2026-2028	6	NE 4th Avenue	Repair cracks and offset joints in the 8-inch VCP pipe between MH 6-8-2 and 6-8-1. (314')	$15,000
2026-2028	6	NE 5th Avenue	Repair separated/offset joints and fix sag in the 8-inch VCP pipe between MH 6-7B-1 and 6-7B-2. (336')	$25,000

TABLE 7-6 – (continued)

Project Schedule[(1)]

Year	Basin(s)	Location	Description	Cost
2026-2028	7	NE 3rd Avenue	Repair cracks in the 8-inch CONC pipe between MH 7-8-2 and 7-8-1. (255')	$15,000
2026-2028	7	NE 3rd Avenue	Repair cracks and check for regrown roots in 8-inch CONC pipe between MH LH and 7-5-1A.	$15,000
2026-2028	7	NE 3rd Loop	Repair cracks and check for regrown roots in laterals and 8-inch CONC pipe between MH 7-1-8 and 7-1-7.	$15,000
2026-2028	8	SE Russell Street	Fix lateral connection problems in the 8-inch CONC pipe between MH 8-4-2 and 8-4-1.	$20,000
2026-2028	9	SE 1st Avenue	Repair cracks in the 8-inch CONC pipe between MH 9-3A-2 and 9-3A-1. (418')	$15,000
2026-2028	9	SE 1st Avenue	Fix sags in the 8-inch CONC pipe between MH 9-3A-1 and 9-3-1. (420')	$15,000
2026-2028	9	NE 2nd Avenue	Repair broken 8-inch CONC pipe between MH 9-1-5 and 9-1-4. (224')	$15,000
2026-2028	9	NE 3rd Avenue	Fix lateral connection problems, check for grease and roots in laterals in 8-inch CONC pipe between MH 9-5-6 and 9-5-5.	$15,000
2026-2028	9	NE 3rd Avenue	Repair cracks and check for grease in 8-inch CONC pipe between MH 9-5-5 and 9-5-4. (111')	$15,000
2026-2028	9	SE 3rd Avenue	Fix sags in the 8-inch CONC pipe between MH 9-6-2 and 9-6-1.	$20,000
2026-2028	9	SE James Street	Repair cracks, check for grease, and investigate sag in the 8-inch CONC pipe between MH 9-6-1 and 9-1-11. (337')	$15,000
2026-2028	9	SE James Street	Repair cracks and check for regrown roots in the 8-inch CONC pipe between MH 9-1-9 and 9-1-8. (380')	$15,000
2026-2028	**Total Inflow Removal projects (completes Low Priority projects)**			**$325,000**

(1) Project list will be reassessed and potentially modified each year to meet objectives.

City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 14, 2021

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2020 – April 2021 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

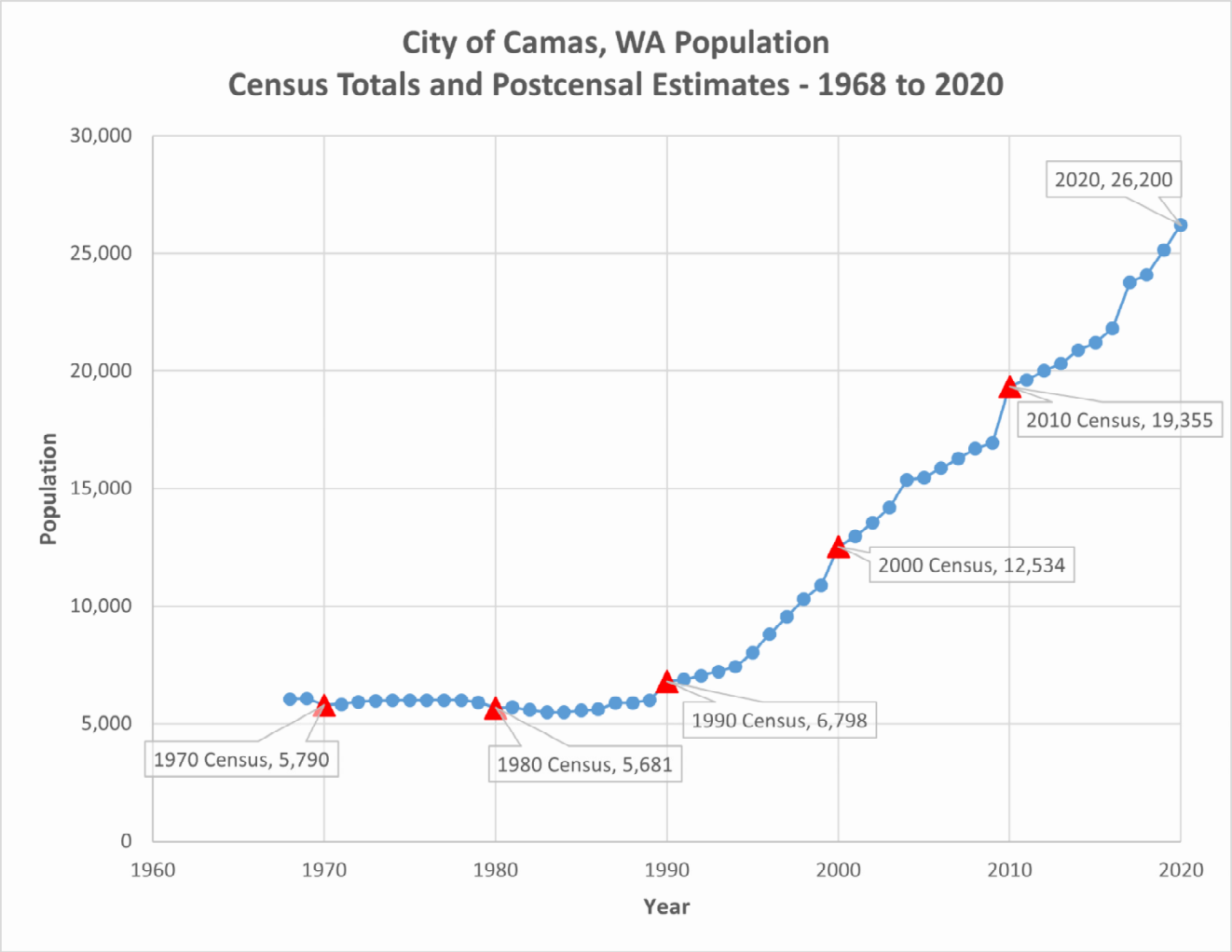
For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

From analysis of the historical data, May 2011-April 2012 continues to best represent an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report. For the twenty-year period of May 1, 2001 to April 30, 2021, the average 12-month rainfall in Camas was 45.57 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, which is approximately the 50th percentile of all twenty 12-month totals and only 2.03 inches more than the twenty-year average.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2001-2020

	Average	Minimum	50th Percentile	Maximum
Annual Total Rainfall (in.)	45.57	28.35 (May 2019 – April 2020)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2001 to April 2021:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2001	1.260	21%	-21%	42.63
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
Average	**1.411**	**23%**	**18%**	**45.57**

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer/Wastewater Facility Plan, last updated in November 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 152,000 linear feet of sewer line has been added, giving Camas approximately 614,000 linear feet (116 miles) of sewer line, as of the end of 2020.

In 2020, approximately 12,000 linear feet of new sanitary sewer line were added to the City's system. The majority of that total (approximately 9,000 linear feet) was connected to several residential developments added during the year. Approximately 3,000 linear feet of sewer were added as a part of our Lacamas Creek Lift Station Improvement project, which saw the construction of two new sanitary lift stations.

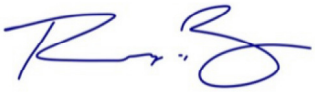
Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 27 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

Sewer Improvement and I/I Reduction Projects

The Lacamas Creek Lift Station Improvements project mentioned above, included the removal and/or abandonment of approximately 1,500 linear feet of aging sewer line, and the complete replacement of lift station that was originally built in 1958. The project saw the removal of a 300-linear-foot, 10 inch, steel gravity which traversed the creek; the abandonment of a 1,600-linear-foot, 6 inch, asbestos-cement forcemain; and the removal of the 62 year old pump station-all of which were within Lacamas Creek's 100-year floodplain. Though there were no projects that took place in the reporting year (May 2020 – April 2021) which were specifically targeted at I/I reduction, the Lacamas Creek Lift Station Improvements project arguably helped to decrease existing sources of inflow and/or infiltration and mitigate the potential for future I/I within its basin.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact me at (360) 834-3263 or via email at bbusch@cityofcamas.us.

Best Regards,



Bob Busch
Wastewater Operations Supervisor

Cc: Sam Adams
Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2001 to APRIL 30, 2021

Month	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	AVG
May	1.413	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	**2.147**
June	1.423	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	**2.085**
July	1.358	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	**1.931**
August	1.334	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	**1.974**
September	1.336	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	**2.025**
October	1.486	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	**2.184**
November	2.014	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	**2.574**
December	2.594	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	**2.846**
January	2.399	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	**3.000**
February	2.128	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	**2.659**
March	2.199	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	**2.722**
April	1.770	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	**2.344**
AVG	**1.788**	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.374**
MAX	**2.594**	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.301**
MIN	**1.334**	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**1.890**
Annual I/I	**1.260**	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.411**
% of MMAD Flow	21%	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%
% +/- vs Prior Year	11%	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2001 to APRIL 30, 2021

Month	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	AVG
May	1.58	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	**2.84**
June	2.97	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	**2.30**
July	0.66	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	**0.43**
August	1.23	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	**0.69**
September	0.80	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	**2.14**
October	2.40	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	**4.53**
November	7.51	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	**6.55**
December	6.34	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	**7.07**
January	6.94	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	**6.03**
February	3.65	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	**4.15**
March	4.93	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	**5.17**
April	3.62	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	**3.66**
TOTAL	**42.63**	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**45.57**
AVG	**3.55**	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**3.80**
MAX	**7.51**	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**9.20**
MIN	**0.66**	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.23**

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	**45.57**	
20-Year Maximum Annual Rainfal (in.):	**73.36**	(2010)
20-Year Minimum Annual Rainfall (in.):	**28.35**	(2019)

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2018 to April 2021

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

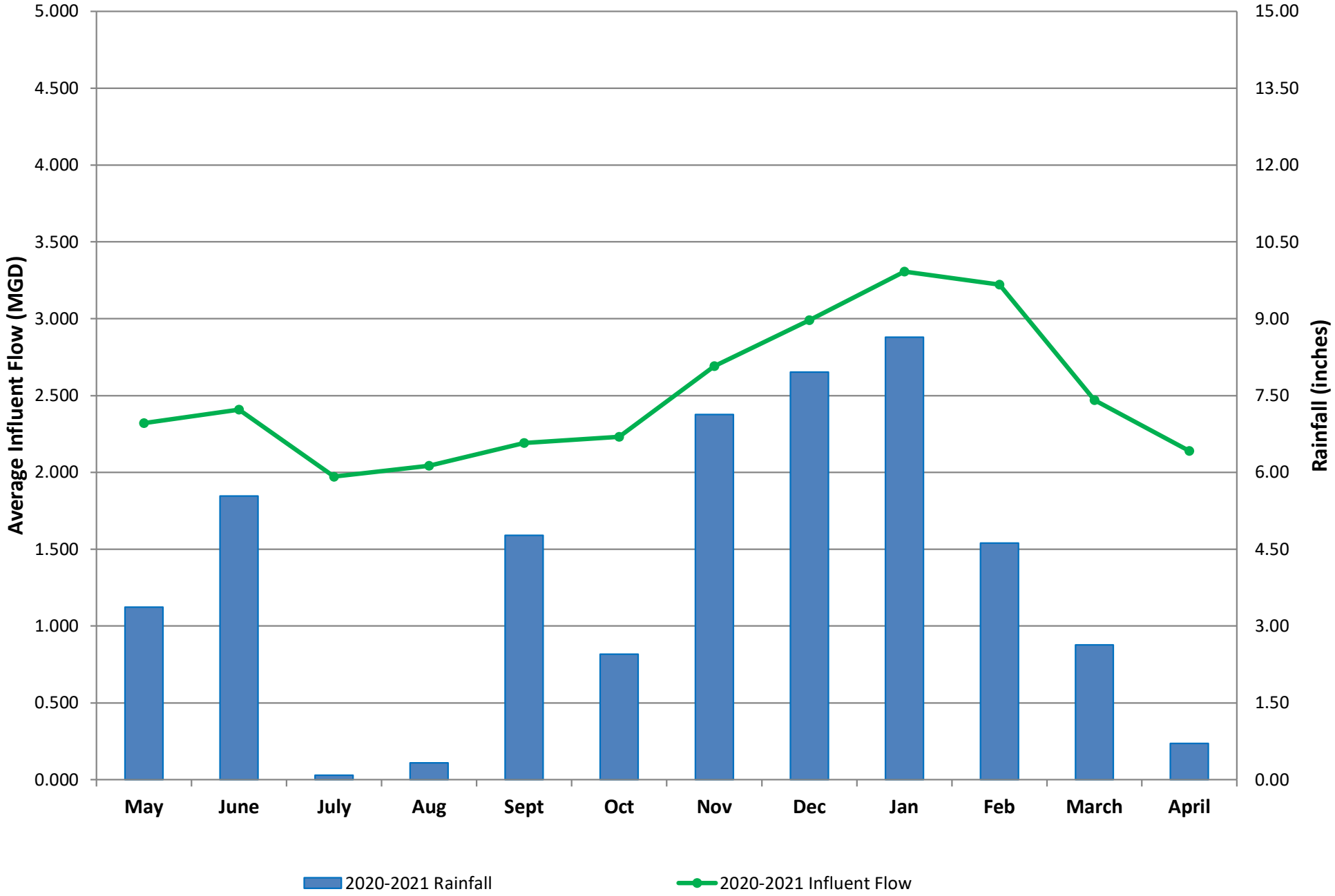
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**	**2018**	**2019**	**2020**
May	1.946	2.050	2.319	0.46	2.10	3.37	23,770	24,090	25,140	1,871	0	0
June	1.983	1.992	2.409	1.87	0.80	5.54	23,770	24,090	25,140	45,563	0	0
July	1.828	1.961	1.972	0.06	0.70	0.09	23,770	24,090	25,140	1,311	2,060	3,130
Aug	1.890	1.943	2.043	0.47	0.75	0.33	23,770	24,090	25,140	0	0	1,910
Sept	1.884	2.151	2.192	1.03	3.42	4.77	23,770	24,090	25,140	2,395	0	4,171
Oct	2.035	2.199	2.231	4.39	3.95	2.45	23,770	24,090	25,140	0	0	3,076
Nov	2.178	2.143	2.691	3.62	1.65	7.13	23,770	24,090	25,140	8,728	0	0
Dec	2.648	2.461	2.991	**6.33**	3.08	7.96	23,770	24,090	25,140	1,323	722	0
Jan	2.480	**3.484**	**3.306**	3.19	**6.71**	**8.64**	24,090	25,140	26,200	356	3,026	0
Feb	**2.880**	2.644	3.222	4.67	1.44	4.62	24,090	25,140	26,200	12,100	0	0
March	2.156	2.476	2.470	1.66	2.97	2.63	24,090	25,140	26,200	0	225	0
April	2.639	2.330	2.139	3.69	0.78	0.71	24,090	25,140	26,200	0	0	0
Period Total:	26.546	27.834	29.984	31.44	28.35	48.24			**Total Added (feet):**	73,647	6,033	12,287
Low Month:	1.828	1.943	1.972	0.06	0.70	0.09			**Total Added (miles):**	13.95	1.14	2.33
High Month:	**2.880**	**3.484**	**3.306**	**6.33**	**6.71**	**8.64**						
Annual Average:	2.212	2.320	2.499	2.62	2.36	4.02						
Period I/I:	1.052	1.541	1.334									

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2018-2019	1.052	-30%	131%	17%	31.44
2019-2020	1.541	2%	47%	25%	28.35
2020-2021	1.334	-12%	-13%	22%	48.24

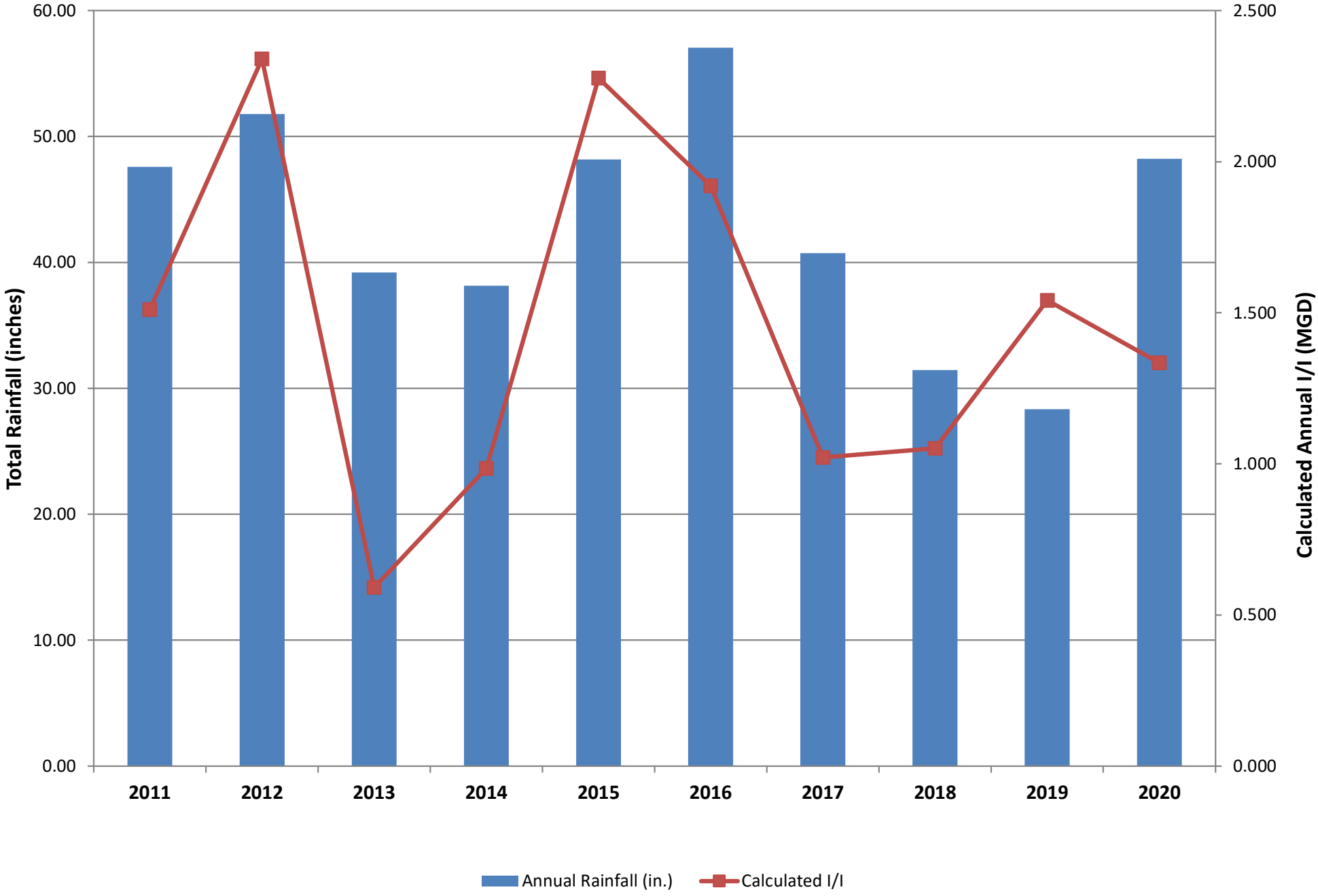
ATTACHMENT C, CHART I

May 2020 - April 2021 Monthly Average Influent Flow and Monthly Total Rainfall



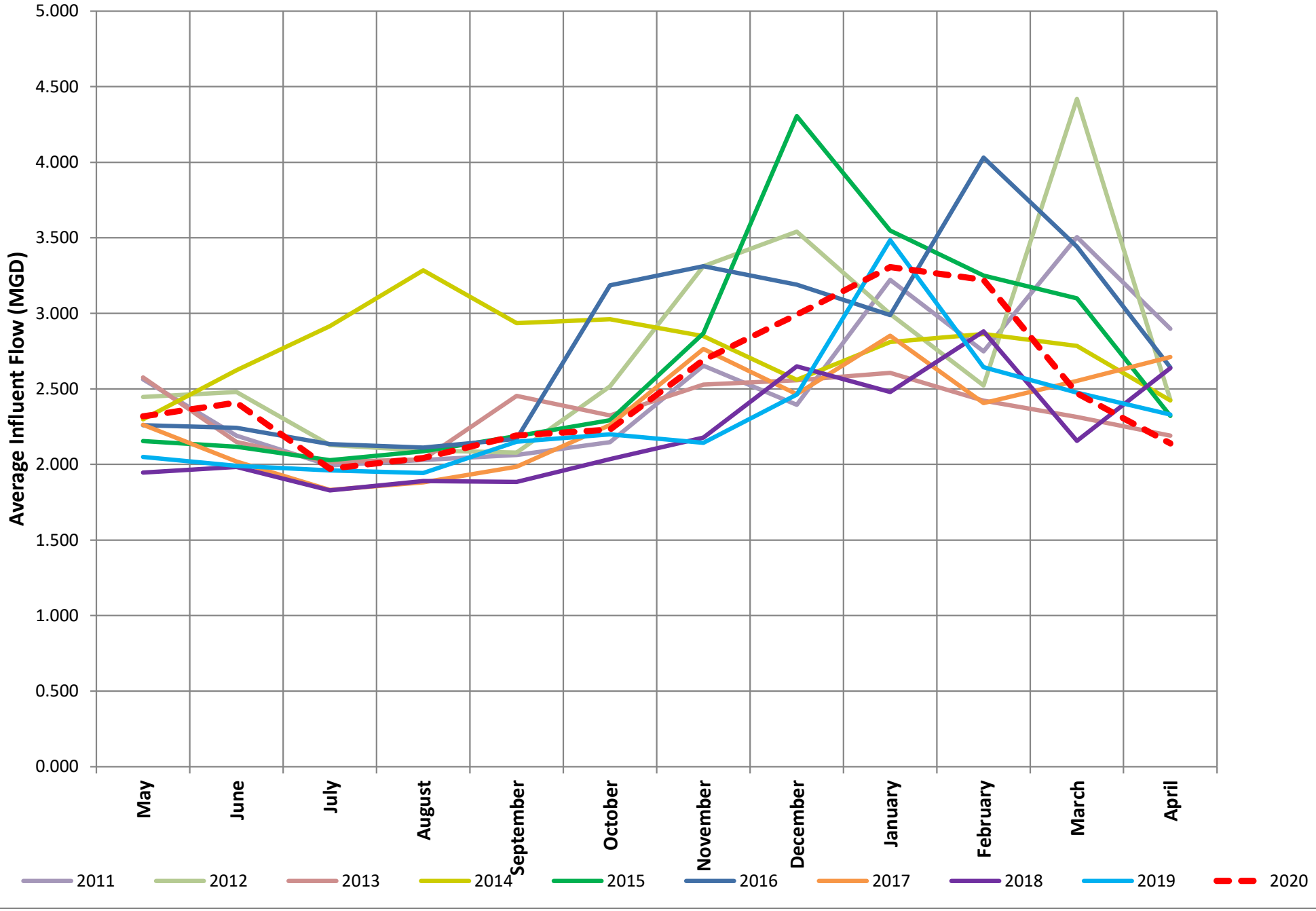
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



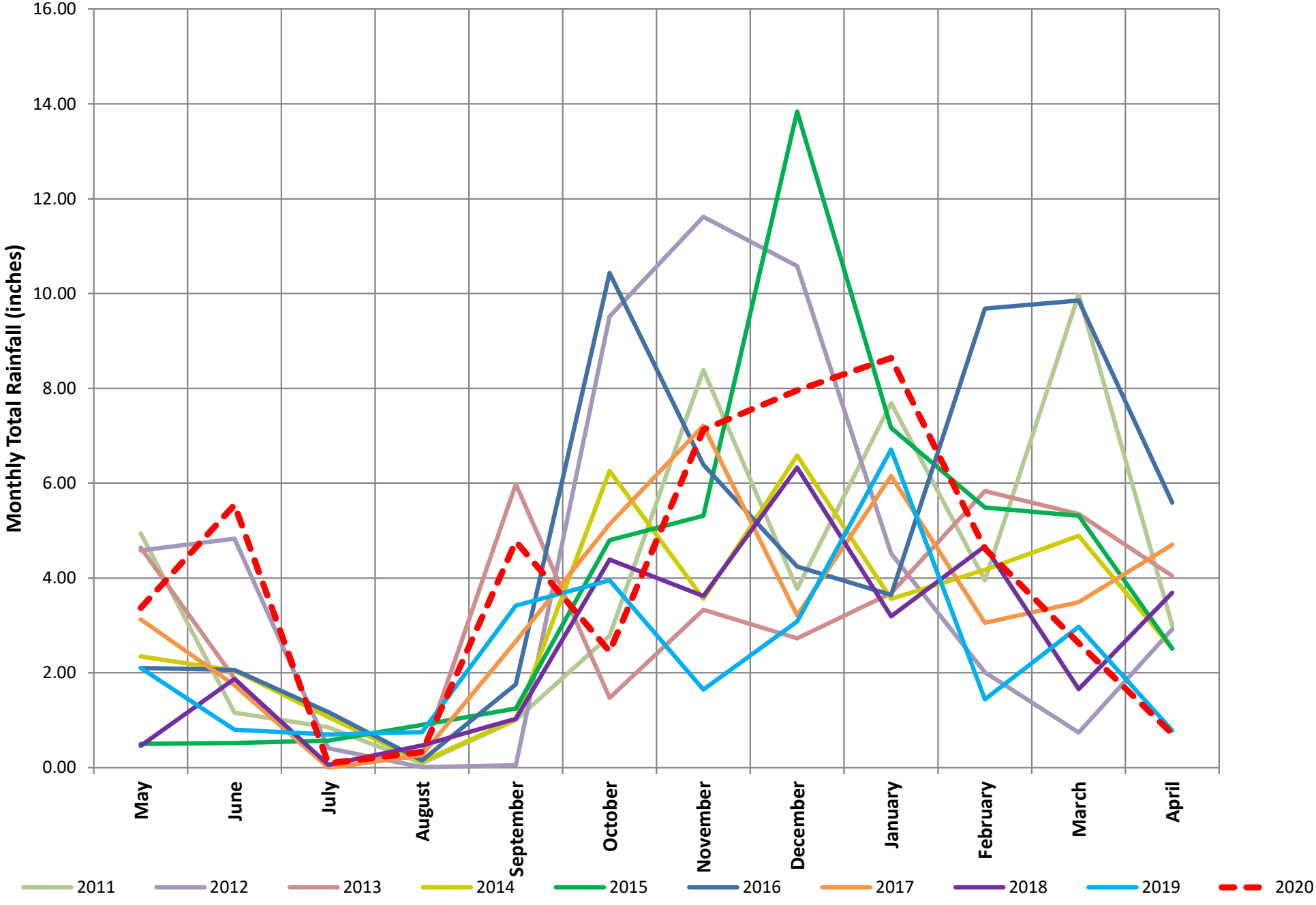
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

June 1, 2022

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2021 – April 2022 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

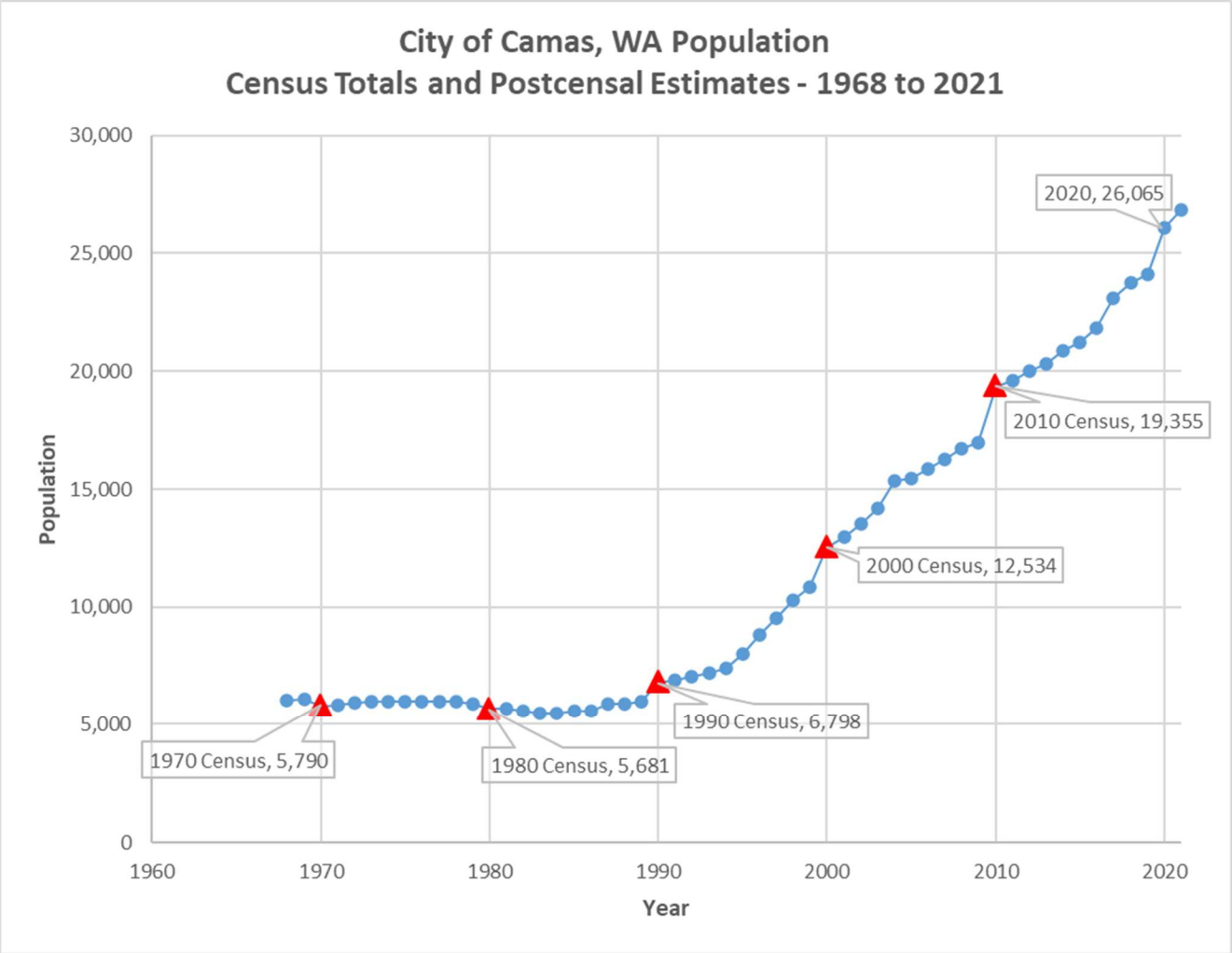
From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

For the twenty-year period of May 1, 2002 to April 30, 2021, the average 12-month rainfall in Camas was 46.33 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only 1.27 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2002-2021

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	46.33	28.35 (May 2019 – April 2020)	47.93 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2021:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	5%	57.77
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer/Wastewater Facility Plan, last updated in November 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 156,000 linear feet of sewer line has been added, giving Camas approximately 618,000 linear feet (117 miles) of sewer line, as of the end of 2021.

In 2021, approximately 4,000 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential developments projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 27 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 834-3263.

Best Regards,



Bob Busch
Wastewater Treatment Plant Operations Supervisor

Cc: Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVG
May	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	**2.183**
June	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	**2.122**
July	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	**1.967**
August	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	**2.015**
September	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	**2.073**
October	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	**2.234**
November	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	**2.633**
December	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	**2.886**
January	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	**3.054**
February	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	**2.681**
March	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	**2.759**
April	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	**2.403**
AVG	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.417**
MAX	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.346**
MIN	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**1.927**
Annual I/I	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.418**
% of MMAD Flow	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	23%
% +/- vs Prior Year	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	AVG
May	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	**2.88**
June	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	**2.28**
July	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	**0.40**
August	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	**0.64**
September	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	**2.33**
October	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	**4.66**
November	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	**6.70**
December	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	**7.15**
January	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	**6.08**
February	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	**4.14**
March	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	**5.19**
April	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	**3.66**
TOTAL	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**46.33**
AVG	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**3.86**
MAX	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**9.34**
MIN	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.20**

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	46.33	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B
City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report
May 2021 to April 2022

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD): **13.44**

Maximum Monthly Average Design Flow (MGD): **6.10**

Design Population Equivalent: **28,075**

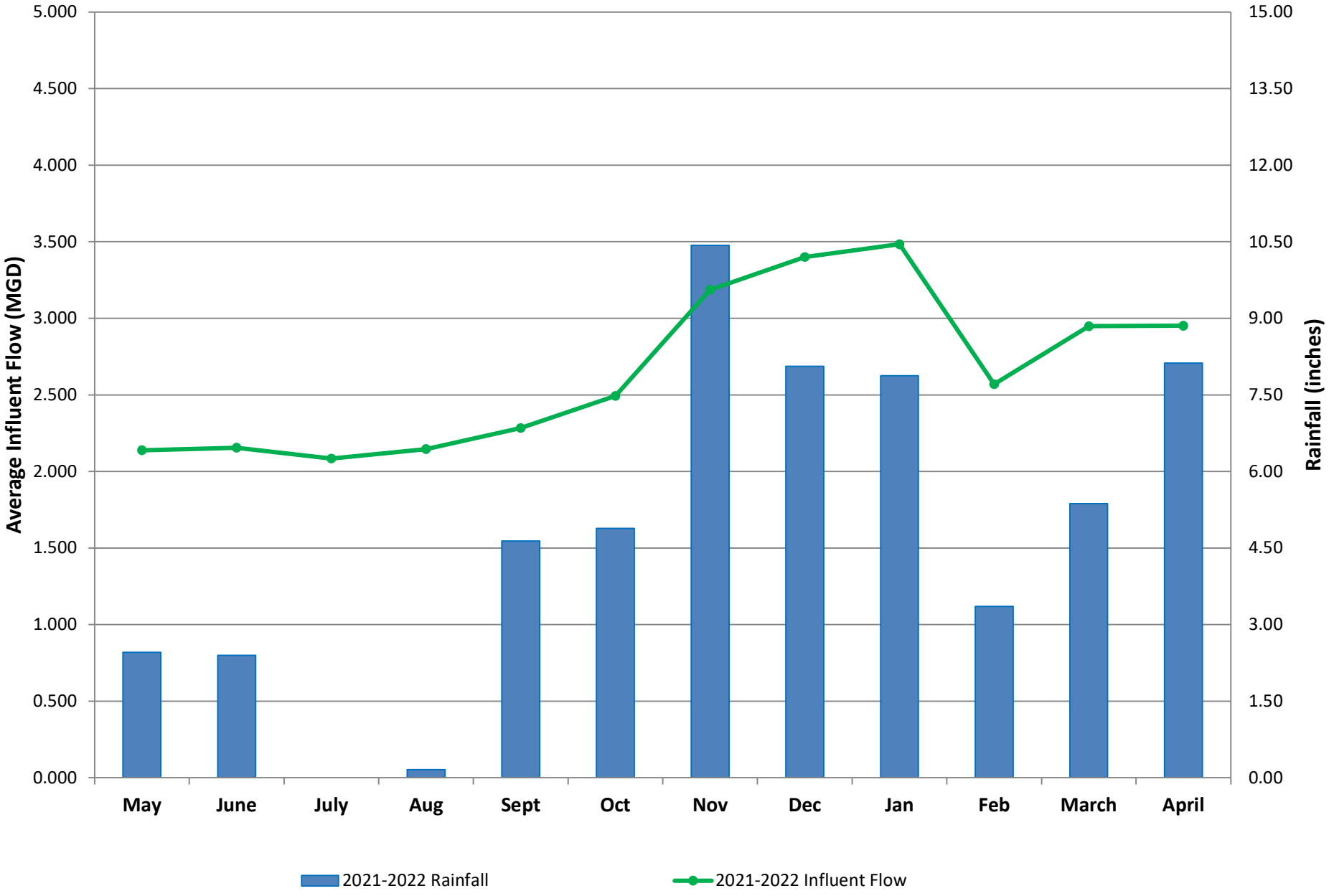
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
May	2.050	2.319	2.138	2.10	3.37	2.46	24,090	26,065	26,870	0	0	1,714
June	1.992	2.409	2.156	0.80	5.54	2.40	24,090	26,065	26,870	0	0	1,114
July	1.961	1.972	2.084	0.70	0.09	0.00	24,090	26,065	26,870	2,060	3,130	0
Aug	1.943	2.043	2.146	0.75	0.33	0.16	24,090	26,065	26,870	0	1,910	0
Sept	2.151	2.192	2.284	3.42	4.77	4.64	24,090	26,065	26,870	0	4,171	0
Oct	2.199	2.231	2.493	3.95	2.45	4.89	24,090	26,065	26,870	0	3,076	0
Nov	2.143	2.691	3.187	1.65	7.13	**10.43**	24,090	26,065	26,870	0	0	0
Dec	2.461	2.991	3.401	3.08	7.96	8.06	24,090	26,065	26,870	722	0	0
Jan	**3.484**	**3.306**	**3.484**	**6.71**	**8.64**	7.88	26,065	26,870	*26,870*	3,026	0	0
Feb	2.644	3.222	2.570	1.44	4.62	3.36	26,065	26,870	*26,870*	0	0	0
March	2.476	2.470	2.949	2.97	2.63	5.37	26,065	26,870	*26,870*	225	525	0
April	2.330	2.139	2.952	0.78	0.71	8.12	26,065	26,870	*26,870*	0	580	0
Period Total:	27.834	29.984	31.842	28.35	48.24	57.77			**Total Added (feet):**	6,033	13,392	2,828
Low Month:	1.943	1.972	2.084	0.70	0.09	0.00			**Total Added (miles):**	1.14	2.54	0.54
High Month:	**3.484**	**3.306**	**3.484**	**6.71**	**8.64**	**10.43**						
Annual Average:	2.320	2.499	2.654	2.36	4.02	4.81						
Period I/I:	1.541	1.334	1.400									

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2019-2020	1.541	2%	131%	25%	28.35
2020-2021	1.334	-12%	-13%	22%	48.24
2021-2022	1.400	-7%	5%	23%	57.77

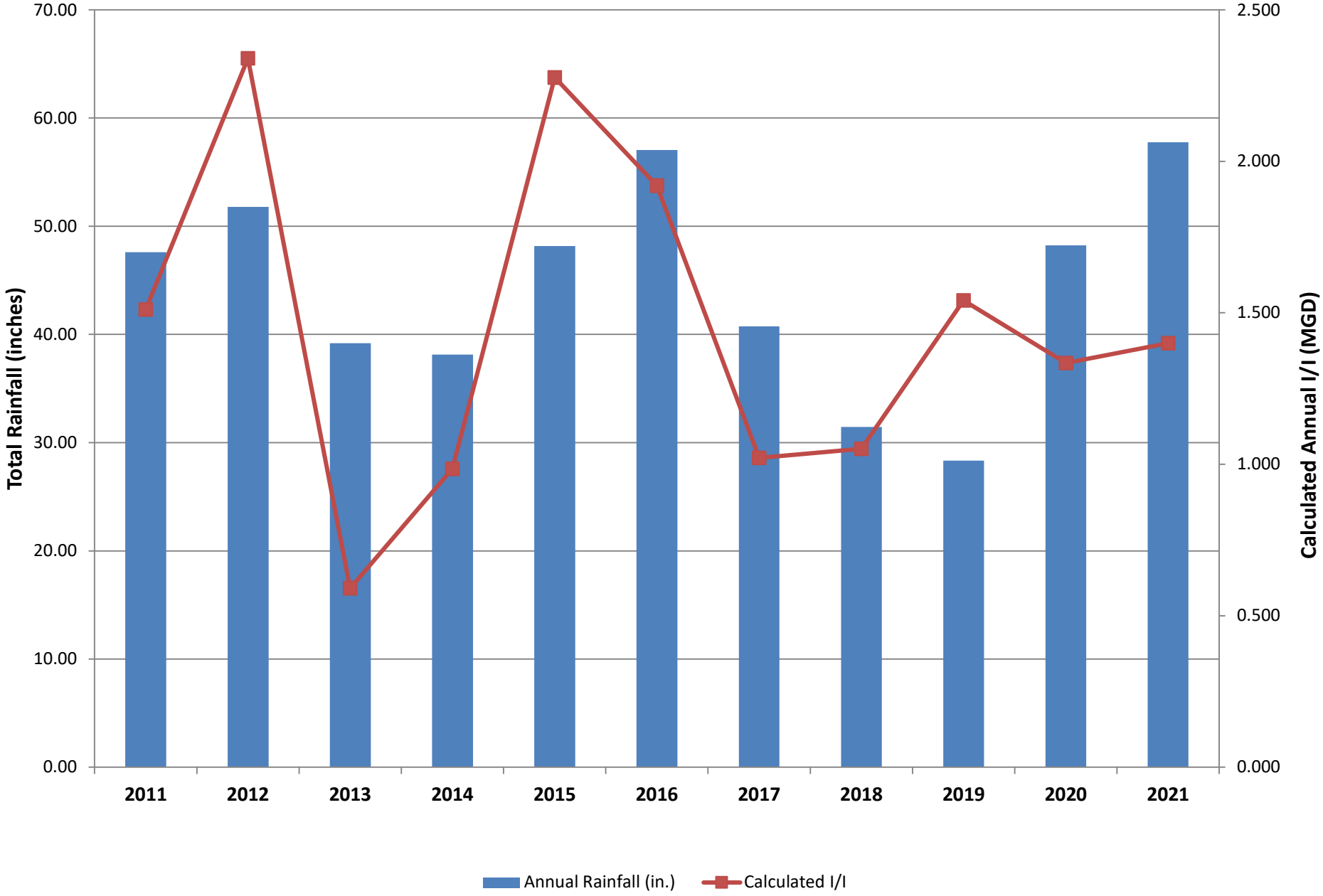
ATTACHMENT C, CHART I

May 2021 - April 2022 Monthly Average Influent Flow and Monthly Total Rainfall



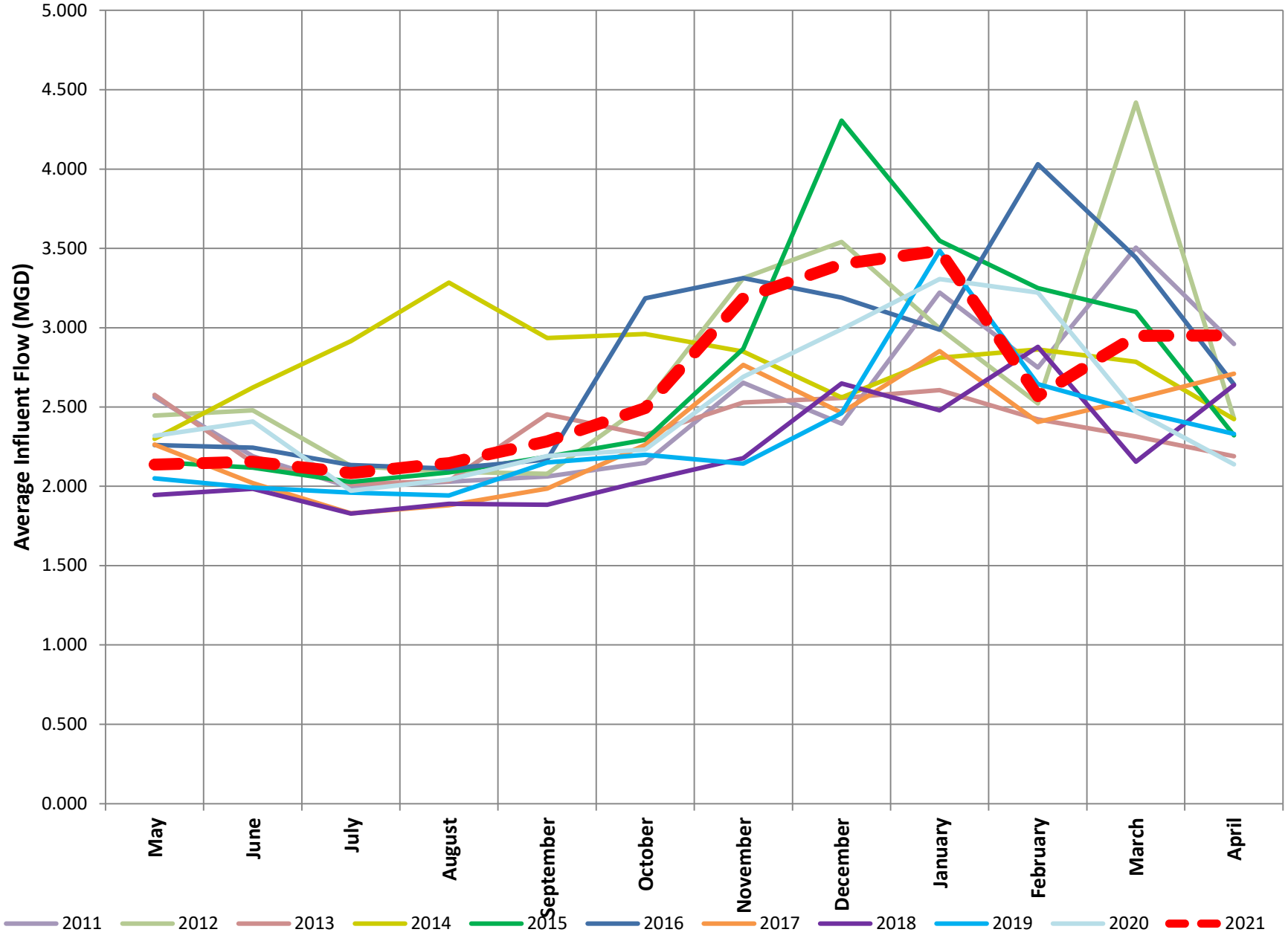
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



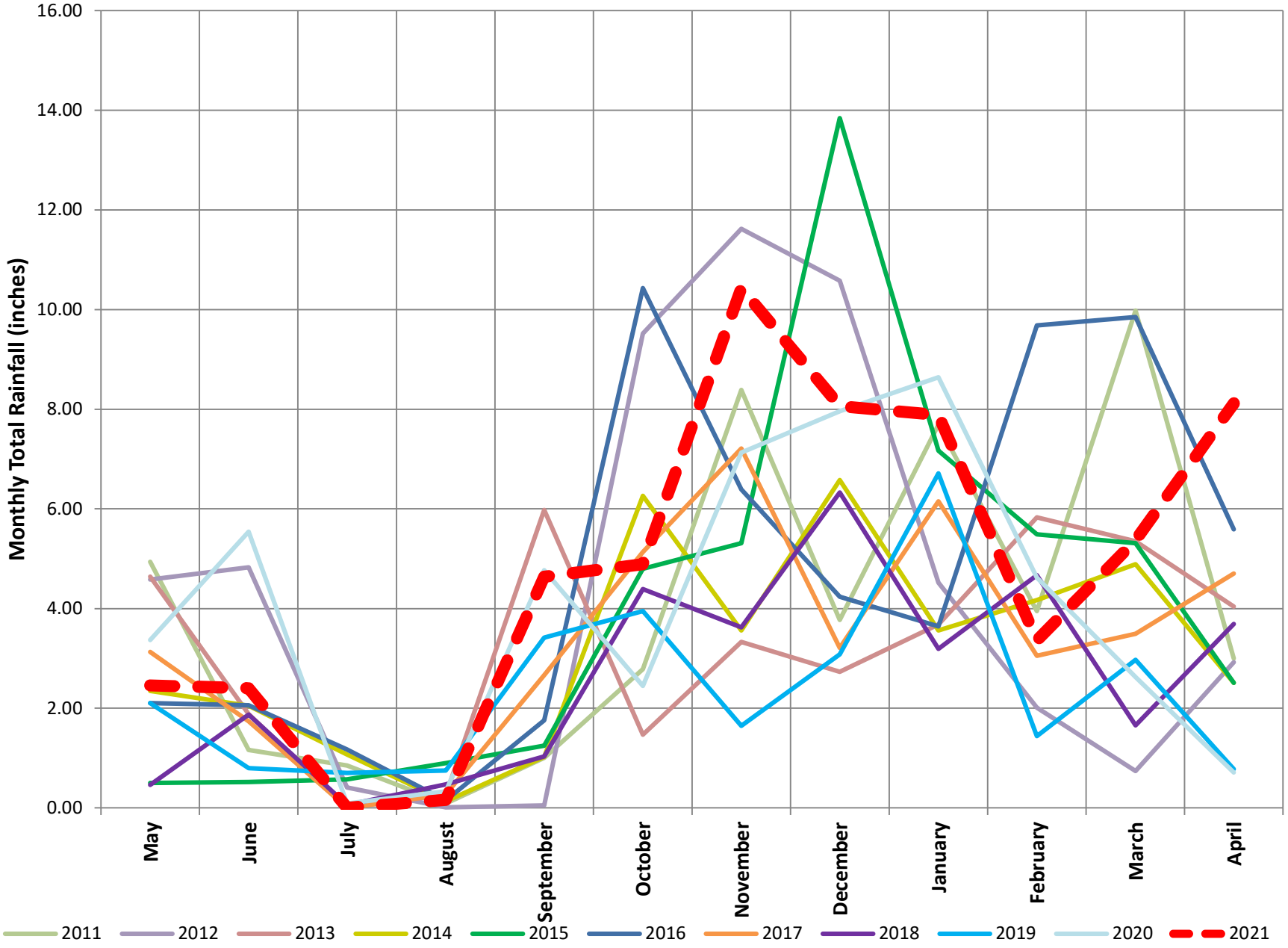
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

June 1, 2023

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2022 – April 2023 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*
3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*

4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

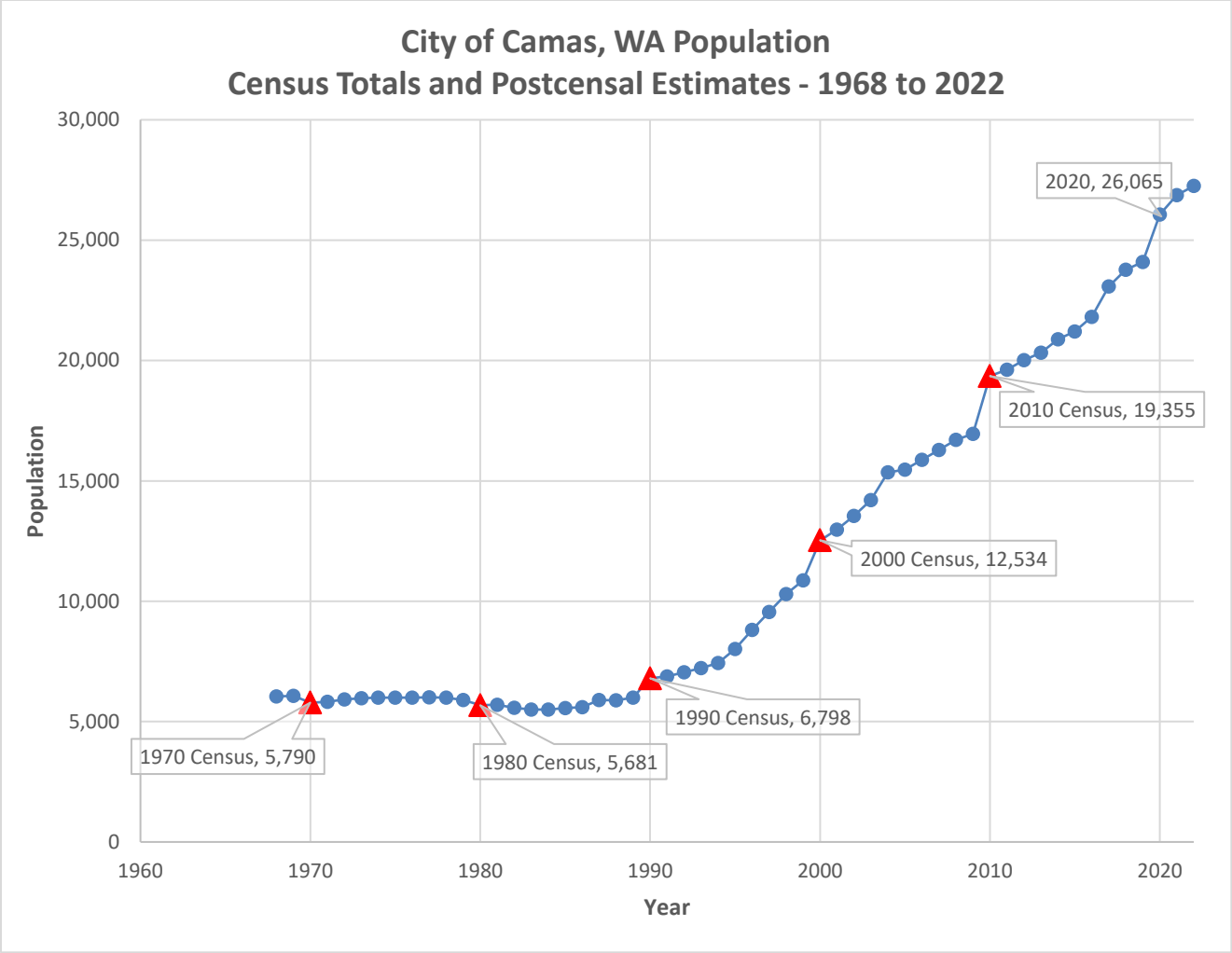
From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

For the twenty-year period of May 1, 2003 to April 30, 2023, the average 12-month rainfall in Camas was 46.73 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only .87 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2002-2022

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	46.73	28.35 (May 2019 – April 2020)	47.93 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth, which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2023:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	5%	57.77
2022	1.264	21%	-10%	47.68
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer Plan, last updated in November of 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 156,800 linear feet of sewer line has been added, giving Camas approximately 619,000 linear feet (117 miles) of sewer line, as of the end of 2022.

In 2022, approximately 800 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential development projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 28 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 817-7164.

Best Regards,

Darren Eki

Darren Eki
Wastewater Treatment Plant Operations Supervisor

Cc: Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	AVG
May	1.542	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	2.886	**2.217**
June	1.547	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	2.838	**2.156**
July	1.458	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	2.098	**1.974**
August	1.420	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	2.109	**2.019**
September	1.434	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	2.140	**2.076**
October	1.447	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	2.294	**2.237**
November	1.500	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	2.842	**2.643**
December	2.066	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	3.362	**2.909**
January	2.431	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	3.044	**3.054**
February	2.220	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	2.710	**2.682**
March	2.488	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	3.141	**2.777**
April	2.052	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	3.320	**2.446**
AVG	**1.800**	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.732**	2.417
MAX	**2.488**	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.362**	3.346
MIN	**1.420**	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**2.098**	1.927
Annual I/I	**1.069**	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.264**	1.418
% of MMAD Flow	18%	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	21%	23%
% +/- vs Prior Year	-15%	18%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	-10%	18%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2002 to APRIL 30, 2022

Month	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	AVG
May	1.65	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	6.63	**3.06**
June	1.75	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	6.73	**2.49**
July	0.25	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	0.43	**0.40**
August	0.02	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	0.00	**0.61**
September	1.41	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	0.01	**2.22**
October	1.09	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	5.16	**4.68**
November	2.90	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	7.49	**6.74**
December	9.30	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	6.01	**7.10**
January	8.83	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	5.83	**6.07**
February	2.75	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	3.54	**4.11**
March	7.49	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	5.85	**5.19**
April	4.04	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	7.13	**3.66**
TOTAL	**41.48**	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**54.81**	46.73
AVG	**3.46**	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**4.57**	3.86
MAX	**9.30**	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**7.49**	9.34
MIN	**0.02**	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.00**	0.20

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	46.33	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2022 to April 2023

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

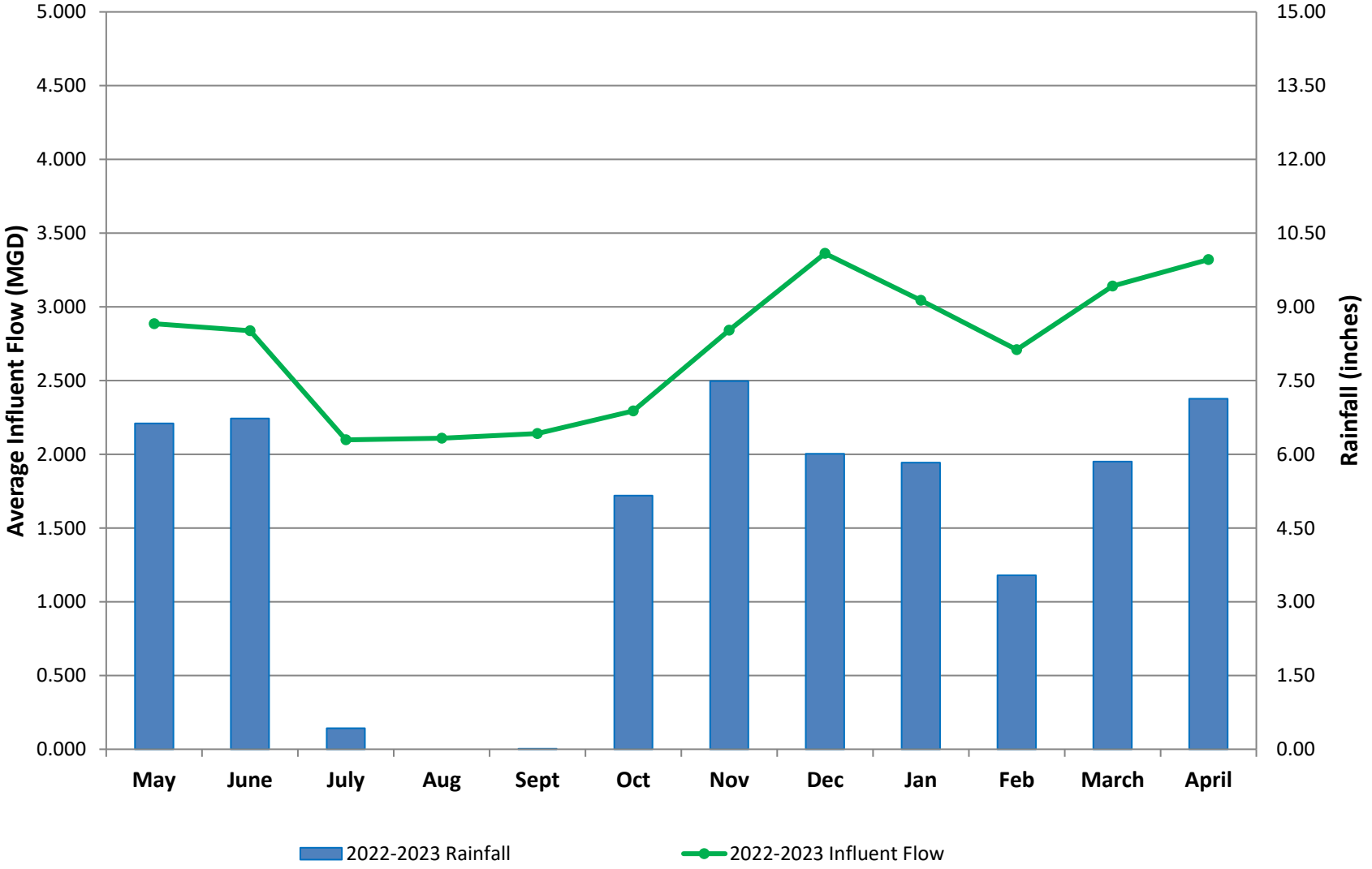
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**	**2020**	**2021**	**2022**
May	2.319	2.138	2.886	3.37	2.46	6.63	26,065	26,870	27,250	0	1,714	0
June	2.409	2.156	2.838	5.54	2.40	6.73	26,065	26,870	27,250	0	1,114	0
July	1.972	2.084	2.098	0.09	0.00	0.43	26,065	26,870	27,250	3,130	0	0
Aug	2.043	2.146	2.109	0.33	0.16	0.00	26,065	26,870	27,250	1,910	0	0
Sept	2.192	2.284	2.140	4.77	4.64	0.01	26,065	26,870	27,250	4,171	0	0
Oct	2.231	2.493	2.294	2.45	4.89	5.16	26,065	26,870	27,250	3,076	0	0
Nov	2.691	3.187	2.842	7.13	**10.43**	**7.49**	26,065	26,870	27,250	0	0	0
Dec	2.991	3.401	**3.362**	7.96	8.06	6.01	26,065	26,870	27,250	0	0	0
Jan	**3.306**	**3.484**	3.044	**8.64**	7.88	5.83	26,870	27,250	27,598	0	0	0
Feb	3.222	2.570	2.710	4.62	3.36	3.54	26,870	27,250	27,598	0	0	0
March	2.470	2.949	3.141	2.63	5.37	5.85	26,870	27,250	27,598	525	795	0
April	2.139	2.952	3.320	0.71	8.12	7.13	26,870	27,250	27,598	580	0	0
Period Total:	29.984	31.842	32.784	48.24	57.77	54.81			**Total Added (feet):**	13,392	3,623	0
Low Month:	1.972	2.084	2.098	0.09	0.00	0.00			**Total Added (miles):**	2.54	0.69	0.00
High Month:	**3.306**	**3.484**	**3.362**	**8.64**	**10.43**	**7.49**						
Annual Average:	2.499	2.654	2.732	4.02	4.81	4.57						
Period I/I:	1.334	1.400	1.264									

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2020-2021	1.334	-12%	131%	22%	48.24
2021-2022	1.400	-7%	5%	23%	57.77
2022-2023	1.264	-16%	-10%	21%	54.81

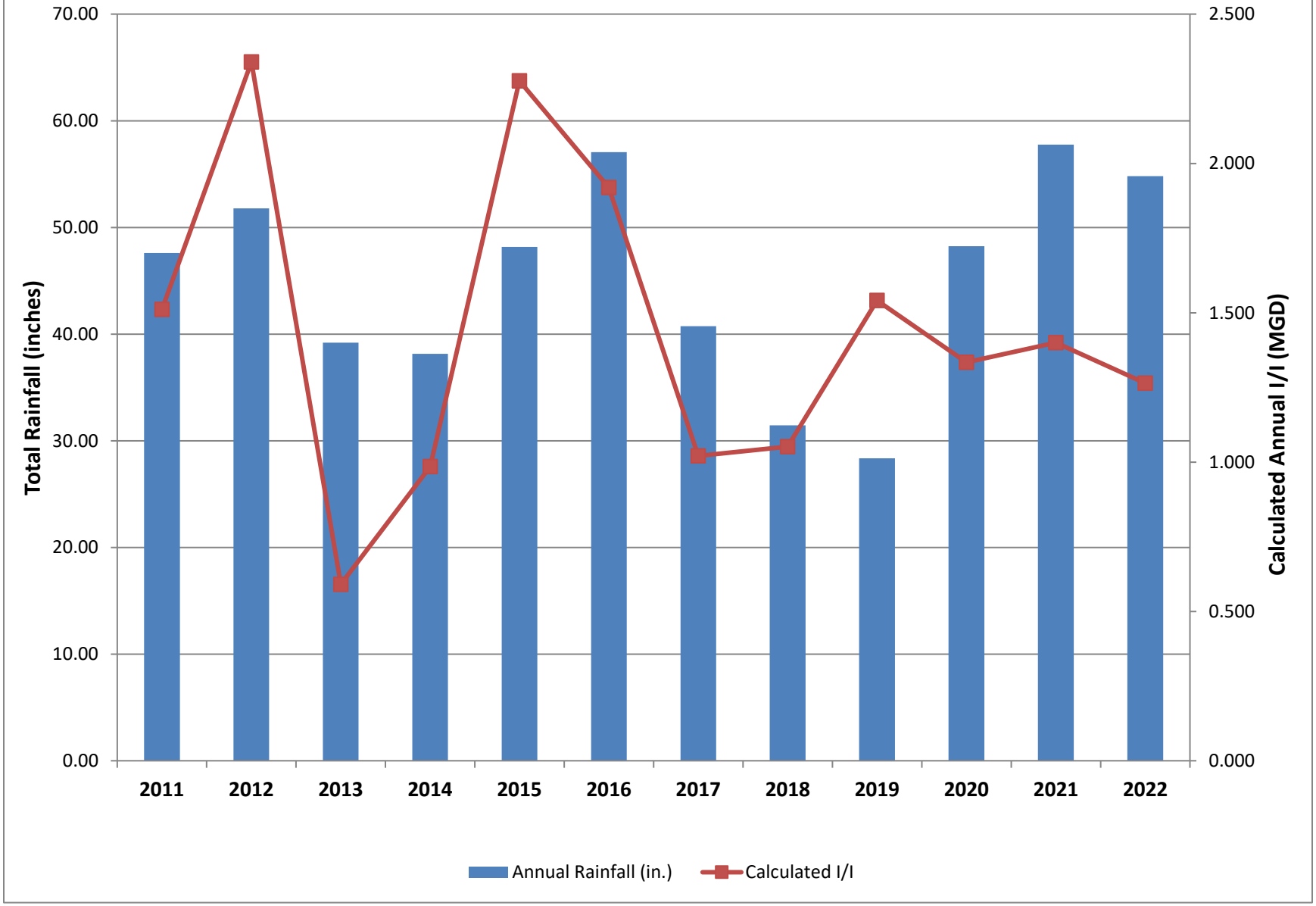
ATTACHMENT C, CHART I

May 2022 - April 2023 Monthly Average Influent Flow and Monthly Total Rainfall



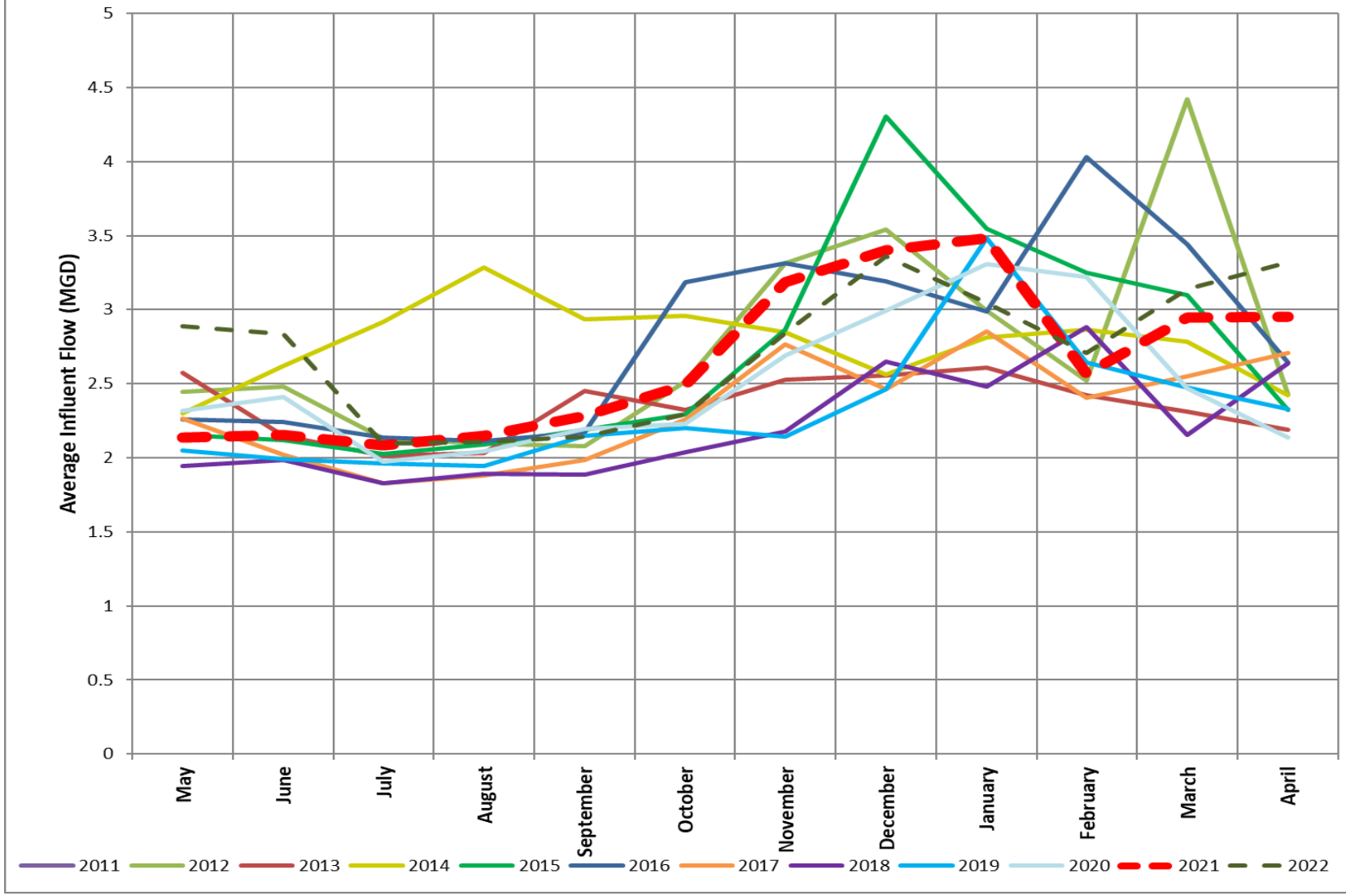
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



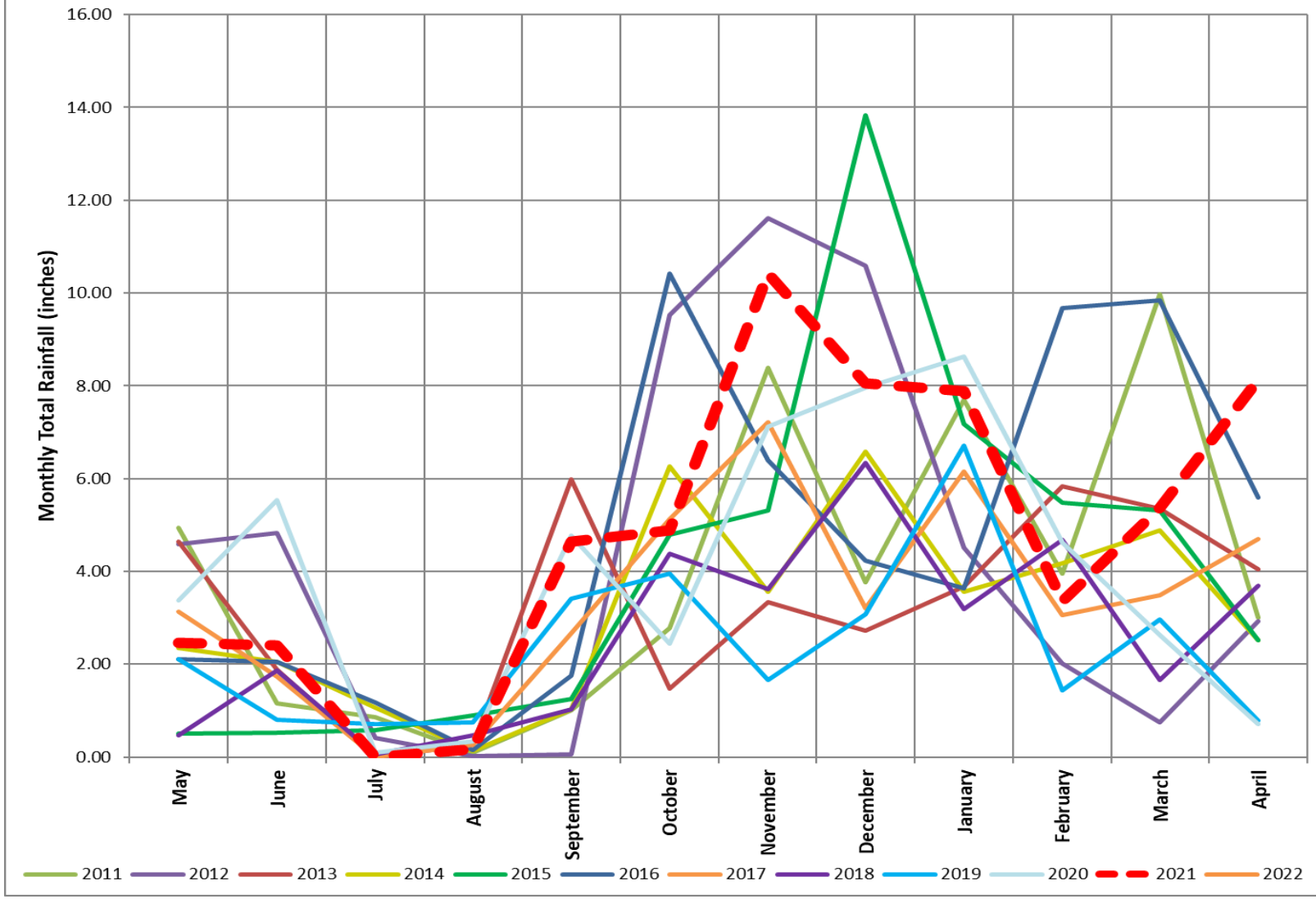
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 9, 2024

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2023 – April 2024 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*

3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*
4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

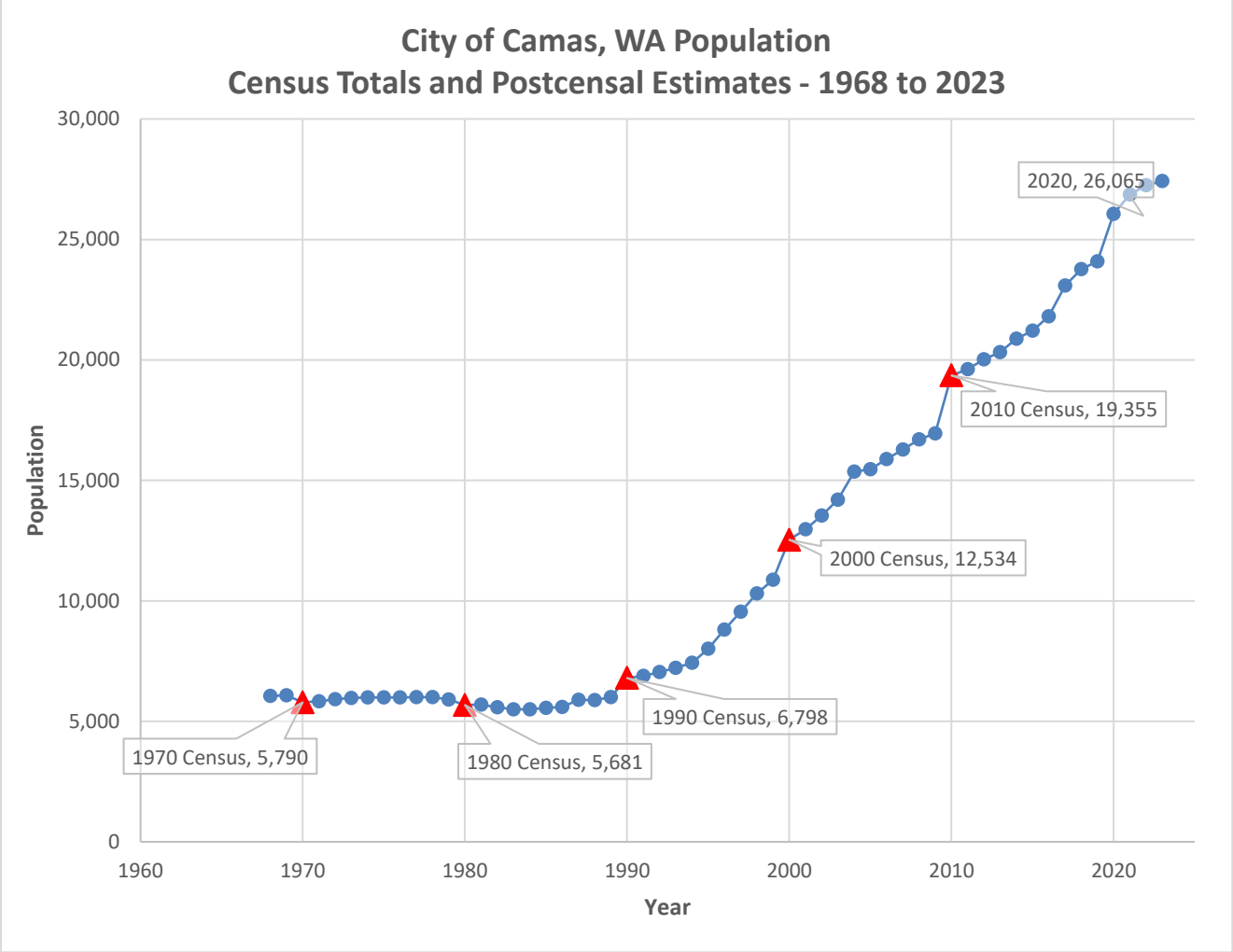
For the twenty-year period of May 1, 2003 to April 30, 2023, the average 12-month rainfall in Camas was 47.56 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only 1.27 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2003-2023

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	47.56	28.35 (May 2019 – April 2020)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth,

which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2023:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	+5%	57.77
2022	1.264	21%	-10%	54.81
2023	2.266	37%	+79%	58.80
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer Plan, last updated in November of 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 156,800 linear feet of sewer line has been added, giving Camas approximately 619,637 linear feet (117 miles) of sewer line, as of the end of 2023.

In 2023/24, approximately 7878 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential development projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 28 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 834-3263.

Best Regards,

Darren Eki

Darren Eki
Wastewater Treatment Plant Operations Supervisor

Cc: Steve Wall

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2003 to APRIL 30, 2023

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	AVG
May	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	2.886	2.230	**2.249**
June	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	2.838	2.180	**2.186**
July	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	2.098	2.068	**2.003**
August	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	2.109	2.141	**2.053**
September	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	2.140	2.199	**2.112**
October	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	2.294	2.314	**2.278**
November	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	2.842	2.732	**2.701**
December	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	3.362	3.553	**2.980**
January	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	3.044	4.334	**3.144**
February	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	2.710	3.244	**2.731**
March	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	3.141	2.932	**2.799**
April	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	3.320	2.517	**2.469**
AVG	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.732**	**2.704**	2.464
MAX	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.362**	**4.334**	3.389
MIN	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**2.098**	**2.068**	1.961
Annual I/I	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.264**	**2.266**	**1.428**
% of MMAD Flow	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	21%	37%	23%
% +/- vs Prior Year	-15%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	-10%	79%	16%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2003 to APRIL 30, 2024

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	AVG
May	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	6.63	1.44	**3.05**
June	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	6.73	1.51	**2.48**
July	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	0.43	0.00	**0.39**
August	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	0.00	0.83	**0.65**
September	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	0.01	2.02	**2.25**
October	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	5.16	2.85	**4.76**
November	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	7.49	7.40	**6.95**
December	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	6.01	12.01	**7.23**
January	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	5.83	15.57	**6.39**
February	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	3.54	6.54	**4.29**
March	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	5.85	4.13	**5.07**
April	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	7.13	4.50	**3.87**
TOTAL	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**54.81**	**58.80**	47.56
AVG	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**4.57**	**4.90**	3.92
MAX	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**7.49**	**15.57**	9.25
MIN	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.00**	**0.00**	0.20

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	47.56	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B

City of Camas WWTP (WA0020249) - Annual Infiltration and Flow Report

May 2023 to April 2024

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

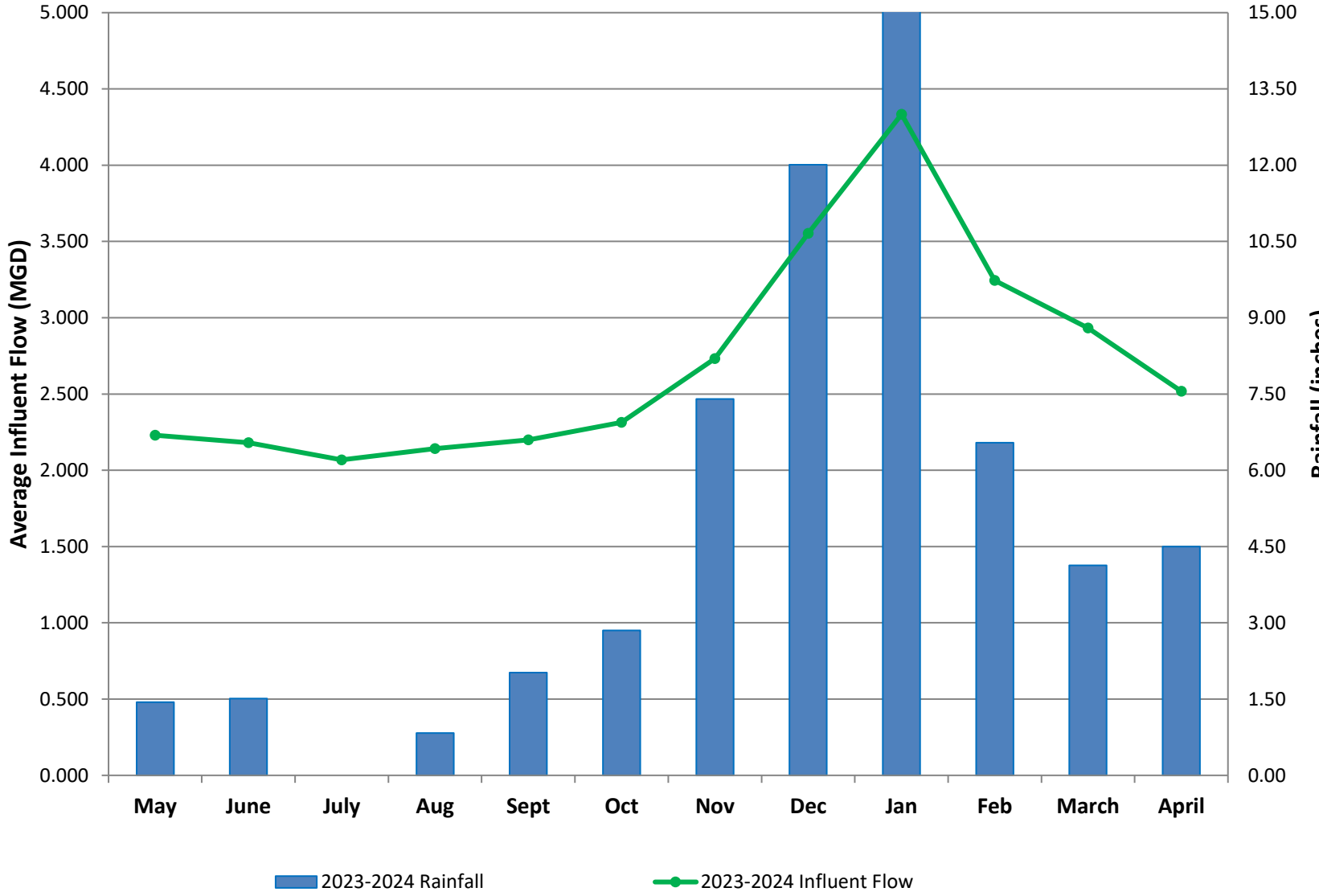
	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**
May	2.138	2.886	2.230	2.46	6.63	1.44	26,870	27,250	27,420	1,714	0	1,269
June	2.156	2.838	2.180	2.40	6.73	1.51	26,870	27,250	27,420	1,114	0	0
July	2.084	2.098	2.068	0.00	0.43	0.00	26,870	27,250	27,250	0	0	0
Aug	2.146	2.109	2.141	0.16	0.00	0.83	26,870	27,250	27,420	0	0	4,135
Sept	2.284	2.140	2.199	4.64	0.01	2.02	26,870	27,250	27,420	0	0	0
Oct	2.493	2.294	2.314	4.89	5.16	2.85	26,870	27,250	27,420	0	0	0
Nov	3.187	2.842	2.732	**10.43**	**7.49**	7.40	26,870	27,250	27,420	0	0	0
Dec	3.401	**3.362**	3.553	8.06	6.01	12.01	26,870	27,250	27,420	0	0	0
Jan	**3.484**	3.044	**4.334**	7.88	5.83	**15.57**	27,250	27,420	27,420	0	0	0
Feb	2.570	2.710	3.244	3.36	3.54	6.54	27,250	27,420	27,420	0	0	0
March	2.949	3.141	2.932	5.37	5.85	4.13	27,250	27,420	27,420	795	1,269	0
April	2.952	3.320	2.517	8.12	7.13	4.50	27,250	27,420	27,420	0	0	2,474
Period Total:	31.842	32.784	32.445	57.77	54.81	58.80			**Total Added (feet):**	3,623	1,269	7,878
Low Month:	2.084	2.098	2.068	0.00	0.00	0.00			**Total Added (miles):**	0.69	0.24	1.49
High Month:	**3.484**	**3.362**	**4.334**	**10.43**	**7.49**	**15.57**						
Annual Average:	2.654	2.732	2.704	4.81	4.57	4.90						
Period I/I:	1.400	1.264	2.266									

INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2021-2022	1.400	-7%	-7%	23%	57.77
2022-2023	1.264	-16%	-10%	21%	54.81
2023-2024	2.266	50%	79%	37%	58.80

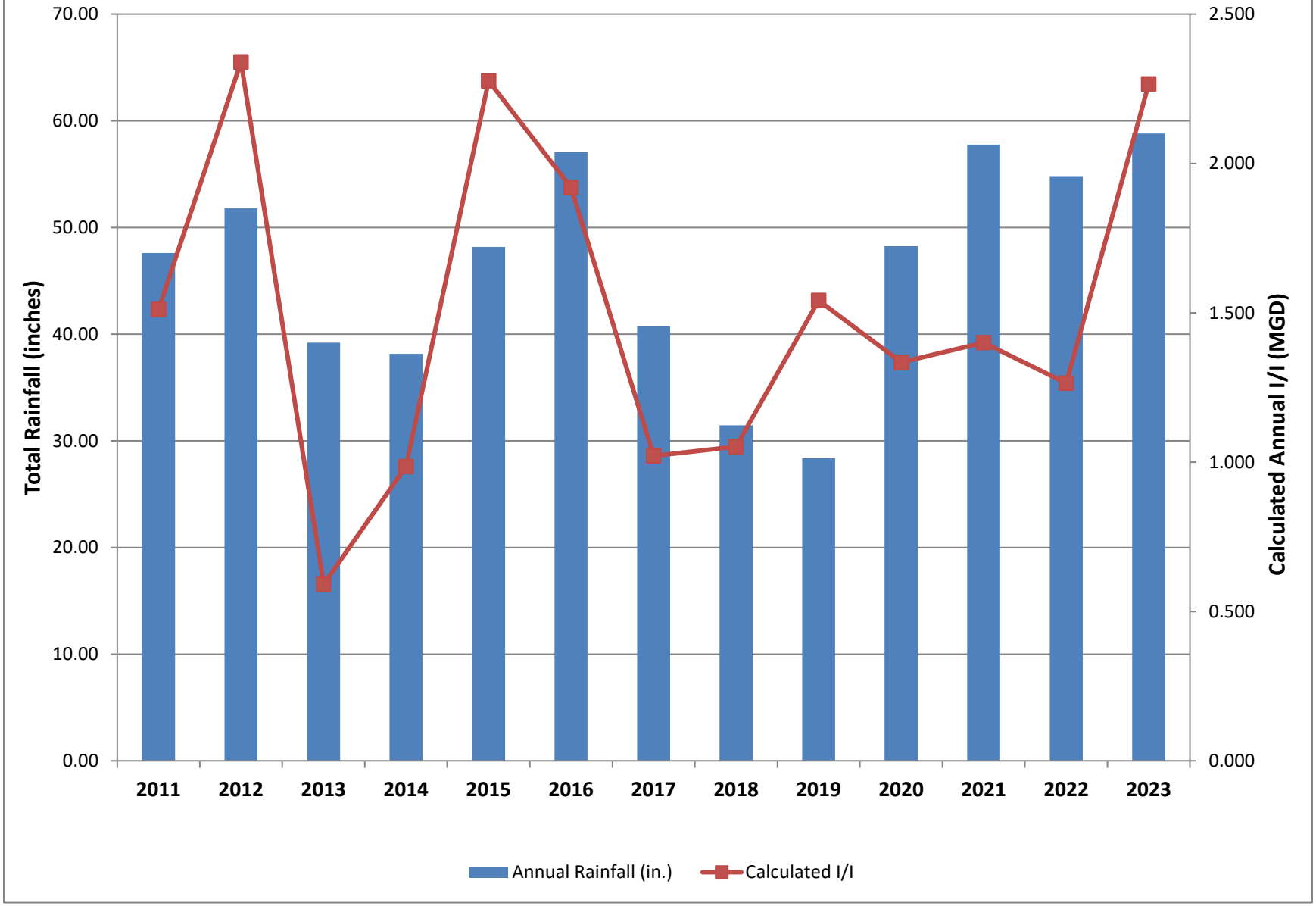
ATTACHMENT C, CHART I

May 2023 - April 2024 Monthly Average Influent Flow and Monthly Total Rainfall



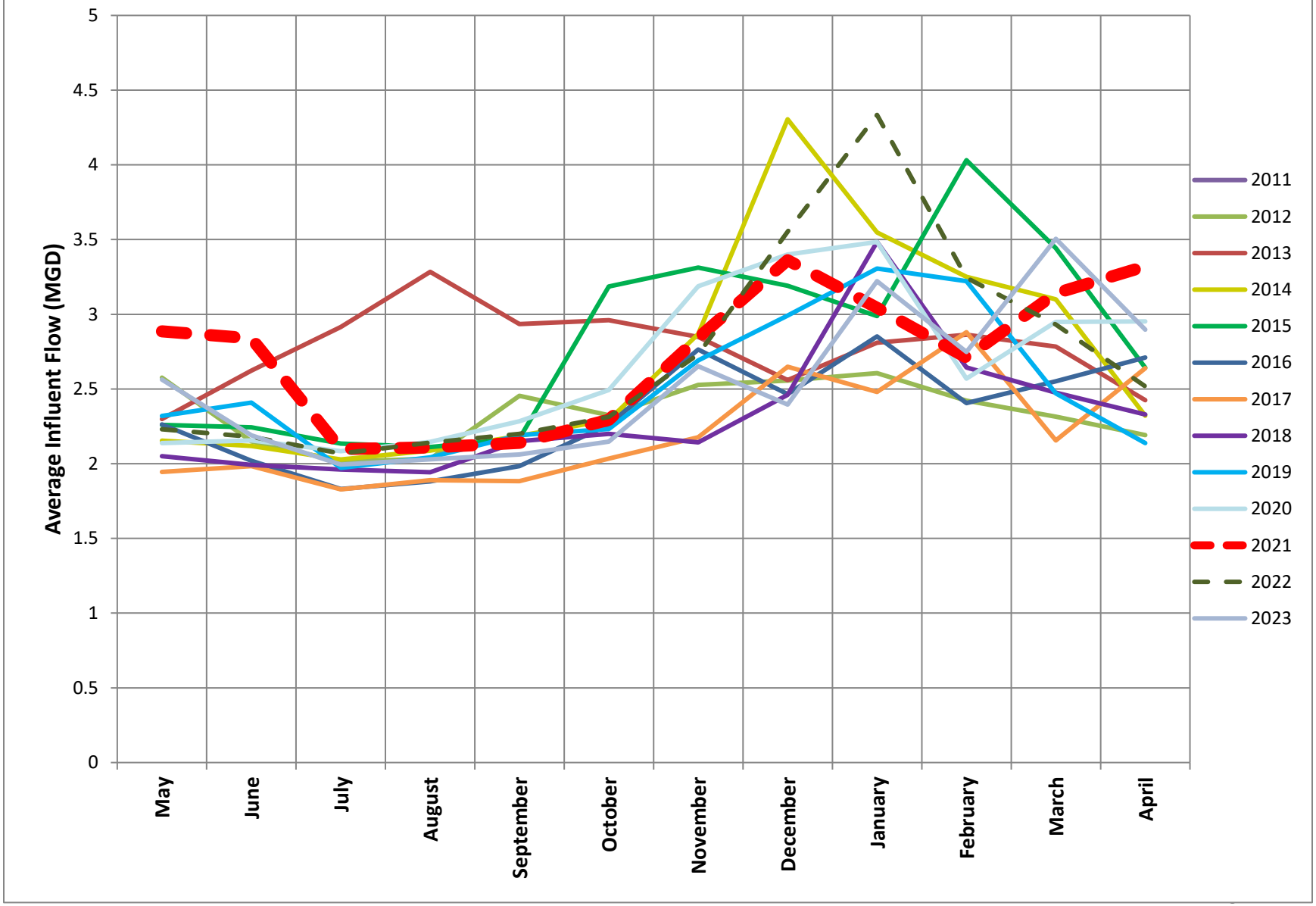
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2012)



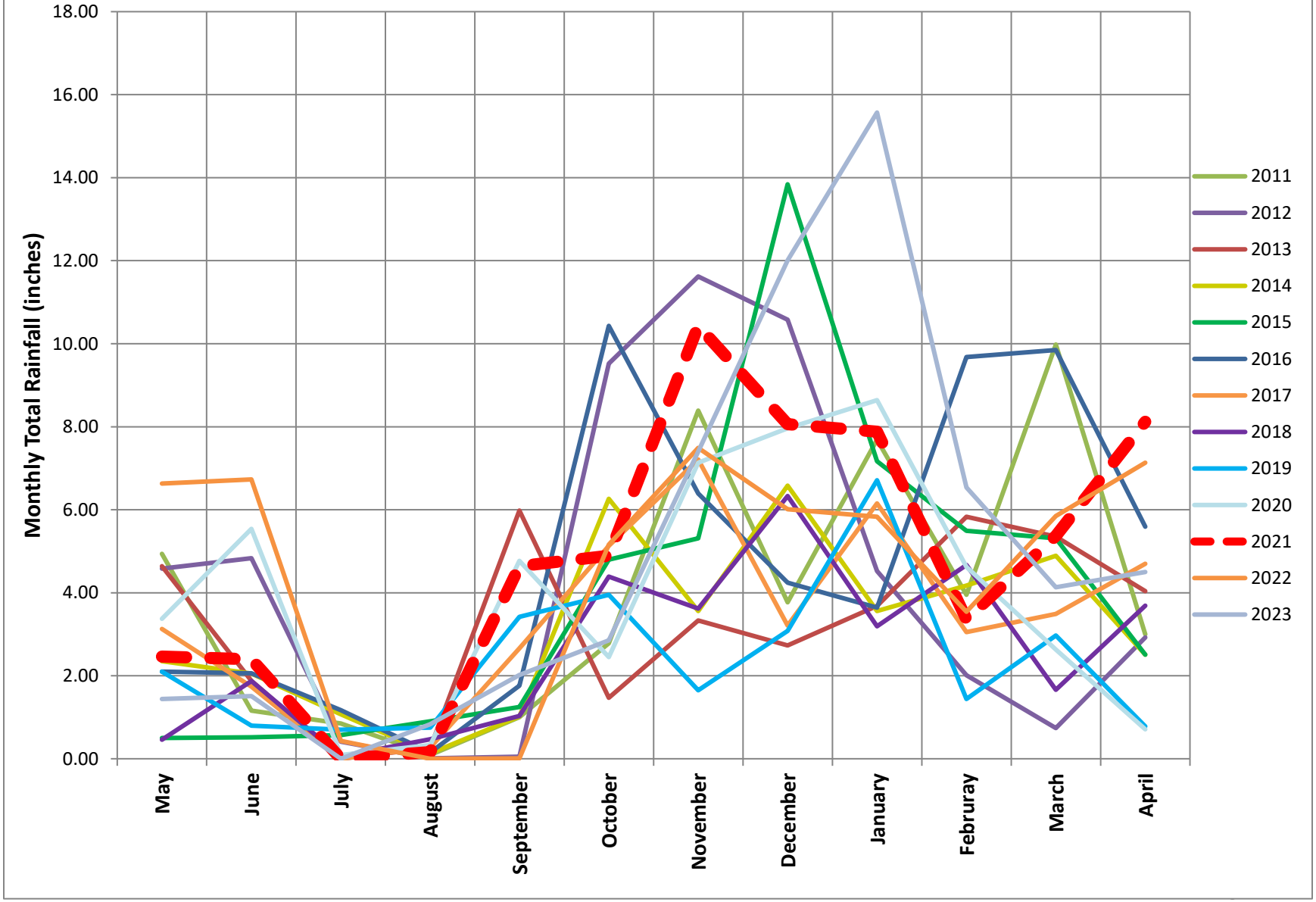
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



City of Camas Washington
Public Works Department
616 NE 4th Avenue
Camas, WA 98607

July 7, 2025

Carey Cholski
Washington State Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Subject: **May 2024 – April 2025 Annual Inflow and Infiltration Report**
City of Camas, WA Wastewater Treatment Facility (Permit No. WA0020249)

Ms. Cholski,

Pursuant to Section S4.E of our current NPDES Permit, enclosed is our annual Inflow and Infiltration (I/I) report. Section S4.E.3 of our permit states:

> *The Permittee must conduct an annual analysis of infiltration and inflow according to Ecology's guidance manual for treatment plant operators. This report shall consider the 12-month period May 1st through the following April 30th as the annual period and shall be submitted by July 15, 2017 and annually thereafter. This report shall include an update on the status of each inflow reduction project completed in fulfillment of S4.E.2 (above) including the funds expended or contractually obligated, and the proportion of the project completed as of the end of the reporting period. For each basin or sub-basin in which work has been done within the reporting period, the report shall include the estimated inflow rates before and after the project and the estimated effect on the overall Publicly Owned Treatment Works (POTW) inflow rate.*

According to Ecology's Information Manual for Treatment Plant Operators (Feb. 2004), an Annual I/I Report should include each of the following elements:

1. *The average monthly flow and total precipitation for each month for the past year together with a graph … plotting a comparison of precipitation versus influent flow.*
2. *The maximum monthly and peak hourly hydraulic design capacity for the plant.*

3. *The design population equivalent for the treatment plant and the population served by the facility, per month, for the past year.*
4. *The amount of I/I for each year since the base year and the percent of maximum monthly design capacity each year's I/I represents.*
5. *The percent increase or reduction in I/I for each year subsequent to the base year I/I.*
6. *The additional lengths of sewer lines added to the collection system, per month, for the past year. Also include a brief summary of any major sewer rehabilitation or I/I reduction projects.*

The following information and attachments are now being submitted to satisfy these requirements.

I. REPORTING PERIOD AND BASE YEAR

As described in Section S4.E.3 of our current NPDES permit, the annual period for our I/I report is May 1st through April 30th. Accordingly, please note that when this report refers to the "reporting period" or "year", it is referring to the 12-month period from May 1st through April 30th. For any particular year that is referenced in the report, it is denoting the May through April reporting year and the calendar year in which May falls.

For the purposes of selecting an appropriate Base Year, the past twenty years of historical precipitation and plant influent flow data are reviewed annually. A summary of the monthly precipitation totals and influent flow averages for the past twenty years are included in Attachment A.

Since our facility's 2016 I&I report, the May 2011-April 2012 reporting year has been used as the Base Year, as it has reflected Camas' average rainfall, population growth and disposition of the City's sanitary sewer collection system.

From analysis of the historical data, May 2011-April 2012 continues to best an average, annual rainfall in Camas and therefore continues to serve as the Base Year for the purposes of this report.

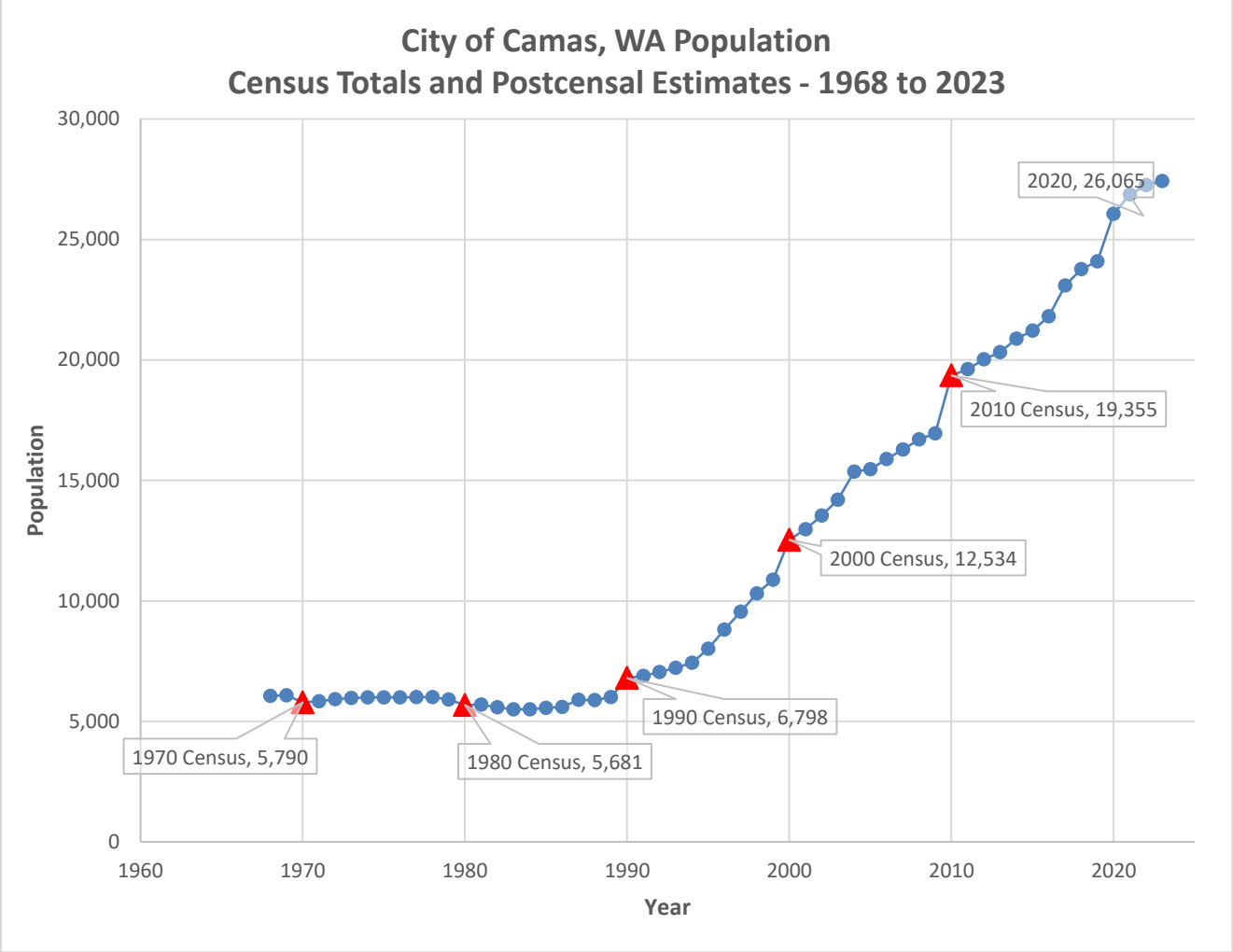
For the twenty-year period of May 1, 2003 to April 30, 2023, the average 12-month rainfall in Camas was 47.56 inches. From May 1, 2011 to April 30th 2012, the rainfall was 47.60, only 1.27 inches more than the twenty-year average. This represented the closest annual total to the twenty-year average, of all twenty years of data reviewed.

TABLE 1 - 12-Month May Through April Rainfall Totals, 2003-2023

	Average	Minimum	Base Year	Maximum
Annual Total Rainfall (in.)	47.56	28.35 (May 2019 – April 2020)	47.60 (May 2011-April 2012)	73.36 (May 2010-April 2011)

In addition to representing the 20-year median rainfall, using 2011-2012 as the "Base Year" incorporates the City's rapid growth that has occurred in the last 20 years. In I/I annual reports prior to 2016, the City of Camas had been using 1989 as the Base Year. Since 1989, the City of Camas has seen rapid growth in population and significant additions to its wastewater collection system. The May 2011-April 2012 period captures that growth,

which has taken place primarily after 1990. The chart below illustrates the City's annual, calendar year, population growth since 1968:



Historical Population Estimates for Camas, WA by Washington State Office of Financial Management
(https://ofm.wa.gov/washington-data-research/population-demographics/population-estimates/april-1-official-population-estimates)

II. INFLOW AND INFILTRATION ANALYSIS

Facility Design Parameters

The maximum monthly hydraulic design capacity for the Camas Wastewater Treatment Plant (WWTP) is 6.10 million gallons per day (MGD) and has a peak hourly hydraulic design capacity of 13.44 MGD. The Design Population Equivalent for the Camas WWTP is 28,075.

Calculated I/I and Annual Rainfall 20-Year History

The following chart is a summary of the calculated I/I, the percent of maximum monthly design capacity the calculated I/I represents, the percentage increase or decrease of I/I from the previous year and the total rainfall for each reporting year from May 2002 to April 2025:

TABLE 2 – Camas Calculated I/I & Rainfall

Year	Calculated I/I (MGD)	I/I as % of Design Capacity	I/I % Increase/Decrease from Prior Year	Total 12-Month Rainfall (in.)
2002	1.069	18%	-15%	41.48
2003	1.258	21%	+18%	37.74
2004	0.661	11%	-47%	36.81
2005	2.093	34%	+217%	53.16
2006	1.400	23%	-33%	47.80
2007	2.145	35%	+53%	48.05
2008	0.911	15%	-58%	49.72
2009	1.242	20%	+36%	49.92
2010	1.615	26%	+30%	73.36
2011	1.511	25%	-6%	47.60
2012	2.340	38%	+55%	51.79
2013	0.591	10%	-75%	39.19
2014	0.985	16%	+67%	38.15
2015	2.277	37%	+131%	48.17
2016	1.920	31%	-16%	57.06
2017	1.021	17%	-47%	40.74
2018	1.052	17%	+3%	31.44
2019	1.541	25%	+47%	28.35
2020	1.334	22%	-13%	48.24
2021	1.400	23%	+5%	57.77
2022	1.264	21%	-16%	54.81
2023	2.266	37%	+79%	58.80
2024	1.734	28%	-23%	55.00
Average				

Yellow Highlight = Base Year

Annual Report Form

Please see Attachment B for the Annual I/I Report form which summarizes the following data:

- The average monthly flow and total precipitation for each month, for the past three years.
- The calculated amount of I/I for each year.
- The percent of maximum monthly design capacity that each period's I/I represents.
- The population served by the facility, per month, for the past three years.
- The additional lengths of sewer lines added to the collection system, per month and per year, for the past three years.
- A summary of the I/I from the past three years, including a comparison with the selected Base Year (2011)

Charts

Please see Attachment C for several charts which plot I/I data to illustrate the following:

- Chart I: Comparison of precipitation versus influent flow for each month of the current reporting period.
- Chart II: Comparison of 12-month total precipitation and calculated I/I, for each year since the Base Year.
- Chart III: Monthly Average Influent Flow at the WWTP since the Base Year.
- Chart IV: Monthly Total Rainfall since the Base Year.

III. COLLECTION SYSTEM AND I/I REDUCTION PROJECTS AND MEASURES

Collection System Details

According to the City of Camas' General Sewer Plan, last updated in November of 2009, the city sanitary collection system was comprised of approximately 462,000 linear feet (87.5 miles) of pipe. Since 2009, approximately 165,515 linear feet of sewer line has been added, giving Camas approximately 627,515 linear feet (118 miles) of sewer line, as of the end of 2024.

In 2024/25, approximately 17,149 linear feet of new sanitary sewer line were added to the City's system. All of which were installed in connection with residential development projects occurring throughout the year.

Camas' collection system is comprised of a combination of both traditional gravity sewer, force mains, pressure sewer lines, and 28 lift stations. Please see Attachment B for the lengths of sewer lines added to the collection system, per month and per year, for the past three years.

If you have any questions regarding this report or require any additional information, please do not hesitate to contact the Camas Wastewater Treatment Facility at (360) 834-3263.

Best Regards,

Jacob Taylor

Jacob Taylor
Lead Wastewater Treatment Plant Operator

Cc: Rob Charles, Utilities Manager

ATTACHMENT A - Camas 20-Year WWTP Influent Flow and Rainfall

WWTP Design Capacity	
Peak Day Design Flow (MGD):	10.04
Max. Monthly Average Design (MMAD) Flow (MGD):	6.10
Design Population Equivalent:	28,075

Monthly Average Influent Flow (MGD) - MAY 1, 2004 to APRIL 30, 2024

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	AVG
May	1.622	1.953	2.607	2.177	2.064	2.056	2.255	2.370	2.563	2.446	2.576	2.299	2.155	2.259	2.263	1.946	2.050	2.319	2.138	2.886	2.230	2.733	**2.271**
June	1.520	1.996	2.083	2.095	1.997	2.092	1.918	2.833	2.190	2.480	2.149	2.623	2.118	2.244	2.019	1.983	1.992	2.409	2.156	2.838	2.180	2.205	**2.187**
July	1.483	1.832	1.925	2.023	1.954	1.903	1.904	1.973	1.994	2.129	2.015	2.915	2.028	2.135	1.831	1.828	1.961	1.972	2.084	2.098	2.068	2.021	**2.004**
August	1.450	2.011	1.981	2.050	1.948	2.015	1.921	1.955	2.029	2.093	2.033	3.284	2.088	2.112	1.881	1.890	1.943	2.043	2.146	2.109	2.141	2.049	**2.053**
September	1.549	1.948	2.031	2.087	2.035	1.971	1.963	2.055	2.062	2.079	2.454	2.935	2.187	2.169	1.985	1.884	2.151	2.192	2.284	2.140	2.199	2.288	**2.120**
October	1.619	2.089	2.212	2.101	2.252	2.013	2.078	2.226	2.148	2.518	2.324	2.961	2.292	3.185	2.262	2.035	2.199	2.231	2.493	2.294	2.314	2.619	**2.294**
November	1.903	2.202	2.700	3.423	2.484	2.391	2.510	3.057	2.653	3.312	2.528	2.849	2.867	3.312	2.764	2.178	2.143	2.691	3.187	2.842	2.732	3.525	**2.739**
December	2.573	2.494	3.086	3.148	3.465	2.433	2.580	3.364	2.396	3.540	2.556	2.560	4.305	3.191	2.465	2.648	2.461	2.991	3.401	3.362	3.553	3.756	**3.015**
January	2.708	2.262	4.018	2.798	4.094	2.814	3.146	3.042	3.222	2.995	2.606	2.810	3.548	2.988	2.852	2.480	3.484	3.306	3.484	3.044	4.334	3.269	**3.150**
February	2.414	2.165	2.584	2.754	2.643	2.061	2.567	2.648	2.748	2.522	2.422	2.863	3.251	4.031	2.405	2.880	2.644	3.222	2.570	2.710	3.244	3.438	**2.763**
March	1.887	2.345	2.576	2.819	2.442	2.504	2.388	3.570	3.505	4.419	2.314	2.784	3.099	3.442	2.552	2.156	2.476	2.470	2.949	3.141	2.932	3.420	**2.827**
April	1.627	2.156	2.377	2.327	2.302	2.327	2.308	2.904	2.898	2.428	2.191	2.425	2.321	2.643	2.710	2.639	2.330	2.139	2.952	3.320	2.517	2.749	**2.481**
AVG	**1.863**	**2.121**	**2.515**	**2.483**	**2.473**	**2.215**	**2.295**	**2.666**	**2.534**	**2.747**	**2.347**	**2.776**	**2.688**	**2.809**	**2.332**	**2.212**	**2.320**	**2.499**	**2.654**	**2.732**	**2.704**	**2.565**	**2.464**
MAX	**2.708**	**2.494**	**4.018**	**3.423**	**4.094**	**2.814**	**3.146**	**3.570**	**3.505**	**4.419**	**2.606**	**3.284**	**4.305**	**4.031**	**2.852**	**2.880**	**3.484**	**3.306**	**3.484**	**3.362**	**4.334**	**3.756**	**3.389**
MIN	**1.450**	**1.832**	**1.925**	**2.023**	**1.948**	**1.903**	**1.904**	**1.955**	**1.994**	**2.079**	**2.015**	**2.299**	**2.028**	**2.112**	**1.831**	**1.828**	**1.943**	**1.972**	**2.084**	**2.098**	**2.068**	**2.021**	**1.961**
Annual I/I	**1.258**	**0.661**	**2.093**	**1.400**	**2.145**	**0.911**	**1.242**	**1.615**	**1.511**	**2.340**	**0.591**	**0.985**	**2.277**	**1.920**	**1.021**	**1.052**	**1.541**	**1.334**	**1.400**	**1.264**	**2.266**	**1.734**	**1.428**
% of MMAD Flow	21%	11%	34%	23%	35%	15%	20%	26%	25%	38%	10%	16%	37%	31%	17%	17%	25%	22%	23%	21%	37%	28%	23%
% +/- vs Prior Year	-15%	-47%	217%	-33%	53%	-58%	36%	30%	-6%	55%	-75%	67%	131%	-16%	-47%	3%	47%	-13%	5%	-10%	62%	37%	16%

YELLOW = BASE YEAR

Monthly Total Rainfall (in.) - MAY 1, 2004 to APRIL 30, 2024

Month	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	AVG
May	2.00	1.65	6.14	2.94	2.11	2.11	4.44	3.93	4.94	4.58	4.64	2.35	0.50	2.10	3.13	0.46	2.10	3.37	2.46	6.63	1.44	4.93	**3.13**
June	0.52	1.52	3.22	1.24	2.01	2.19	1.18	7.03	1.16	4.83	1.88	2.05	0.52	2.06	1.74	1.87	0.80	5.54	2.40	6.73	1.51	2.20	**2.46**
July	0.00	0.24	0.71	0.67	0.74	0.04	0.09	0.35	0.85	0.41	0.00	1.07	0.57	1.17	0.00	0.06	0.70	0.09	0.00	0.43	0.00	0.18	**0.38**
August	0.09	3.91	0.74	0.02	0.99	1.98	0.60	0.90	0.09	0.01	0.26	0.13	0.90	0.15	0.27	0.47	0.75	0.33	0.16	0.00	0.83	1.36	**0.68**
September	1.36	2.45	2.37	2.35	3.46	0.81	1.18	3.64	1.00	0.05	5.98	1.02	1.25	1.76	2.66	1.03	3.42	4.77	4.64	0.01	2.02	2.38	**2.26**
October	3.09	5.32	5.02	2.44	5.15	4.43	4.11	6.39	2.78	9.52	1.47	6.26	4.80	10.43	5.13	4.39	3.95	2.45	4.89	5.16	2.85	5.12	**4.78**
November	5.57	3.19	5.10	12.77	6.29	11.17	7.59	10.76	8.39	11.62	3.33	3.56	5.31	6.39	7.21	3.62	1.65	7.13	10.43	7.49	7.40	9.20	**7.05**
December	8.99	4.87	8.88	6.57	10.54	7.27	5.98	10.26	3.77	10.58	2.73	6.58	13.84	4.24	3.21	6.33	3.08	7.96	8.06	6.01	12.01	11.04	**7.40**
January	6.73	2.28	11.35	2.69	4.82	6.30	8.87	6.87	7.69	4.52	3.68	3.56	7.17	3.64	6.15	3.19	6.71	8.64	7.88	5.83	15.57	3.92	**6.28**
February	5.68	1.81	2.92	5.54	2.59	2.19	4.97	6.05	3.95	2.01	5.83	4.17	5.49	9.68	3.05	4.67	1.44	4.62	3.36	3.54	6.54	6.30	**4.38**
March	2.28	4.65	3.86	6.79	3.71	6.97	6.17	9.75	9.98	0.74	5.35	4.89	5.31	9.85	3.49	1.66	2.97	2.63	5.37	5.85	4.13	6.58	**5.07**
April	1.43	4.92	2.85	3.78	5.64	4.26	4.74	7.43	3.00	2.92	4.04	2.51	2.51	5.59	4.70	3.69	0.78	0.71	8.12	7.13	4.50	1.79	**3.87**
TOTAL	**37.74**	**36.81**	**53.16**	**47.80**	**48.05**	**49.72**	**49.92**	**73.36**	**47.60**	**51.79**	**39.19**	**38.15**	**48.17**	**57.06**	**40.74**	**31.44**	**28.35**	**48.24**	**57.77**	**54.81**	**58.80**	**55.00**	**47.89**
AVG	**3.15**	**3.07**	**4.43**	**3.98**	**4.00**	**4.14**	**4.16**	**6.11**	**3.97**	**4.32**	**3.27**	**3.18**	**4.01**	**4.76**	**3.40**	**2.62**	**2.36**	**4.02**	**4.81**	**4.57**	**4.90**	**4.58**	**3.92**
MAX	**8.99**	**5.32**	**11.35**	**12.77**	**10.54**	**11.17**	**8.87**	**10.76**	**9.98**	**11.62**	**5.98**	**6.58**	**13.84**	**10.43**	**7.21**	**6.33**	**6.71**	**8.64**	**10.43**	**7.49**	**15.57**	**11.04**	**9.25**
MIN	**0.00**	**0.24**	**0.71**	**0.02**	**0.74**	**0.04**	**0.09**	**0.35**	**0.09**	**0.01**	**0.00**	**0.13**	**0.50**	**0.15**	**0.00**	**0.06**	**0.70**	**0.09**	**0.00**	**0.00**	**0.00**	**0.18**	**0.20**

20-Year Rainfall Summary		
20-Year Average Annual Rainfall (in.):	47.89	
20-Year Maximum Annual Rainfal (in.):	73.36	(2010)
20-Year Minimum Annual Rainfall (in.):	28.35	(2019)

ATTACHMENT B

City of Camas WWTP (WA0020249) - Annual Infiltration and Inflow Report

May 2024 to April 2025

WWTP Design Capacity

Peak Hourly Hydraulic Design Flow (MGD):	**13.44**
Maximum Monthly Average Design Flow (MGD):	**6.10**
Design Population Equivalent:	**28,075**

	Monthly Average WWTP Influent Flow (MGD)			Total Monthly Rainfall (inches)			Population Served			Additional Sewer Lines Added (ft.)		
Month	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**	**2022**	**2023**	**2024**
May	2.886	2.230	2.733	6.63	1.44	4.93	27,250	27,420	27,420	0	1,269	1,269
June	2.838	2.180	2.205	6.73	1.51	2.20	27,250	27,420	27,420	0	0	0
July	2.098	2.068	2.021	0.43	0.00	0.18	27,250	27,250	27,250	0	0	0
Aug	2.109	2.141	2.049	0.00	0.83	1.36	27,250	27,420	27,420	0	4,135	4,135
Sept	2.140	2.199	2.288	0.01	2.02	2.38	27,250	27,420	27,420	0	0	0
Oct	2.294	2.314	2.619	5.16	2.85	5.12	27,250	27,420	27,420	0	0	0
Nov	2.842	2.732	3.525	**7.49**	7.40	9.20	27,250	27,420	27,420	0	0	0
Dec	**3.362**	3.553	**3.756**	6.01	12.01	**11.04**	27,250	27,420	27,420	0	0	0
Jan	3.044	**4.334**	3.269	5.83	**15.57**	3.92	27,420	27,420	27,660	0	0	1351
Feb	2.710	3.244	3.438	3.54	6.54	6.30	27,420	27,420	27,660	0	0	0
March	3.141	2.932	3.420	5.85	4.13	6.58	27,420	27,420	27,660	0	0	6098
April	3.320	2.517	2.749	7.13	4.50	1.79	27,420	27,420	27,660	0	2,474	4296
Period Total:	32.784	32.445	34.072	54.81	58.80	55.00			**Total Added (feet):**	0	7,878	17,149
Low Month:	2.098	2.068	2.021	0.00	0.00	0.18			**Total Added (miles):**	0.00	1.49	3.25
High Month:	**3.362**	**4.334**	**3.756**	**7.49**	**15.57**	**11.04**						
Annual Average:	2.732	2.704	2.839	4.57	4.90	4.58						
Period I/I:	1.264	2.266	1.734									

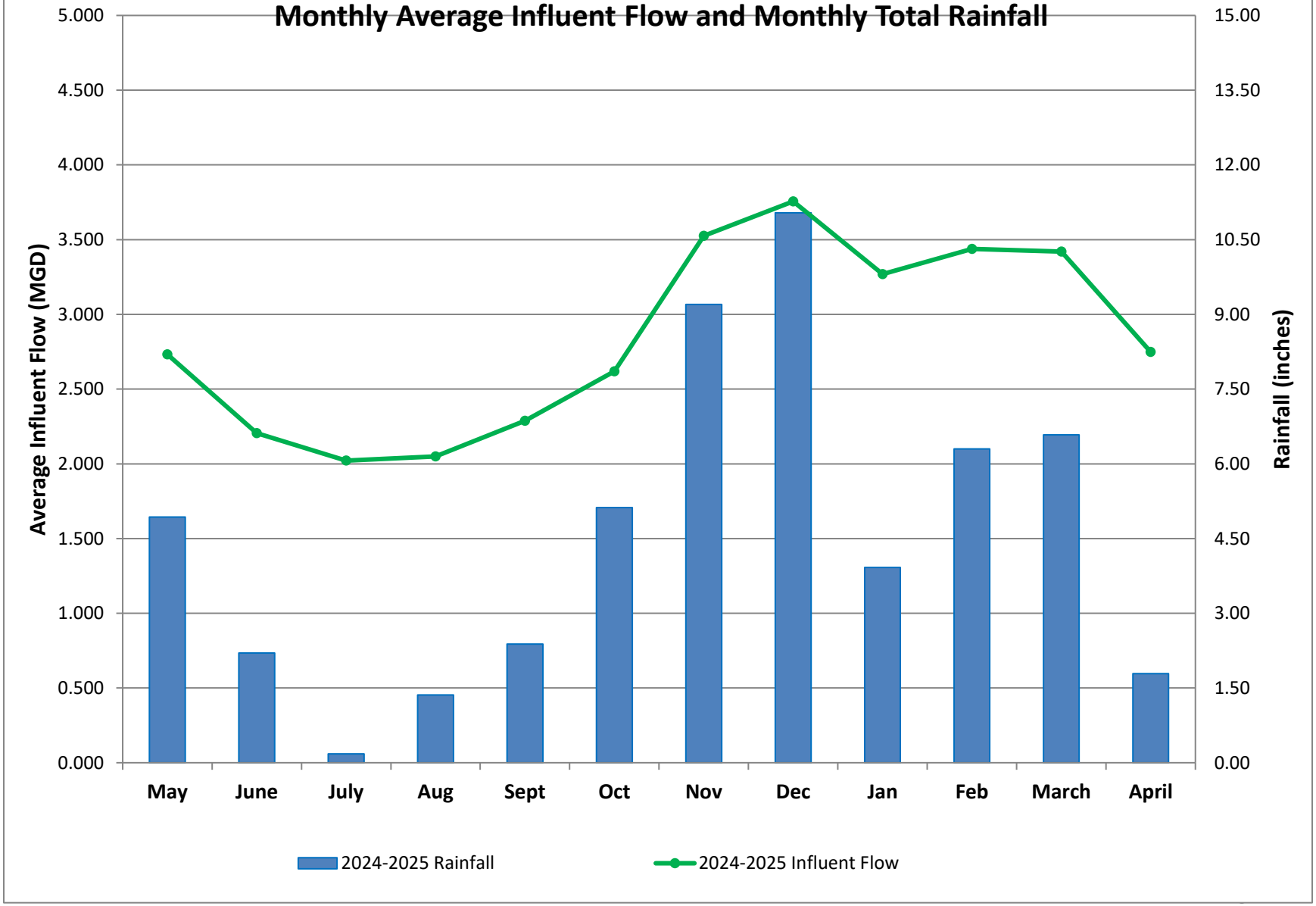
INFILTRATION/INFLOW SUMMARY

Year	I/I	% Increase/Decrease From Base I/I	% Increase/Decrease from Prior Year	% of Max Month. Design Flow	Total Rainfall
Base Year: 2011	***1.511***	***n/a***	***-6%***	***25%***	***47.60***
2022-2023	1.264	-16%	-16%	21%	54.81
2023-2024	2.266	50%	79%	37%	58.80
2024-2025	1.734	15%	-23%	28%	55.00

ATTACHMENT C, CHART I

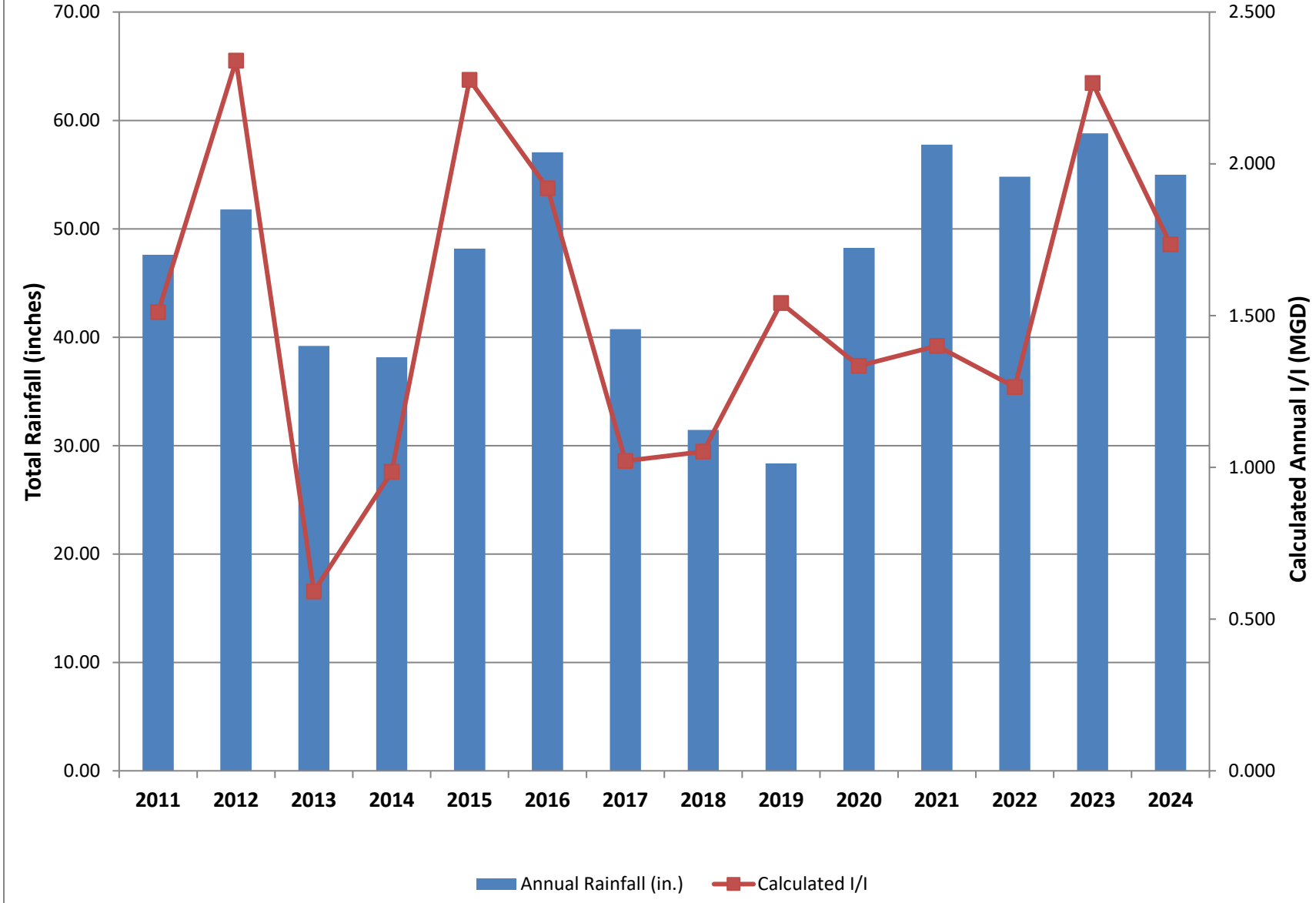
May 2024 - April 2025

Monthly Average Influent Flow and Monthly Total Rainfall



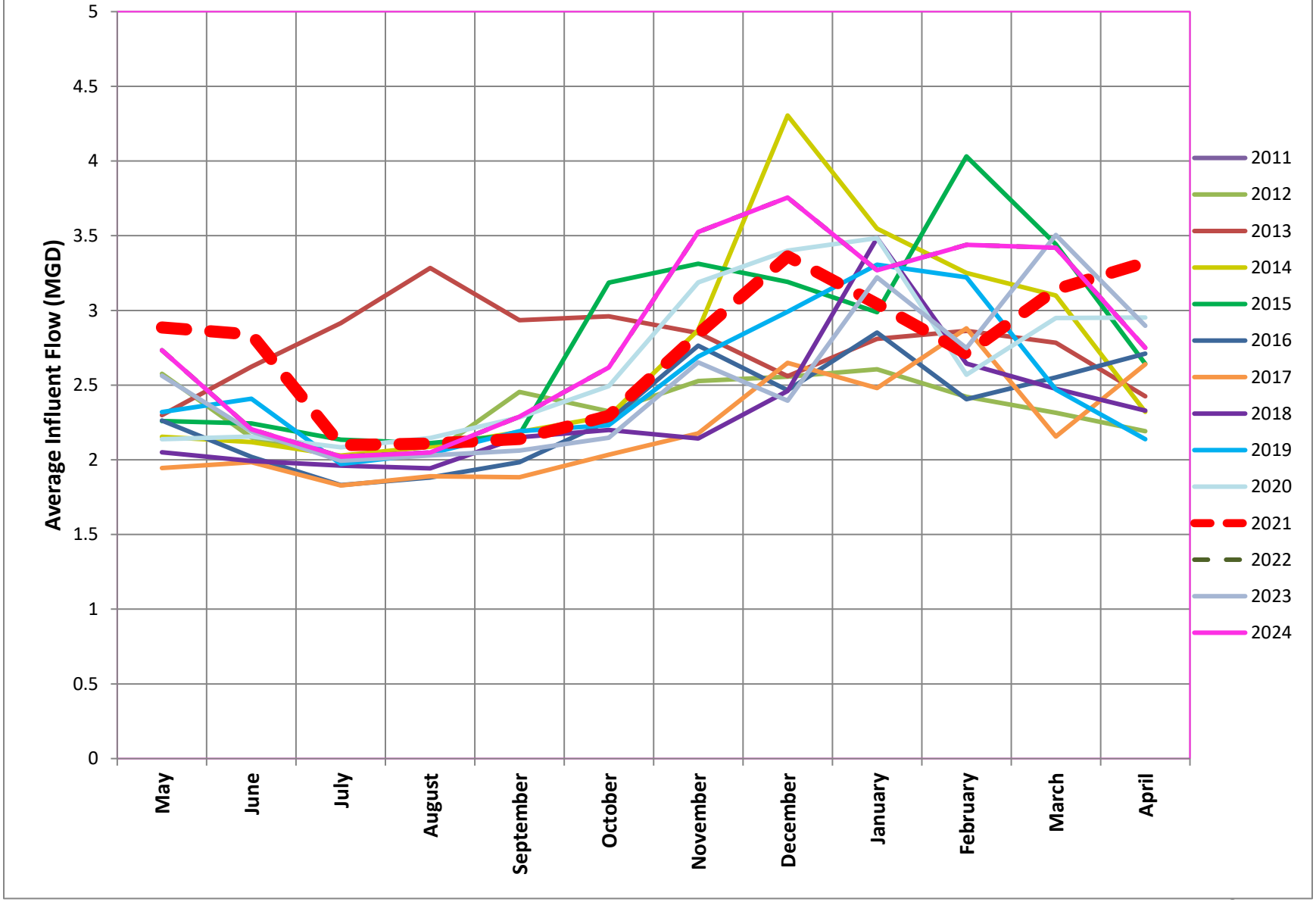
ATTACHMENT C, CHART II

Annual Rainfall & Calculated I/I Since Base Year (2011)



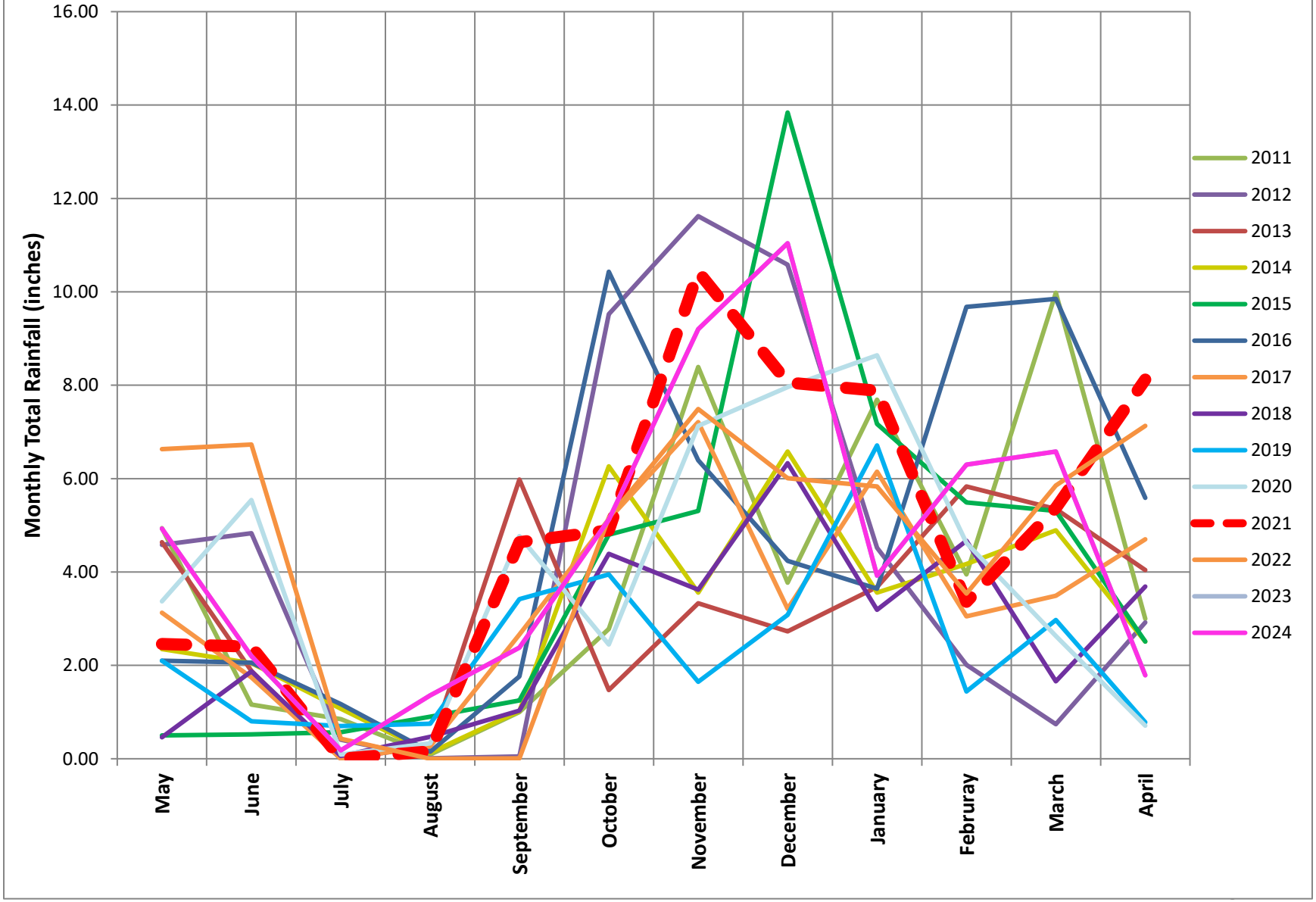
ATTACHMENT C, CHART III

WWTP Monthly Average Influent Flow Since Base Year (2011)



ATTACHMENT C, CHART IV

Monthly Total Rainfall Since Base Year (2011)



APPENDIX G

LOCAL LIMITS PROGRAM REPORTS

~ To be included in a future submittal. ~

APPENDIX H

WASTEWATER TREATMENT PLANT PERMITS

DEPARTMENT OF ECOLOGY
State of Washington

Issuance Date: July 1, 2025
Effective Date: August 1, 2025
Expiration Date: July 31, 2030

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT WA0020249

State of Washington
DEPARTMENT OF ECOLOGY

Southwest Region Office
PO Box 47775
Olympia, WA 98504-7775

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1342 et seq

City of Camas
616 Northeast 4th Avenue
Camas, Washington 98607

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

Facility Location: 1129 Southeast Polk Street Camas, WA 98607
Treatment Type: Activated sludge with nutrient removal, pH adjustment, filtration and UV disinfection
Receiving Water: Columbia River, RM 121

Digitally signed by Kolosseus, Andrew (ECY)
Date: 2025.06.24 14:57:21 -07'00'

Andrew Kolosseus
Water Quality Section Manager
Southwest Region Office
Washington State Department of Ecology

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SUMMARY OF PERMIT SUBMITTALS

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

Table 1 - Summary of permit submittals

Permit section	Submittal	Frequency	First submittal date
S3.A	Monthly Discharge Monitoring Report (DMR)	Monthly	September 15, 2025
S3.A	Quarterly Discharge Monitoring Report (DMR)	Quarterly	January 15, 2026
S3.A	Annual Discharge Monitoring Report (DMR)	Annual	January 15, 2027
S3.F	Reporting permit violations	As necessary	
S4.B	Plans for maintaining adequate capacity	As necessary	
S4.D	Notification of new or altered sources	As necessary	
S5.F	Bypass notification	As necessary	
S5.G	Operations and maintenance manual review confirmation letter	Annually	October 15, 2025
S6.A	Notify Ecology when Industrial Users violate discharge prohibitions	As necessary	
S6.B.1	Notify Ecology of any proposed discharger which may be a SIU	As necessary	
S6.C	Industrial User survey submittal	1/permit cycle	July 31, 2028
S6.E	Local Limit Evaluation	Every 5 years	August 1, 2026
S8	Application for permit renewal	1/permit cycle	February 1, 2030
S9.A	Spill control plan update	As necessary	
S10.A	Sediment sampling and analysis plan	1/permit cycle	February 15, 2026
S10.B	Sediment data report	1/permit cycle	February 15, 2027
S11	Outfall Evaluation	Every 5 years	October 31, 2029
S12.A	Acute toxicity: effluent test results for permit renewal application	Twice per permit cycle	August 1, 2028 February 1, 2029
S13.A	Chronic toxicity: effluent test results for permit renewal application	Twice per permit cycle	August 1, 2028 February 1, 2029
G1	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	
G20	Compliance schedules	As necessary	
G21	Contract submittal	As necessary	

SPECIAL CONDITIONS

S1. Discharge limits

S1.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, the Permittee may discharge treated domestic wastewater to the Columbia River at the permitted location subject to compliance with the following limits:

Table 2 – Effluent limits: Outfall 0001

Latitude: 45.57479° N Longitude: 122.391897° W

Parameter	Average Monthly [a]	Average Weekly [b]
Biochemical Oxygen Demand (5-day) (BOD_5)	20 mg/L	30 mg/L
BOD_5	842 lbs/day	1,264 lbs/day
BOD_5	85% removal of influent BOD_5	N/A
Total Suspended Solids (TSS)	20 mg/L	30 mg/L
TSS	1,017 lbs/day	1,525 lbs/day
TSS	85% removal of influent TSS	N/A
Heat Load [d]	5.87 x 10^8 kilocalories per day (kcal/day)	N/A

Parameter	Minimum	Maximum
pH	6.0 standard units	9.0 standard units

Parameter	Monthly Geometric Mean	Weekly Geometric Mean
Fecal Coliform Bacteria [c]	200/100 mL	400/100 mL

Parameter	Average Monthly	Average Weekly [b]
Total Ammonia (WQ-based) – June - September	20 mg/L	30 mg/L
Total Ammonia (WQ-based) – October - May	7 mg/L	11 mg/L

[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.

[b] Average weekly discharge limit means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week. See footnote c for bacteria calculations.

[c] Ecology provides directions to calculate the monthly and the 7-day geometric mean in the *Information Manual for Treatment Plant Operators* (Ecology, 2004).

[d] Applicable only from June 1 – September 30

S1.B. Mixing zone authorization

Mixing zone for Outfall 0001

The following paragraphs define the maximum boundaries of the mixing zones.

Chronic mixing zone

The width of the chronic mixing zone is limited ¼ of the width of the Columbia River (approximately 1,000 feet). The length of the chronic mixing zone extends 100 feet upstream and 321 feet downstream of the outfall. The mixing zone extends from the bottom to the top of the water column. The mixing zone must not utilize greater than 25% of the flow. The concentration of pollutants at the edge of the chronic zone must meet chronic aquatic life criteria and human health criteria.

Acute mixing zone

The width of the acute mixing zone is limited to a distance of 1,000 feet in any horizontal direction from the outfall. The length of the acute mixing zone extends 10 feet upstream and 32 feet downstream of the outfall. The mixing zone extends from the bottom to the top of the water column. The acute mixing zone must not utilize greater than 2.5% of the flow. The concentration of pollutants at the edge of the acute zone must meet acute aquatic life criteria.

Table 3 – Dilution factors

Criteria	Dilution factor
Acute Aquatic Life Criteria	27 (summer) 23 (winter)
Chronic Aquatic Life Criteria	185 (summer) 121 (winter)
Human Health Criteria - Carcinogen	185
Human Health Criteria - Non-carcinogen	185

S2. Monitoring requirements

S2.A. Monitoring schedule

The Permittee must monitor in accordance with the following schedule and the requirements specified in Appendix A.

Table 4 – Wastewater influent

Wastewater influent means the raw sewage flow from the collection system into the treatment facility. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.

Parameter	Units & speciation	Minimum sampling frequency	Sample type
Flow	MGD	Continuous [c]	Metered/Recorded
BOD_5	mg/L	4/week [h]	Composite Sample (24 hour) [a]
BOD_5	lbs/day	4/week	Calculated [b]
TSS	mg/L	4/week	Composite Sample (24 hour) [a]
TSS	lbs/day	4/week	Calculated [b]

Table 5 – Final wastewater effluent

Final wastewater effluent means wastewater exiting the last treatment process or operation. Typically, this is after or at the exit from the chlorine contact chamber or other disinfection process. The Permittee may take effluent samples for the BOD_5 analysis before or after the disinfection process. If taken after, the Permittee must dechlorinate and reseed the sample.

Parameter	Units & speciation	Minimum sampling frequency	Sample type
Flow	MGD	Continuous [c]	Metered/Recorded
BOD_5	mg/L	4/week [h]	Composite Sample (24 hour) [a]
BOD_5	lbs/day	4/week	Calculated [b]
BOD_5	% removal	Monthly [i]	Calculated [d]
TSS	mg/L	4/week	Composite Sample (24 hour) [a]
TSS	lbs/day	4/week	Calculated [b]
TSS	% removal	Monthly	Calculated [d]
Fecal Coliform [f]	# /100 ml	4/week	Grab [e]
E. coli [j]	#/100 ml	Monthly	Grab
pH [g]	standard units	Continuous [c]	Metered/Recorded
Temperature [k]	°C	Continuous	Metered/Recorded
Heat Load [l]	Kcal/day	Monthly (June – September)	Calculated
Total Ammonia	mg/L as N	4/week	Composite Sample (24 hour)

Table 6 – Permit renewal application requirements, final wastewater effluent

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. Data collected for pretreatment monitoring (Table 7) may be used to satisfy this monitoring requirement.

Parameter	Units & speciation	Minimum sampling frequency	Sample type
Dissolved Oxygen	mg/L	Once per year	Grab [e]
Total Kjeldahl Nitrogen	mg/L as N	Once per year	24-Hour Composite
Nitrate plus Nitrite	mg/L as N	Once per year	24-Hour Composite
Oil and Grease	mg/L	Once per year	Grab
Phosphorus (Total)	mg/L as P	Once per year	24-Hour Composite
Total Dissolved Solids	mg/L	Once per year	24-Hour Composite
Total Hardness	mg/L	Once per year	24-Hour Composite
Cyanide	µg/L	Once per year	Grab
Total Phenolic Compounds	µg/L	Once per year	Grab
Priority Pollutants (PP) – Total Metals [m]	µg/L; ng/L for Mercury	Once per year	24-Hour Composite Grab for Mercury
PP – Volatile Organic Compounds	µg/L	Once per year	Grab
PP – Acid-extractable Compounds	µg/L	Once per year	24-Hour Composite
PP – Base-neutral Compounds	µg/L	Once per year	24-Hour Composite
PP – Dioxin	pg/L	Once per year	24-Hour Composite
PP – Pesticides/PCBs	µg/L	Once per year	24-Hour Composite

Table 7 – Pretreatment Monitoring

The Permittee must monitor the following parameters in the influent at the headworks, effluent, and biosolids in accordance with pretreatment requirements in Special Condition S6.D.

Parameter	Units & speciation	Minimum sampling frequency	Sample location(s)	Sample type
pH	Standard Units	Quarterly [n]	Influent Biosolids	Grab [e]
Oil and Grease	mg/L	Quarterly [n]	Influent Effluent	Grab
Cyanide	µg/L	Quarterly [n]	Influent Effluent	Grab
Total Phenolic Compounds	µg/L	Quarterly [n]	Influent Effluent	Grab
Chromium (hex), dissolved	µg/L	Quarterly [n]	Influent Effluent	24-Hour composite

Molybdenum, total	µg/L; mg/kg for biosolids	Quarterly [n]	Influent Biosolids	24-Hour composite
Priority Pollutants (PP) – Total Metals [m]	µg/L; ng/L for mercury; mg/kg for biosolids	Quarterly [n]	Influent Effluent Biosolids	24-Hour composite; Grab for mercury
PP – Volatile Organic Compounds	µg/L	Once per year	Influent Effluent	Grab
PP – Acid-extractable Compounds	µg/L	Once per year	Influent Effluent	24-Hour composite
PP – Base-neutral Compounds	µg/L	Once per year	Influent Effluent	24-Hour composite
PP – Dioxin	pg/L	Once per year	Influent Effluent	24-Hour Composite
PP – Pesticides/PCBs	µg/L or ng/L	Once per year	Influent Effluent	24-Hour composite

Table 8 – Additional monitoring

Monitoring type	Description
Sediment study	As specified in condition S10
Acute whole effluent toxicity testing	As specified in condition S12
Chronic whole effluent toxicity testing	As specified in condition S13

Footnotes:

[a] Twenty-four (24)-hour composite means a series of individual samples collected over a 24-hour period into a single container and analyzed as one sample.

[b] Calculated means figured concurrently with the respective sample, using the following formula: Concentration (in mg/L) X Flow (in MGD) X Conversion Factor (8.34) = lbs/day

[c] Continuous means uninterrupted except for brief lengths of time for calibration, power failure, or unanticipated equipment repair or maintenance. The time interval for the associated data logger must be no greater than 30 minutes. Sample every three hours when continuous monitoring is not possible.

[d] Calculate the percent removal of BOD_5 and TSS as follows: Percent (%) removal = [(Influent concentration (mg/L) – Effluent concentration (mg/L)]/[Influent concentration (mg/L)] x 100%

[e] Grab means an individual sample collected over a fifteen (15) minute, or less, period.

[f] Report a numeric value for fecal coliforms following the procedures in the Information Manual for Wastewater Treatment Plant Operators, Publication 04-10-020 (Ecology, 2004). Do not report a result as Too Numerous to Count (TNTC).

[g] Report the instantaneous maximum and minimum pH daily. Do not average pH values.

[h] 4/week means four (4) times during each calendar week and on a rotational basis throughout the days of the week.

[i] Monthly means once every calendar month during alternate weeks.

[j] *E. coli* and Fecal Coliform analyses must occur on the same day. Split a single grab sample upon collection, prior to laboratory analysis.

[k] Conduct temperature grab sampling when the effluent is at or near its daily maximum temperature, which usually occurs in the late afternoon. If measuring temperature continuously, report a daily maximum from half-hour measurements over a 24-hour period. Continuous monitoring instruments must achieve an accuracy of 0.2 degrees C, and the Permittee must verify accuracy annually.

[l] The average monthly head load is calculated as the product of the average monthly effluent temperature (°C) multiplied by the average monthly flow (MGD) and the conversion factor of 3.776×10^6. The average monthly temperature is the sum of the average daily temperature divided by the number of discharges measured during the month. The average monthly flow is the same value as historically reported as average monthly flow. It is the sum of all the flows in the month divided by the number of days in the month.

[m] Priority Pollutant Scans for Total Metals must use total recoverable metal laboratory methods for all parameters except for hexavalent chromium. The 40 Code of Federal Regulations (CFR) 136 method for hexavalent chromium measures only its dissolved form.

[n] Quarterly sampling periods are January through March, April through June, July through September and October through December starting October 1, 2025. Begin quarterly monitoring for the quarter beginning on October 1, 2025, and submit results by January 15, 2026.

S2.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, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets, and maintenance-related conditions affecting effluent quality.

Sampling and analytical methods used to meet the monitoring requirements specified in this permit must conform to the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 CFR Part 136 (or as applicable in 40 CFR subchapter N [Parts 400–471] or 40 CFR subchapter O [Parts 501-503]) unless otherwise specified in this permit. Ecology may specify alternative methods for parameters without limits and for those parameters without an EPA approved test method in 40 CFR Part 136.

S2.C. Flow measurement, field measurement, and continuous monitoring devices

The Permittee must:

1. Select and use appropriate flow measurement, field 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, the manufacturer's recommendation, and approved O&M manual procedures for the device and the wastestream.
3. Calibrate continuous monitoring instruments weekly unless it can demonstrate a longer period is sufficient based on monitoring records. The Permittee:
   a. May calibrate apparatus for continuous monitoring of dissolved oxygen by air calibration.
   b. Must calibrate continuous pH measurement instruments according to the manufacturer's requirements.
4. Calibrate micro-recording temperature devices, known as thermistors, using protocols from *Standard Operating Procedure EAP080, Version 2.2, Continuous Temperature Monitoring of Freshwater Rivers and Streams* (Ecology, 2022). Calibration as specified in this document is not required if the Permittee uses recording devices certified by the manufacturer.
5. Use field measurement devices as directed by the manufacturer and do not use reagents beyond their expiration dates.
6. Establish a calibration frequency for each device or instrument in the O&M manual that conforms to the frequency recommended by the manufacturer.
7. Calibrate flow-monitoring devices at a minimum frequency of at least one calibration per year.
8. Maintain calibration records for at least three years.

S2.D. Laboratory accreditation

The Permittee must ensure that all monitoring data required by Ecology for permit specified parameters is prepared by a laboratory registered or accredited under the provisions of Chapter 173-50 Washington Administrative Code (WAC), Accreditation of Environmental Laboratories. Flow, temperature, settleable solids, conductivity, pH, and internal process control parameters are exempt from this requirement. The Permittee must obtain accreditation for conductivity and pH if it must receive accreditation or registration for other parameters.

S2.E. Request for reduction in monitoring

The Permittee may request a reduction of the sampling frequency after twelve (12) months of monitoring. Ecology will review each request and at its discretion grant the request when it reissues the permit or by a permit modification.

The Permittee must:

1. Provide a written request.

2. Clearly state the parameters for which it is requesting reduced monitoring.
3. Clearly state the justification for the reduction.

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.

S3.A. Discharge Monitoring Reports

The first monitoring period begins on the effective date of the permit (unless otherwise specified). The Permittee must:

1. Summarize, report, and submit monitoring data obtained during each monitoring period on the electronic Discharge Monitoring Report (DMR) form provided by Ecology within the Water Quality Permitting Portal[1]. Include data for each of the parameters tabulated in Special Conditions S2 and as required by the form. Report a value for each day sampling occurred (unless specifically exempted in the permit) and for the summary values (when applicable) included on the electronic form.
2. Submit DMRs no later than the dates specified below, unless otherwise specified in this permit.
3. Submit DMRs for parameters with the monitoring frequencies specified in S2 (monthly, quarterly, annual, etc.) at the reporting schedule identified below. The Permittee must:
   a. Submit **monthly** DMRs by the 15th day of the following month.
   b. Submit **quarterly** DMRs, unless otherwise specified in the permit, by the 15th day of the month following the monitoring period. Quarterly sampling periods are January through March, April through June, July through September, and October through December. The Permittee must submit the first quarterly DMR by (Reserved for Issuance) for the quarter beginning on (Reserved for Issuance).
   c. Submit **annual** DMRs, unless otherwise specified in the permit, by January 15th for the previous calendar year. The annual sampling period is a calendar year, starting (Reserved for Issuance).
4. Enter the “No Discharge” reporting code for an entire DMR, for a specific monitoring point, or a specific parameter as appropriate, if the Permittee did not discharge wastewater or a specific pollutant during a given monitoring period.
5. Report single analytical values below detection as “less than the Detection Level (DL)” by entering the < followed by the numeric value of the detection level (e.g. < 2.0) on the DMR. If the method used did not meet the minimum

[1] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance

DL and Quantitation Level (QL) identified in the permit report the actual QL and DL in the comments or in the location provided.

6. Report single analytical values between the DL and the QL by entering the estimated value, the code for estimated value/below quantitation limit (J) and any additional information in the comments.
7. When an outside laboratory performs the analysis, submit a copy of the laboratory report as an attachment using WQWebDMR. Contract laboratory reports must include the chain of custody and QA/QC results.
8. Submit bacteria monitoring results as follows:
   a. Do Not report zero for bacterial monitoring. Report as required by the laboratory method.
   b. Calculate and report an arithmetic average value for each day for bacteria if multiple samples were taken in one day.
   c. Calculate the geometric mean values for bacteria (unless otherwise specified in the permit) using the reported numeric value for all bacteria samples measured above the detection value except when it took multiple samples in one day. If multiple samples are taken in one day, use the arithmetic average for the day in the geometric mean calculation. Use the detection value for those samples measured below detection.
9. Report the test method used for analysis in the comments if the laboratory used an alternative method not specified in the permit and as allowed in Appendix A.
10. Calculate average values and calculated total values (unless otherwise specified in the permit) using:
    a. The reported numeric value for all parameters measured between the detection value and the quantitation value for the sample analysis.
    b. One-half (1/2) the detection value (for values reported below detection) if the lab detected the parameter in another sample from the same monitoring point for the reporting period.
    c. Zero (for values reported below detection) if the lab did not detect the parameter in another sample for reporting period.
11. Report single sample grouped parameters (for example: priority pollutants, PAHs, pulp and paper chlorophenolics, TTOs) on the WQWebDMR form and include: sample date, concentration detection, DL (as necessary), and laboratory QL (as necessary).

S3.B. Permit submittals and schedules

The Permittee must use the Water Quality Permitting Portal – Permit Submittals application (unless otherwise specified in the permit) to submit all permit-required reports by the date specified in the permit.

When another permit condition requires submittal of a paper (hard copy) report, the Permittee must ensure that it is postmarked or received by Ecology no later than the dates specified by this permit. Send these paper reports to Ecology at:

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

S3.C. Records retention

The Permittee must retain records of all monitoring information for a minimum of three years. Such information must include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. The Permittee must extend this period of retention during any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

S3.D. 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 date and time the analysis was performed.
4. The individual who performed the analysis.
5. The analytical technique or method used.
6. The results of all analyses.

S3.E. Additional monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Special 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 unless otherwise specified by Special Condition S2.

S3.F. Reporting permit violations

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

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

The permittee must make reasonable attempts to collect a sample of any unusual discharge or discharge condition including prohibited bypasses, upsets,

and maintenance-related conditions affecting effluent quality. The sample must be representative of the volume and nature of the uncharacteristic discharge and must represent a relevant subset of parameters required to be monitored under section S2.A. The additional monitoring results must be reported on the monthly DMR, along with a note of explanation. Refer to the Information Manual for Treatment Plant Operators, Publication 04-10-020 (Ecology, 2004), for guidance on incorporating extra sampling results into DMR calculations.

2. Immediate reporting

The Permittee must immediately report (see definition of “immediate reporting” in Appendix C of the Fact Sheet) to Ecology and the local health jurisdiction at the numbers listed below, all:

- Failures of the disinfection system.
- Plant bypasses resulting in a discharge to a waterbody.
- Any upset that causes an exceedance of an effluent limit in the permit (See G.15, "Upset").
- Collection system overflows.
- Any other failures of the sewage system (pipe breaks, etc.).

Southwest Region Office	360-407-6300
Clark County Public Health	564-397-8000

The Permittee must also immediately report any sanitary sewer overflow (SSO) that discharges to a municipal separate storm sewer system (MS4) to the appropriate MS4 owner or operator.

3. Twenty-four (24) hour reporting

The Permittee must report the following to Ecology at the telephone number listed in S3.F.2, within 24 hours from the time the Permittee becomes aware of any of the following:

- Any violation of a maximum daily or instantaneous maximum discharge limit for any of the pollutants in Special Condition S1.A of this permit.
- Any noncompliance that may endanger health or the environment, unless previously reported under immediate reporting requirements.

4. Five-day follow up report

The Permittee must also submit a written report within five days of the time that the Permittee becomes aware of any reportable event under S3.F.2 or S3.F.3.

(See definition of “Days (compliance period interval)” in Appendix C of the Fact Sheet.)

Submit the written report electronically using the Water Quality Permitting Portal – Permit Submittals application.

The permittee may use any reporting form that includes all the required content listed in this section.

The report 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 the Permittee expects the noncompliance to continue if not yet 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:
   (i) Indicate the type of event (e.g., combined sewer overflow, sanitary sewer overflow, or bypass event).
   (ii) Indicate the type of sewer overflow structure (e.g., manhole, combined sewer overflow outfall).
   (iii) Estimate the quantity (in gallons) of the untreated overflow.
   (iv) Indicate whether the noncompliance was related to wet weather; and
   (v) Indicate the types of human health and environmental impacts of the event.
f. Include a description of actions taken to stop, contain, and cleanup unauthorized discharges and to mitigate any associated environmental impacts.
g. If an ERTS number was assigned to the event when it was initially reported, include this number in the five-day follow up report for reference.
h. Identification of other agencies contacted per the emergency notification call list in S3.F.2.
i. If samples were taken to characterize the event, provide any analytical results that are available with the five-day report. If the data was collected at the same monitoring points and for parameters specified on the DMR, the sample results must also be reported on the DMR.

5. Waiver of written reports

   Ecology may waive the report required in S3.F.4 on a case-by-case basis if the Permittee has submitted a timely oral report. If a waiver is requested, the Permittee must obtain documentation of this waiver in writing or email from Ecology.

6. All other permit violation reporting

The Permittee must report all other permit violations when they submit monitoring reports under Special Condition S3.A. (Reporting). The reports must contain the information listed in S3.F.4. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or from the resulting liability for failure to comply.

S3.G. Other reporting

1. Spills of oil or hazardous materials

In addition to the requirements in S3.F, the Permittee must report a spill of oil or hazardous materials in accordance with the requirements of Revised Code of Washington (RCW) 90.56.280 and WAC 173-303-145. Visit the website How to Report a Spill[2] for further instructions.

2. Failure to submit relevant or correct facts

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

S3.H. 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

S4.A. Design criteria

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

Table 9 - Design criteria

Parameter	Unit
Maximum Month Design Flow (MMDF)	6.10 MGD
BOD_5 Influent Loading for Maximum Month	5,616 lbs/day
TSS Influent Loading for Maximum Month	8,011 lbs/day

S4.B. Plans for maintaining adequate capacity

1. The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:
   a. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.

[2] https://ecology.wa.gov/About-us/Get-involved/Report-an-environmental-issue/Report-a-spill

b. The projected plant flow or loading would reach design capacity within five years.

2. The plan and schedule must identify the actions necessary to maintain adequate capacity for the expected population growth and to meet the limits and requirements of the permit. The Permittee must consider the following topics and actions in its plan:
   a. Analysis of the present design and proposed process modifications.
   b. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system.
   c. Limits on future sewer extensions or connections or additional waste loads.
   d. Modification or expansion of facilities.
   e. Reduction of industrial or commercial flows or waste loads.

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and must be approved by Ecology prior to any construction.

S4.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.

S4.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 wastewater treatment plant is proposed which:
   a. Would interfere with the operation of, or exceed the design capacity of, any portion of the wastewater treatment plant.
   b. Is not part of an approved general sewer plan or approved plans and specifications.
   c. Is 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 wastewater treatment plant'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 treatment plant, 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), which 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.

S5.A. Certified operator

This permitted facility must be operated by an operator certified by the state of Washington for at least a Class IV 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 III plant must be in charge during all regularly scheduled shifts.

S5.B. Operation and maintenance 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.

S5.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 according to the approved O&M manual or as otherwise 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.

S5.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.

The Permittee must maintain Reliability Class II (EPA 430-99-74-001) 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.

S5.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.

S5.F. Bypass procedures

A bypass is the intentional diversion of waste streams from any portion of a treatment facility. This permit prohibits all bypasses except when the bypass is for essential maintenance, as authorized in special condition S5.F.1, or is approved by Ecology as an anticipated bypass following the procedures in S5.F.2.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions: This permit allows bypasses for essential maintenance of the treatment system when necessary to ensure efficient operation of the system. The Permittee may bypass the treatment system for essential maintenance only if doing so does not cause violations of effluent limits. The Permittee is not required to notify Ecology when bypassing for essential maintenance. However, the Permittee must comply with the monitoring requirements specified in special condition S2.B.
2. Anticipated bypasses for non-essential maintenance: Ecology may approve an anticipated bypass under the conditions listed below. This permit prohibits any anticipated bypass that is not approved through the following process.
    a. If a bypass is for non-essential maintenance, the Permittee must notify Ecology, if possible, at least ten (10) days before the planned date of bypass. The notice must contain:

        - A description of the bypass and the reason the bypass is necessary.
        - An analysis of all known alternatives which would eliminate, reduce, or mitigate the potential impacts from the proposed bypass.
        - A cost-effectiveness analysis of alternatives.
        - 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 recurrence 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 the project planning and design process. The project-specific engineering report as well as the plans and specifications must include details of probable construction bypasses 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 determine if the Permittee has met the conditions of special condition S5.F.2 a and b and consider the following prior to issuing a determination letter, an administrative order, or a permit modification as appropriate for an anticipated bypass:

    - If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.
    - If the 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.
    - If 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 which occurred during normal periods of equipment downtime or preventative maintenance.
        - Transport of untreated wastes to another treatment facility.

S5.G. Operations and maintenance (O&M) manual

1. The Permittee must:
   a. Review the O&M Manual at least annually and confirm this review by letter to Ecology by **October 15th** of each year.
   b. Submit to Ecology for review and approval substantial changes or updates to the O&M Manual.
   c. Keep the approved O&M Manual at the permitted facility.
   d. Follow the instructions and procedures of this manual.
2. In addition to the requirements of WAC 173-240-080(1) through (5), the O&M Manual must be consistent with the guidance in Section G1-4.4 in the *Criteria for Sewage Works Design (Orange Book)* (Ecology, 2023). The O&M Manual must include:
   a. Emergency procedures for cleanup in the event of wastewater system upset or failure.
   b. A review of system components which if failed could pollute surface water or could impact human health. Provide a procedure for a routine schedule of checking the function of these components.
   c. Wastewater system maintenance procedures that contribute to the generation of process wastewater.
   d. Reporting protocols for submitting reports to Ecology to comply with the reporting requirements in the discharge permit.
   e. Any directions to maintenance staff when cleaning or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine).
   f. The treatment plant process control monitoring schedule.
   g. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.

S6. Pretreatment

The Permittee must work with Ecology to ensure that all industrial users (see “industrial user” and “industrial wastewater” definitions in the fact sheet glossary) of the publicly owned treatment works (POTW) comply with the pretreatment requirements of the federal Clean Water Act, Washington state law and the federal General Pretreatment Regulations. Pretreatment requirements apply to sewers, pipes, and other conveyances in addition to devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature (see “POTW” definition in the fact sheet glossary).

S6.A. Duty to enforce discharge prohibitions

The Permittee must notify Ecology, within 30 days of becoming aware, if any industrial user violates the following discharge prohibitions and initiate enforcement action to promptly curtail any such discharge.

1. 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.
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 the collection system or otherwise cause interference with the POTW.
   d. Any pollutant, including oxygen-demanding pollutants, (BOD_5, 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 that the temperature at the POTW headworks exceeds 40 degrees Celsius (104 degrees Fahrenheit) unless Ecology, upon request of the Permittee, approves alternate temperature limits in writing.
   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 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.

S6.B. Identification of new industrial wastewater sources and notification of permit requirements

The Permittee must establish a process for authorizing industrial wastewater discharges.

The Permittee must:

1. Immediately notify Ecology of any proposed industrial wastewater discharges from a source which is or may be a significant industrial user (SIU).
2. Within 30 days of becoming aware, notify Ecology of existing industrial users which change operations or increase wastewater discharge volume in a manner which makes them an SIU.
3. Within 30 days of becoming aware, notify Ecology of existing, unpermitted industrial users that are an SIU.
4. Require all SIUs to obtain a state waste discharge permit (SWDP) from Ecology prior to accepting or as a condition of continuing to accept their industrial wastewater.

S6.C. Industrial user survey

The Permittee must complete an industrial user survey and must submit a report of the survey to Ecology by **July 31, 2028.** The Permittee should use Ecology's "Guidance Manual for Performing an Industrial User Survey" to develop and compile the survey. In addition to identifying new industrial users, the Permittee must reevaluate existing nondomestic users identified in previous surveys for significantly altered processes or discharge practices. The intent of the industrial user survey is to compile a master list of nondomestic users (commercial and industrial, including hauled waste) introducing pollutants to the POTW and identify significant industrial users. The survey must capture nondomestic users in the entire sewershed of the receiving POTW. If the Permittee receives wastewater to the POTW from other jurisdictions, the Permittee must identify nondomestic users in those jurisdictions as well.

The survey report must include:

1. A description of the survey procedures (information gathering methods) the Permittee used to develop the master list of nondomestic users.
2. Identification of other jurisdictions that contribute wastewater to the POTW, as well as the process used to identify nondomestic users in those jurisdictions.
3. Example survey forms.
4. A master list of nondomestic users. The master list must include:
   a. Names and addresses of all nondomestic users.

b. A description of the processes that affect or contribute to the user's wastewater.
c. The principal products and raw materials of each user that affects or contributes to the user's wastewater.
d. The average daily volume of wastewater discharged by each user, indicating the estimated amount attributable to process wastewater.
e. A statement of whether the user is subject to one or more categorical standards, and if so, under which category and subcategory.
f. A statement of whether the user is a significant industrial user and why (i.e. hydraulic or organic loading, categorical standards).
g. A statement whether the user is subject to local restrictions or requirements.
h. A statement whether any problems at the POTW, including upset, pass through, or interference, have been attributed to the user in the past 4.5 years.

S6.D. Monitoring requirements

The Permittee must:

1. Monitor the influent and effluent for the pollutants identified in Special Condition S2, any compounds identified because of Special Condition S6.E.8, and any other pollutants expected from non-domestic sources. Use the methods for collection, preservation, storage, and analysis, and monitoring frequencies, identified in Special Condition S2.
2. Monitor the sludge for the pollutants identified in Special Condition S2. Monitoring frequencies are identified in Special Condition S2.
3. Sample POTW influent and effluent on a day when industrial discharges are occurring at normal-to-maximum levels.
4. Obtain 24-hour composite samples for the analysis of acid and base/neutral extractable compounds and metals.
5. Ensure that all reported test data for metals represents the total amount of the constituents present in all phases, whether solid, suspended, or dissolved elemental or combined, including all oxidation states unless otherwise indicated.
6. Collect a sludge sample concurrently with a wastewater sample as a single grab of residual sludge. Sludge metals priority pollutant sampling and analysis must conform to EPA SW 846 6000 Series Methods and EPA SW 846 7000 Series Methods unless the Permittee requests an alternate method and Ecology has approved.
7. Collect grab samples for cyanide, phenols, and oils. Measure hexane soluble oils (or equivalent) only in the influent and effluent.
8. Make a reasonable attempt to identify all other substances and quantify all pollutants shown to be present by gas chromatograph/mass spectrometer

(GC/MS) analysis per 40 CFR 136, Appendix A, EPA Method 624.1 and EPA Method 625.1, in addition to quantifying pH, oil and grease, and all priority pollutants. The Permittee should attempt to make determinations of pollutants for each fraction, which produces identifiable spectra on total ion plots (reconstructed gas chromatograms). The Permittee may express results for non-substituted aliphatic compounds as total hydrocarbon content.

9. Use a laboratory whose computer data processing programs are capable of comparing sample mass spectra to a computerized library of mass spectra, with visual confirmation by an experienced analyst.
10. Conduct additional sampling and appropriate testing to determine concentration and variability, and to evaluate trends for all detected substances determined to be pollutants.

S6.E. Local Limit Evaluation

The Permittee must submit a written technical evaluation of the need to revise local limits under 40 CFR 403.5(c)(1) within 1 year of the permit effective date, on or before **August 1, 2026**, and every 5 years thereafter, or sooner if any of the following occur:

- A new industrial user(s) begins a discharge that may significantly impact the POTW, including but not limited to:
  - The flow is ≥5% of the average dry weather hydraulic or organic capacity of the POTW treatment plant, or
  - The flow represents a 25% or greater increase in the total industrial flow to the POTW, or
  - The discharge contains elevated levels of pollutants for which there are established local limits or permit limits, or
  - The discharge contains a new pollutant(s) of concern to the POTW.
- Any existing industrial user(s) modifies their discharge in a manner that may significantly impact the POTW as listed above.
- Changes or upgrades occur to the POTW's operations or treatment capacities.

The written technical evaluation submittal must include, at a minimum, the following:

1. Evaluation of the maximum allowable headworks loading and the maximum allowable industrial loading for each previously identified pollutant of concern.
   a. Evaluation must consider water quality in the receiving water, inhibition levels for biological processes at the treatment plant, sludge quality goals, and any other applicable, limiting factors.
   b. Evaluation of pollutants of additional pollutants of concern; including, hexavalent chromium. The Permittee must evaluate any other pollutants of concern based on impacts to water quality, sludge quality, and worker health and safety.

2. Narrative discussion of the need to revise allocated local limits.
3. All supporting calculations and a narrative of all assumptions used in the calculations.

The Permittee must notify Ecology of any local limit modifications that arise from a technical evaluation.

S7. Solid wastes

S7.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.

S7.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. Application for permit renewal or modification for facility changes

The Permittee must submit an application for renewal of this permit by **February 1, 2030.**

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

S9. Spill control plan

S9.A. Spill control plan submittals and requirements

The Permittee must:

1. Review the plan at least annually and update the spill plan as needed.
2. Send changes to the plan to Ecology.
3. Follow the plan and any supplements throughout the term of the permit.

S9.B. Spill control plan components

The spill control plan must include the following:

1. A list of all oil and petroleum products and other materials used and/or stored on-site, which when spilled, or otherwise released into the environment, designate as Dangerous Waste (DW) or Extremely Hazardous Waste (EHW)

by the procedures set forth in WAC 173-303-070. Include other materials used and/or stored on-site which may become pollutants or cause pollution upon reaching state's waters.

2. A description of preventive measures and facilities (including an overall facility plot showing drainage patterns) which prevent, contain, or treat spills of these materials.
3. A description of the reporting system the Permittee will use to alert responsible managers and legal authorities in the event of a spill.
4. A description of operator training to implement the plan.

The Permittee may submit plans and manuals required by 40 CFR Part 112, contingency plans required by Chapter 173-303 WAC, or other plans required by other agencies, which meet the intent of this section.

S10. Sediment monitoring

S10.A. Sediment sampling and analysis plan

The Permittee must submit to Ecology for review and approval a sediment sampling and analysis plan for sediment monitoring by **February 15, 2026**. The purpose of the plan is to characterize or recharacterize sediment (the nature and extent of chemical contamination and biological toxicity) quality in the vicinity of the Permittee's discharge locations. The Permittee must follow the guidance provided in Appendix A of the *Sediment Cleanup User's Manual* (Ecology, 2021) (or most recent edition), Sampling Guidance for NPDES Permits under the Sediment Management Standards.

S10.B. Sediment data report

Following Ecology approval of the sediment sampling and analysis plan, the Permittee must collect sediments between August 15th and September 30th. The Permittee must submit to Ecology a sediment data report containing the results of the sediment sampling and analysis no later than **February 15, 2027**. The sediment data report must conform to the approved sediment sampling and analysis plan. In addition, the Permittee must follow the guidance provided in the Sediment Cleanup User's Manual, Appendix A: Sampling Guidance for NPDES Permits under the Sediment Management Standards (Ecology, 2021) (or most recent edition). The report must document when the data was successfully loaded into EIM as required below.

In addition to the sediment data report, submit the sediment chemical data, biological data, or both, to Ecology's Environmental Information System (EIM)[3]. Data

[3] https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database

must be submitted to EIM according to the instructions on the EIM website. The EIM website provides information on submitting data, and a link to the EIM Help Center.

In addition to the EIM data submittal, Ecology's MyEIM[4] tools must be used to confirm that the submitted data was accurately entered into EIM. Any differences between the MyEIM analytical results and sediment data report must be identified and explained.

S11. Outfall Evaluation

The Permittee must inspect, every five years, the submerged portion of the outfall line and diffuser to document its integrity and continued function. If conditions allow for a photographic verification, the Permittee must include such verification in the report. By **October 31, 2029**, the Permittee must submit the inspection report to Ecology through the Water Quality Permitting Portal – Permit Submittals application. The Permittee must submit hard copies of any video files to Ecology as required by Permit Condition S3.B. The Portal does not support submittal of video files.

The inspector must at minimum:

- Assess the physical condition of the outfall pipe, diffuser, and associated couplings.
- Determine the extent of sediment accumulation in the vicinity of the diffuser.
- Ensure diffuser ports are free of obstructions and are allowing uniform flow.
- Confirm physical location (latitude/longitude) and depth of the diffuser section of the outfall.

S12. Acute toxicity

S12.A. Testing when there is no permit limit for acute toxicity

The Permittee must:

1. Conduct acute toxicity testing on the final effluent once in June 2028 and once in December 2028.
2. Conduct acute toxicity testing on a series of at least five concentrations of effluent, including 100 percent effluent and a control.
3. Use each of the following species and protocols for each acute toxicity test:

Table 10 - Freshwater acute toxicity tests

Acute Toxicity Tests	Species	Method
Fathead Minnow 96-Hour Static-Renewal Test	Pimephales Promelas	EPA-821-R-02-012

[4] https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database/Using-MyEIM

Daphnid 48-Hour Static Test	Ceriodaphnia Dubia, Daphnia Pulex, OR Daphnia Magna	EPA-821-R-02-012

4. Submit a written report to Ecology no later than August 1, 2028, and February 1, 2029.

S12.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria*, Publication 95-80 (Ecology, 2016). Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.
2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 – 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016).
4. All toxicity tests must meet quality assurance criteria and test conditions specified in the EPA methods listed in Subsection C and *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016). If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Section A or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in the order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the ACEC. The summer ACEC equals 3.7 percent effluent. The winter ACEC equals 4.3 percent effluent.
8. All whole effluent toxicity tests, effluent screening tests, and rapid screening tests that involve hypothesis testing must comply with the acute statistical power standard of 29 percent as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

S13. Chronic toxicity

S13.A. Testing when there is no permit limit for chronic toxicity

The Permittee must:

1. Conduct chronic toxicity testing on final effluent once in June 2028 and once in December 2028.
2. Conduct chronic toxicity testing on a series of at least five concentrations of effluent and a control. This series of dilutions must include the seasonal ACEC. The summer ACEC equals 3.7 percent effluent; the winter ACEC equals 4.3 percent effluent. The series of dilutions should also contain the summer or winter CCEC of 0.83 and 0.54 percent effluent, respectively.
3. Compare the ACEC to the control using hypothesis testing at the 0.05 level of significance as described in Appendix H, EPA/600/4-89/001.
4. Submit a written report to Ecology no later than **August 1, 2028,** and **February 1, 2029.**
5. Perform chronic toxicity tests with all the following species and the most recent version of the following protocols:

Table 11 - Freshwater chronic toxicity tests

Freshwater Chronic Test	Species	Method
Fathead Minnow Survival and Growth	*Pimephales Promelas*	EPA-821-R-02-013
Water Flea Survival and Reproduction	*Ceriodaphnia Dubia*	EPA-821-R-02-013

S13.B. Sampling and reporting requirements

1. The Permittee must submit all reports for toxicity testing in accordance with *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016). Reports must contain toxicity data, bench sheets, and reference toxicant results for test methods. In addition, the Permittee must submit toxicity test data in electronic format (CETIS export file preferred) for entry into Ecology's database.
2. The Permittee must collect 24-hour composite effluent samples for toxicity testing. The Permittee must cool the samples to 0 – 6 degrees Celsius during collection and send them to the lab immediately upon completion. The lab must begin the toxicity testing as soon as possible but no later than 36 hours after sampling was completed.
3. The laboratory must conduct water quality measurements on all samples and test solutions for toxicity testing, as specified in *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016).

4. All toxicity tests must meet quality assurance criteria and test conditions specified in the EPA methods listed in Subsection C and *Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria* (Ecology, 2016). If Ecology determines any test results to be invalid or anomalous, the Permittee must repeat the testing with freshly collected effluent.
5. The laboratory must use control water and dilution water meeting the requirements of the EPA methods listed in Section A or pristine natural water of sufficient quality for good control performance.
6. The Permittee must conduct whole effluent toxicity tests on an unmodified sample of final effluent.
7. The Permittee may choose to conduct a full dilution series test during compliance testing in the order to determine dose response. In this case, the series must have a minimum of five effluent concentrations and a control. The series of concentrations must include the CCEC and the ACEC. The CCEC and the ACEC may either substitute for the effluent concentrations that are closest to them in the dilution series or be extra effluent concentrations. The summer CCEC equals 0.83 percent effluent. The winter CCEC equals 0.54 percent effluent. The summer ACEC equals 3.7 percent effluent. The winter ACEC equals 4.3 percent effluent
8. All whole effluent toxicity tests that involve hypothesis testing must comply with the chronic statistical power standard of 39 percent as defined in WAC 173-205-020. If the test does not meet the power standard, the Permittee must repeat the test on a fresh sample with an increased number of replicates to increase the power.

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GENERAL CONDITIONS

G1. Signatory requirements

1. All applications submitted to Ecology must be signed and certified.
   a. In the case of corporations, by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

      - 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, 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.

   b. In the case of a partnership, by a general partner.
   c. In the case of sole proprietorship, by the proprietor.
   d. 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.

2. 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:
   a. The authorization is made in writing by a person described above and submitted to Ecology.
   b. 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.)

3. Changes to authorization. If an authorization under paragraph G1.2, 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 G1.2, above, must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
4. 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:

1. 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.
2. 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.
3. To inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
4. 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.

1. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
   a. Violation of any permit term or condition.

b. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
c. A material change in quantity or type of waste disposal.
d. 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.
e. 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.
f. Nonpayment of fees assessed pursuant to RCW 90.48.465.
g. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

2. The following are causes for modification but not revocation and reissuance except when the Permittee requests or agrees:
   a. A material change in the condition of the waters of the state.
   b. New information not available at the time of permit issuance that would have justified the application of different permit conditions.
   c. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.
   d. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions or requiring permit revision.
   e. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.
   f. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.
   g. Incorporation of an approved local pretreatment program into a municipality's permit.
3. The following are causes for modification or alternatively revocation and reissuance:
   a. When cause exists for termination for reasons listed in 1.a through 1.g of this section, and Ecology determines that modification or revocation and reissuance is appropriate.
   b. 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 G7) 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 one hundred eighty (180) 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.
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 excuses 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 emanates, 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.

1. Transfers by Modification

   Except as provided in paragraph (2) 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.

2. Automatic Transfers

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

a. The Permittee notifies Ecology at least thirty (30) days in advance of the proposed transfer date.
b. 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.
c. 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 40 CFR 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 shall 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 may 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 Special Condition S3.F.
4. The Permittee complied with any remedial measures required under S3.F 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 shall, 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 shall 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. Service agreement review

The Permittee must submit to Ecology any proposed service agreements and proposed revisions or updates to existing agreements 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 as required by RCW 70.150.040(9). In the event that Ecology does not comment within a thirty-day (30) period, the Permittee may assume consistency and proceed with the service agreement or the revised/updated service agreement.

APPENDIX A – List of Pollutants, Analytical Methods, Detection Levels and Quantitation Levels

The Permittee must use the specified analytical methods, detection levels (DLs) [1] and quantitation levels (QLs) [2] in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit, and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

If the Permittee is unable to obtain the required DL and QL due to matrix effects, the Permittee must submit a matrix-specific detection level (MDL) and a quantitation level (QL) to Ecology with appropriate laboratory documentation when the detection levels are too high to provide results near or below criteria (or applicable permit limits).

The lists below include conventional pollutants (as defined in CWA section 502(6) and 40 CFR Part 122), toxic or priority pollutants as defined in CWA section 307(a)(1) and listed in 40 CFR Part 122 Appendix D, 40 CFR Part 401.15 and 40 CFR Part 423 Appendix A), and nonconventionals. 40 CFR Part 122 Appendix D (Table V) also identifies toxic pollutants and hazardous substances which are required to be reported by dischargers if expected to be present. This permit appendix A list does not include those parameters.

The list also includes:

- Dioxin and furan congeners identified using EPA Method 1613.

Appendix A Table 1 – Conventional pollutants

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Biochemical Oxygen Demand		SM5210-B		2 mg/L
Biochemical Oxygen Demand, Soluble		SM5210-B [3]		2 mg/L

Fecal Coliform		SM 9221E, 9221F SM 9222D	N/A	Specified in method sample aliquot dependent
Oil and Grease (HEM) (Hexane Extractable Material)		1664 A or B	1,400	5,000
pH		SM4500-H+ B	N/A	N/A
Total Suspended Solids		SM2540-D		5 mg/L

Appendix A Table 2 - Nonconventional pollutants

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Alkalinity, Total		SM2320-B		5 mg/L as $CaCO_3$
Aluminum, Total	7429-90-5	200.8	2.0	10
Ammonia, Total (as N)		SM4500-NH3-B and C/D/E/G/H		20
Barium Total	7440-39-3	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)		EPA SW 846 8021/8260	1	2
Boron, Total	7440-42-8	200.8	2.0	10.0
Chemical Oxygen Demand		SM5220-D		10 mg/L
Chloride		SM4500-Cl B/C/D/E and SM4110 B		Sample and limit dependent
Chlorine, Total Residual		SM4500 Cl G	10	50
Cobalt, Total	7440-48-4	200.8	0.05	0.25
Color		SM2120 B/C/E		10 color units
Dissolved oxygen		SM4500-OC/OG		0.2 mg/L
E.coli		SM 9221B, 9221F, 9223B	N/A	Specified in method; sample aliquot dependent

Enterococci		EPA 1600 SM 9230B, 9230C, 9230D,	N/A	Specified in method; sample aliquot dependent
Flow		Calibrated device		
Fluoride	16984-48-8	SM4500-F E	25	100
Hardness, Total		SM2340B		200 as $CaCO_3$
Iron, Total	7439-89-6	200.7	12.5	50
Magnesium, Total	7439-95-4	200.7	10	50
Manganese, Total	7439-96-5	200.8	0.1	0.5
Molybdenum, Total	7439-98-7	200.8	0.1	0.5
Nitrate + Nitrite Nitrogen (as N)		SM4500-NO_3- E/F/H		100
Nitrogen, Total Kjeldahl (as N)		SM4500-N_{org}B/C and SM4500NH_3-B/C/D/EF/G/H		300
NWTPH Dx [4]		Ecology NWTPH Dx	250	250
NWTPH Gx [5]		Ecology NWTPH Gx	250	250
Phosphorus, Total (as P)		SM 4500 PB followed by SM4500-PE/PF	3	10
Salinity		SM2520-B		3 practical salinity units or scale (PSU or PSS)
Settleable Solids		SM2540 -F		Sample and limit dependent
Soluble Reactive Phosphorus (as P)		SM4500-P E/F/G	3	10
Sulfate (as mg/L SO_4)		SM4110-B		0.2 mg/L
Sulfide (as mg/L S)		SM4500-S2F/D/G		0.2 mg/L
Sulfite (as mg/L SO_3)		SM4500-SO3B		2 mg/L
Temperature		Analog recorder or micro-recording devices (thermistors)		0.2°C
Tin, Total	7440-31-5	200.8	0.3	1.5
Titanium, Total	7440-32-6	200.8	0.5	2.5

Total Coliform		SM 9221B SM 9222B	N/A	Specified in method; sample aliquot dependent
Total Organic Carbon		SM5310-B/C/D		1 mg/L
Total Dissolved solids		SM2540 C		20 mg/L

Appendix A Table 3 - Priority pollutants: Metals, chromium (hex), cyanide & total phenols

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Antimony, Total	114	7440-36-0	200.8	0.3	1.0
Arsenic, Total	115	7440-38-2	200.8	0.1	0.5
Beryllium, Total	117	7440-41-7	200.8	0.1	0.5
Cadmium, Total	118	7440-43-9	200.8	0.05	0.25
Chromium (hex) dissolved	119	18540-29-9	SM3500-Cr C	0.3	1.2
Chromium, Total	119	7440-47-3	200.8	0.2	1.0
Copper, Total	120	7440-50-8	200.8	0.4	2.0
Lead, Total	122	7439-92-1	200.8	0.1	0.5
Mercury, Total	123	7439-97-6	1631E	0.0002	0.0005
Nickel, Total	124	7440-02-0	200.8	0.1	0.5
Selenium, Total	125	7782-49-2	200.8	1.0	1.0
Silver, Total	126	7440-22-4	200.8	0.04	0.2
Thallium, Total	127	7440-28-0	200.8	0.09	0.36
Zinc, Total	128	7440-66-6	200.8	0.5	2.5
Cyanide, Total	121	57-12-5	335.4	5	10
Cyanide, Weak Acid Dissociable	121		SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	121		SM4500-CN G	5	10
Phenols, Total	65		EPA 420.1		50

Appendix A Table 4 - Priority pollutants: Acid compounds

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
2-Chlorophenol	24	95-57-8	625.1	3.3	9.9
2,4-Dichlorophenol	31	120-83-2	625.1	2.7	8.1
2,4-Dimethylphenol	34	105-67-9	625.1	2.7	8.1
4,6-dinitro-o-cresol (2-methyl-4,6,-dinitrophenol)	60	534-52-1	625.1/1625B	24	72
2,4 dinitrophenol	59	51-28-5	625.1	42	126
2-Nitrophenol	57	88-75-5	625.1	3.6	10.8
4-Nitrophenol	58	100-02-7	625.1	2.4	7.2
Parachlorometa cresol (4-chloro-3-methylphenol)	22	59-50-7	625.1	3.0	9.0
Pentachlorophenol	64	87-86-5	625.1	3.6	10.8
Phenol	65	108-95-2	625.1	1.5	4.5
2,4,6-Trichlorophenol	21	88-06-2	625.1	2.7	8.1

Appendix A Table 5 - Priority pollutants: Volatile compounds

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Acrolein	2	107-02-8	624.1	5	10
Acrylonitrile	3	107-13-1	624.1	1.0	2.0
Benzene	4	71-43-2	624.1	4.4	13.2
Bromoform	47	75-25-2	624.1	4.7	14.1
Carbon tetrachloride	6	56-23-5	624.1/601 or SM6230B	2.8	8.4
Chlorobenzene	7	108-90-7	624.1	6.0	18.0
Chloroethane	16	75-00-3	624/601	1.0	2.0
2-Chloroethylvinyl Ether	19	110-75-8	624.1	1.0	2.0
Chloroform	23	67-66-3	624.1 or SM6210B	1.6	4.8

Dibromochloromethane (chlordibromomethane)	51	124-48-1	624.1	3.1	9.3
1,2-Dichlorobenzene	25	95-50-1	624.1	1.9	7.6
1,3-Dichlorobenzene	26	541-73-1	624.1	1.9	7.6
1,4-Dichlorobenzene	27	106-46-7	624.1	4.4	17.6
Dichlorobromomethane	48	75-27-4	624.1	2.2	6.6
1,1-Dichloroethane	13	75-34-3	624.1	4.7	14.1
1,2-Dichloroethane	10	107-06-2	624.1	2.8	8.4
1,1-Dichloroethylene	29	75-35-4	624.1	2.8	8.4
1,2-Dichloropropane	32	78-87-5	624.1	6.0	18.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene)6	33	542-75-6	624.1	5.0	15.0
Ethylbenzene	38	100-41-4	624.1	7.2	21.6
Methyl bromide (Bromomethane)	46	74-83-9	624/601	5.0	10.0
Methyl chloride (Chloromethane)	45	74-87-3	624.1	1.0	2.0
Methylene chloride	44	75-09-2	624.1	2.8	8.4
1,1,2,2-Tetrachloroethane	15	79-34-5	624.1	6.9	20.7
Tetrachloroethylene	85	127-18-4	624.1	4.1	12.3
Toluene	86	108-88-3	624.1	6.0	18.0
1,2-Trans-Dichloroethylene (Ethylene dichloride)	30	156-60-5	624.1	1.6	4.8
1,1,1-Trichloroethane	11	71-55-6	624.1	3.8	11.4
1,1,2-Trichloroethane	14	79-00-5	624.1	5.0	15.0
Trichloroethylene	87	79-01-6	624.1	1.9	5.7
Vinyl chloride	88	75-01-4	624/SM6200B	1.0	2.0

Appendix A Table 6 - Priority pollutants: Base/neutral compounds

Priority pollutants	PP #	CAS number (if available)	Recommended analytical Protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Acenaphthene	1	83-32-9	625.1	1.9	5.7

Acenaphthylene	77	208-96-8	625.1	3.5	10.5
Anthracene	78	120-12-7	625.1	1.9	5.7
Benzidine	5	92-87-5	625.1	44	132
Benzyl butyl phthalate	67	85-68-7	625.1	2.5	7.5
Benzo(a)anthracene	72	56-55-3	625.1	7.8	23.4
Benzo(b)fluoranthene (3,4-benzofluoranthene) [7]	74	205-99-2	610/625.1	4.8	14.4
Benzo(k)fluoranthene (11,12-benzofluoranthene) [7]	75	207-08-9	610/625.1	2.5	7.5
Benzo(a)pyrene	73	50-32-8	610/625.1	2.5	7.5
Benzo(ghi)Perylene	79	191-24-2	610/625.1	4.1	12.3
Bis(2-chloroethoxy)methane	43	111-91-1	625.1	5.3	15.9
Bis(2-chloroethyl)ether	18	111-44-4	611/625.1	5.7	17.1
Bis(2-chloro-1-methylethyl)Ether (Bis(2-chloroisopropyl)ether) [8]	42	108-60-1	625.1	5.7	17.1
Bis(2-ethylhexyl)phthalate	66	117-81-7	625.1	2.5	7.5
4-Bromophenyl phenyl ether	41	101-55-3	625.1	1.9	5.7
2-Chloronaphthalene	20	91-58-7	625.1	1.9	5.7
4-Chlorophenyl phenyl ether	40	7005-72-3	625.1	4.2	12.6
Chrysene	76	218-01-9	610/625.1	2.5	7.5
Dibenzo(a-h)anthracene (1,2,5,6-dibenzanthracene)	82	53-70-3	625.1	2.5	7.5
3,3-Dichlorobenzidine	28	91-94-1	605/625.1	16.5	49.5
Diethyl phthalate	70	84-66-2	625.1	1.9	5.7
Dimethyl phthalate	71	131-11-3	625.1	1.6	4.8
Di-n-butyl phthalate	68	84-74-2	625.1	2.5	7.5
2,4-dinitrotoluene	35	121-14-2	609/625.1	5.7	17.1
2,6-dinitrotoluene	36	606-20-2	609/625.1	1.9	5.7
Di-n-octyl phthalate	69	117-84-0	625.1	2.5	7.5
1,2-Diphenylhydrazine (as Azobenzene)	37	122-66-7	1625B/625.1	5.0	20
Fluoranthene	39	206-44-0	625.1	2.2	6.6
Fluorene	80	86-73-7	625.1	1.9	5.7

Hexachlorobenzene	9	118-74-1	612/625.1	1.9	5.7
Hexachlorobutadiene	52	87-68-3	625.1	0.9	2.7
Hexachlorocyclopentadiene	53	77-47-4	1625B/625.1	2.0	4.0
Hexachloroethane	12	67-72-1	625.1	1.6	4.8
Indeno(1,2,3-cd)Pyrene	83	193-39-5	610/625.1	3.7	11.1
Isophorone	54	78-59-1	625.1	2.2	6.6
Naphthalene	55	91-20-3	625.1	1.6	4.8
Nitrobenzene	56	98-95-3	625.1	1.9	5.7
N-Nitrosodimethylamine	61	62-75-9	607/625.1	2.0	4.0
N-Nitrosodi-n-propylamine	63	621-64-7	607/625.1	0.5	1.0
N-Nitrosodiphenylamine	62	86-30-6	625.1	1.0	2.0
Phenanthrene	81	85-01-8	625.1	5.4	16.2
Pyrene	84	129-00-0	625.1	1.9	5.7
1,2,4-Trichlorobenzene	8	120-82-1	625.1	1.9	5.7

Appendix A Table 7 - Base/neutral compounds – Ecology PBTs

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Benzo(j)fluoranthene [7]	205-82-3	625	0.5	1.0
Benzo(r,s,t)pentaphene	189-55-9	625	1.3	5.0
Dibenzo (a,h)acridine	226-36-8	610M/625M	2.5	10.0
Dibenzo (a,j)acridine	224-42-0	610M/625M	2.5	10.0
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-Methyl cholanthrene	56-49-5	625	2.0	8.0
Perylene	198-55-0	625	1.9	7.6

Appendix A Table 8 - Dioxin

Priority pollutant	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (2,3,7,8 TCDD)	129	1746-01-6	1613B	1.3 pg/L	5 pg/L

Appendix A Table 9 - Pesticides and PCBs

Priority pollutants	PP #	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
Aldrin	89	309-00-2	608.3	4.0 ng/L	12 ng/L
alpha-BHC	102	319-84-6	608.3	3.0 ng/L	9.0 ng/L
beta-BHC	103	319-85-7	608.3	6.0 ng/L	18 ng/L
gamma-BHC (Lindane)	104	58-89-9	608.3	4.0 ng/L	12 ng/L
delta-BHC	105	319-86-8	608.3	9.0 ng/L	27 ng/L
Chlordane [9]	91	57-74-9	608.3	14 ng/L	42 ng/L
4,4'-DDT	92	50-29-3	608.3	12 ng/L	36 ng/L
4,4'-DDE	93	72-55-9	608.3	4.0 ng/L	12 ng/L
4,4' DDD	94	72-54-8	608.3	11ng/L	33 ng/L
Dieldrin	90	60-57-1	608.3	2.0 ng/L	6.0 ng/L
alpha-Endosulfan	95	959-98-8	608.3	14 ng/L	42 ng/L
beta-Endosulfan	96	33213-65-9	608.3	4.0 ng/L	12 ng/L
Endosulfan Sulfate	97	1031-07-8	608.3	66 ng/L	198 ng/L
Endrin	98	72-20-8	608.3	6.0 ng/L	18 ng/L
Endrin Aldehyde	99	7421-93-4	608.3	23 ng/L	70 ng/L
Heptachlor	100	76-44-8	608.3	3.0 ng/L	9.0 ng/L
Heptachlor Epoxide	101	1024-57-3	608.3	83 ng/L	249 ng/L
PCB-1242 [10]	106	53469-21-9	608.3	0.065	0.195
PCB-1254	107	11097-69-1	608.3	0.065	0.195
PCB-1221	108	11104-28-2	608.3	0.065	0.195

PCB-1232	109	11141-16-5	608.3	0.065	0.195
PCB-1248	110	12672-29-6	608.3	0.065	0.195
PCB-1260	111	11096-82-5	608.3	0.065	0.195
PCB-1016 [10]	112	12674-11-2	608.3	0.065	0.195
Toxaphene	113	8001-35-2	608.3	240 ng/L	720 ng/L

Appendix A Table 10 - Nonconventionals – dioxin & furan congeners

Pollutant	CAS number (if available)	Recommended analytical protocol	Detection level (DL) [1] µg/L unless specified	Quantitation level (QL) [2] µg/L unless specified
2,3,7,8- Tetrachlorodibenzo-p-dioxin (TCDD) (this is a priority pollutant also listed in Table 8)	1746-01-6	EPA 1613	1.3 pg/L	5 pg/L
Total TCDD	41903-57-5			
2,3,7,8- Tetrachlorodibenzofuran (TCDF)	51207-31-9		1.3 pg/L	5 pg/L
Total-TCDF	55722-27-5			
1,2,3,7,8- Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4			
Total-PeCDD	36088-22-9			
1,2,3,7,8- Pentachlorodibenzofuran (PeCDF)	57117-41-6			
2,3,4,7,8-PeCDF	57117-31-4			
Total-PeCDF	30402-15-4			
1,2,3,4,7,8- Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6			
1,2,3,6,7,8-HxCDD	57653-85-7			
1,2,3,7,8,9-HxCDD	19408-74-3			
Total-HxCDD	34465-46-8			
1,2,3,4,7,8- Hexachlorodibenzofuran (HxCDF)	70648-26-9			
1,2,3,6,7,8-HxCDF	57117-44-9			
1,2,3,7,8,9-HxCDF	72918-21-9			
2,3,4,6,7,8-HxCDF	60851-34-5			

Total-HxCDF	55684-94-1			
1,2,3,4,6,7,8- Heptachlorodibenzo-p-dioxin (HpCDD)	35822-46-9			
Total-HpCDD	37871-00-4			
1,2,3,4,6,7,8- Heptachlorodibenzofuran (HpCDF)	67562-39-4			
1,2,3,4,7,8,9-HpCDF	55673-89-7			
Total-HpCDF	38998-75-3			
Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9			
Octachlorodibenzofuran (OCDF)	39001-02-0			

Footnotes

[1] Detection level (DL) – or method detection limit means the minimum concentration of an analyte (substance) that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results as determined by the procedure given in 40 CFR part 136, Appendix B.

[2] Quantitation Level (QL) – also known as Minimum Level (ML) – The term ‘‘minimum level’’ refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (DL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the DL in a method, or the DL determined by a laboratory, by a factor of 3. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: ‘‘quantitation limit,’’ ‘‘reporting limit,’’ and ‘‘minimum level’’.

[3] Soluble Biochemical Oxygen Demand – method note: First, filter the sample through a Millipore Nylon filter (or equivalent) - pore size of 0.45-0.50 um (prep all filters by filtering 250 ml of laboratory grade deionized water through the filter and discard). Then, analyze sample as per method 5210-B.

[4] Northwest Total Petroleum Hydrocarbons Diesel Extended Range OR NWTPH Dx – Analytical Methods for Petroleum Hydrocarbons https://apps.ecology.wa.gov/publications/documents/97602.pdf

[5] Northwest Total Petroleum Hydrocarbons Gasoline Extended Range OR NWTPH Gx – Analytical Methods for Petroleum Hydrocarbons https://apps.ecology.wa.gov/publications/documents/97602.pdf

[6] 1, 3-dichloroproylene (mixed isomers) – You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).

[7] Total Benzofluoranthenes – Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.

[8] Bis(2-Chloro-1-Methylethyl) Ether – This compound was previously listed as Bis(2-Chloroisopropyl) Ether (39638-32-9)

[9] Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 14/42 ng/L.

[10] PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

FACT SHEET FOR NPDES PERMIT WA0020249

City of Camas Wastewater Treatment Plant

Date of Public Notice: April 15, 2025

Permit Effective Date: August 1, 2025

Purpose of this fact sheet

This fact sheet explains and documents the decisions the Department of Ecology (Ecology) made in drafting the proposed National Pollutant Discharge Elimination System (NPDES) permit for the city of Camas wastewater treatment plant (WWTP).

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 thirty (30) days before issuing the final permit. Copies of the fact sheet and draft permit for city of Camas, NPDES permit WA0020249, are available for public review and comment from **April 15, 2025, to May 16, 2025.** For more details on preparing and filing comments about these documents, please see Appendix A - Public Involvement Information.

The city of Camas 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 prior to publishing this draft fact sheet for public notice.

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 E - Response to Comments and publish it when issuing the final NPDES permit. Ecology generally will not revise the rest of the fact sheet. The full document will become part of the legal history contained in the facility's permit file.

Summary

The city of Camas operates an activated sludge wastewater treatment plant that discharges to the Columbia River. Ecology issued the previous permit for this facility on September 25, 2015.

The proposed permit includes the same effluent limits for Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), fecal coliform bacteria, and pH as the permit issued in 2015. Average monthly ammonia limits were continued in this permit and average weekly limits for ammonia were developed. Ecology added a new water quality-based limit for heat load based on the wasteload allocation from the Columbia

and Lower Snake River Temperature Total Maximum Daily Load (TMDL). The proposed permit requires the POTW to meet the 85% removal requirements for BOD_5 and TSS as several I/I reduction projects have removed these excessive flows from the collection system. The permit includes new monitoring requirements for *E. coli* and continues pretreatment related monitoring to support Ecology's implementation of the Federal Pretreatment and State Waste Discharge Permit programs.

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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 in the Washington Administrative Code (WAC) apply to domestic wastewater NPDES permits:

- Procedures Ecology follows for issuing NPDES permits (chapter 173-220 WAC)
- Discharge standards for domestic wastewater facilities (chapter 173 221 WAC)
- Water quality criteria for surface waters (chapter 173-201A WAC)
- Water quality criteria for ground waters (chapter 173-200 WAC)
- Whole effluent toxicity testing and limits (chapter 173-205 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 owner/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 performance 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 Information* 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 in response to comment(s). Ecology will summarize the responses to comments and any changes to the permit in Appendix E.

II. Background information

Table 1 - Facility information

Applicant:	**City of Camas Wastewater Treatment Plant**
Facility name and address	City of Camas WWTP 1129 Southeast Polk Street Camas, WA 98607
Contact at facility	Jacob Taylor Wastewater Operations Supervisor 360-316-8925 jtaylor@cityofcamas.us
Responsible official	Steve Hogan Mayor 616 NE 4th Ave Camas, WA 98607 Telephone #:360-834-6864 Email: shogan@cityofcamas.us
Type of treatment	Activated sludge (Modified Ludzack-Ettinger) with selectors, alkalinity addition, anaerobic digestion, and effluent filtration.
Facility location (NAD83/WGS84 reference datum)	Latitude: 45.57866° N Longitude: 122.39447° W
Discharge waterbody name and location (NAD83/WGS84 reference datum)	Columbia River, RM 121 Latitude: 45.57479° N Longitude: 122.391897° W

Permit status

Issuance date of previous permit: September 25, 2015

Application for permit renewal submittal date: April 3, 2020

Inspection status

Date of last non-sampling inspection: January 7, 2025

Figure 1 - Facility location map



II.A. Facility description

1. History

The treatment facility for the city of Camas (City) was constructed in 1972 along the Columbia River in the southeastern portion of the sewer service area. The facility has undergone several modifications since original construction. The Phase I upgrade and expansion (primarily liquid stream) was completed in February of 2000. The Phase 2A upgrade primarily addressing solids treatment, including anaerobic digesters and sludge drying facilities occurred in 2012. Phase 2B, the most recent upgrade, occurred in 2014 and consisted of improved blower controls, the addition of a third secondary clarifier, new effluent filters and digester gas treatment facilities.

The EPA classifies the Camas Wastewater Treatment Plant as a major facility as design flows exceed 1 MGD.

2. Collection system status

The City of Camas sewer service area covers approximately 7,400 acres. The collection system includes conventional gravity sewers with lift stations, septic tank effluent pumping stations (STEP), septic tank effluent filter systems (STEF) and septic tank effluent gravity systems (STEG). Conventional gravity sewers are the most common type of conveyance within the city limits.

Portions of the service area served by conventional gravity sewers are from the 1920s. These early sections of the gravity sewer were constructed with vitrified clay pipe (VCP). Over time, most of the VCP was replaced with cast iron, concrete and eventually PVC. Gravity sewers range from four inch to 24-inches in diameter. The majority of gravity collection system is 8-inches in diameter. There are approximately 45 miles of gravity sewer mains in the service area.

Beginning in the mid-1980s, Camas required customers in the western portion of the sewer service area to connect using STE systems. STEP systems consist of a septic tank equipped with a pump at the outlet to convey effluent flows to the STEP transmission main. STEG systems consist of a septic tank with an outlet that conveys effluent flows by gravity to the STE transmission main. And STEF systems utilize a siphon to convey flows to the STE transmission main. Camas owns and maintains the residential STE systems. They pump out septage from the STE systems on an eight-year cycle. Commercial and industrial STE systems are owned and maintained by the property owner. Septage from commercial, industrial and residential STE systems receive treatment at the WWTP.

Twenty-nine lift stations convey sewage and septic tank effluent to the treatment plant when gravity sewers cannot be utilized. Thirteen lift stations serve the gravity system while fifteen serve the septic tank effluent (STE) systems. One lift station is dedicated to odor control. There is approximately 51,460 LF of forcemain ranging from 4 to 18-inches. The majority of lift stations serve a relatively small service area and have capacities of less than 500 gallons per minute (GPM); however, the main lift station has a capacity of 7,700 GPM and conveys the majority of the gravity collection system to the WWTP through an 18-inch diameter forcemain under Lacamas Creek.

Inflow and infiltration (I/I) from the STE systems is fairly low; however, historically, the inflow from the gravity collection system is fairly high. Since the 1970s, the city has an ongoing I/I reduction program. In 2020, the city conducted a follow up study to document the I/I reduction stemming from implementing recommendations from the 2016 I/I evaluation. This study showed that the City has observed a reduction in peak WWTP flows and high flow events, even though the population of the city and extent of the sewer system have both increased over the study period. As a result, the city’s WWTP no longer sees excessive I/I as defined by the EPA criteria. While excessive I/I may have been

addressed, the city has planned I/I reduction projects for the next five years. These include:

- Ongoing gravity main repair and replacement.
- Crown view pump station improvements.
- Lacamas Creek Pump Station improvements.

3. Treatment process

Liquid stream treatment at the Camas WWTP begins with climbing perforated filter screens at the plant headworks to remove larger material which is washed, compacted, and disposed of at the local landfill. Primary solids -liquid separation occurs in two circular primary clarifiers with the primary effluent discharging to a splitter box where it is combined with returned activated sludge (RAS) from the secondary clarifiers and split between three aeration basins (ABs), where biomass is aerated to promote biological oxidation. Secondary treatment in the ABs consists of influent channel selector zones followed by two anoxic zones and three aerobic zones to remove carbonaceous material and reduce ammonia concentrations. Magnesium hydroxide is added at the splitter box to provide supplemental alkalinity ahead of aeration.

Mixed liquor from the three ABs is combined and split between three secondary clarifiers. Each clarifier proves separation of the biomass from the secondary treatment process and discharges treated effluent to two mechanical disc filters. Ultraviolet disinfection is provided in an open channel system prior to discharge to the outfall in the Columbia River.

Disinfected effluent flows by gravity or is pumped to the outfall via three effluent pumps which are operated in a two duty, one standby configuration. The transition between gravity and pumped effluent flow occurs automatically when pumps are placed in “auto” mode. As the Columbia River level rises, gravity effluent discharge is stopped by closing the flap gate in the effluent manhole.

Solids from the primary clarifiers enter two hydro-cyclones and a grit classifier before thickening by via gravity thickener. Thickened primary sludge is then pumped to anaerobic digesters. Solids from the secondary clarifiers are removed and either pumped back to the aeration splitter box as RAS or wasted to a storage tank and thickened via rotary drum thickener. Thickened primary and secondary solids are combined in the anaerobic digesters for stabilization, removal of volatile solids and production of biogas. Digested sludge is dewatered by centrifuge and is then conveyed to a belt dryer which evaporates the remaining water content in the finished biosolids.

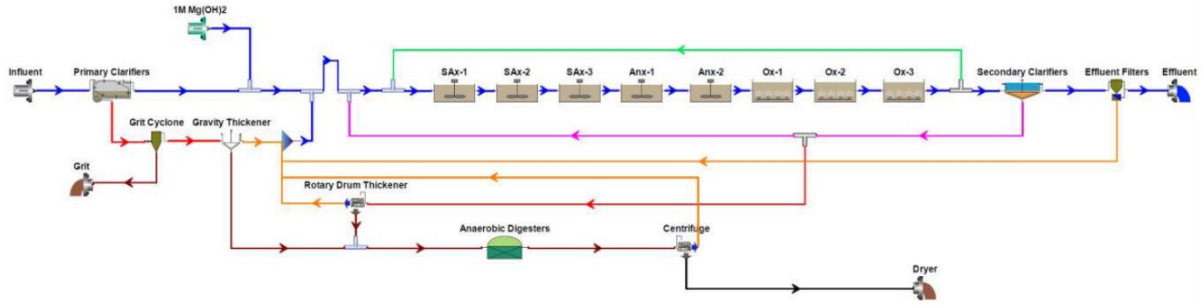
The Camas WWTP is a major facility as classified by EPA as it is over 1 MGD. It is also a Class IV facility requiring the operator in responsible charge of the facility to have a Group IV license.

The plant hours of operation are 5:00 am to 3:30 pm seven days per week.

There are four significant industrial users that have pretreatment permits issued by Ecology. Camas has not been delegated pretreatment authorities. The four industries permitted by Ecology that discharge to the Camas WWTP are:

- Analog Devices, Inc., ST0006154
- nLight Inc, ST0006270
- Northwest Paper Box Manufacturers, Inc., ST0005027
- TSMC Washington, LLC, ST0006200

Figure 2 – Process Flow Diagram



4. Solid wastes and residual solids

The treatment facilities remove solids during the treatment of the wastewater at the headworks (grit and screenings), and at the primary and secondary clarifiers, in addition to incidental solids (rags, scum, and other debris) removed as part of the routine maintenance of the equipment. The Camas WWTP drains grit, rags, scum, and screenings and disposes this solid waste at the local landfill. Solids removed from the primary and secondary clarifiers are thickened, treated by anaerobic digestion and dried before being land applied. This facility has met the solid waste requirements for screening, as required by WAC 173-308-205, by having screens with an aperture of less than 3/8-inch.

5. Discharge outfall

The treated and disinfected effluent flows into the Columbia River through a 36-inch corrugated metal pipe (CMP) and extends approximately 850 feet into the river channel. The diffuser portion of the outfall is located along the outer 150 feet of the pipe and is equipped with 16 vertical risers, each oriented vertically with rubber Tideflex check valve nozzles. The vertical risers discharge effluent perpendicular to the flow of the Columbia River.

II.B. Description of the receiving water

The Camas WWTP discharges to the Columbia River at River Mile (RM) 121. Other nearby point source outfalls include the Washougal WWTP and MS4 discharges. Significant nearby non-point sources of pollutants include diffuse stormwater and agricultural practices. Section IIIE of this fact sheet describes any receiving waterbody impairments.

The ambient background data used for this permit includes the following from the City of Camas Receiving Water Study Report (CH2M,2017):

Table 2 - Ambient background data

Parameter	Value
pH (Maximum / Minimum)	8.10/7.29 standard units
Total Ammonia-N	0.183 mg/L
Hardness	74.0 mg/L as CaCO3
Alkalinity	66.2 mg/L as CaCO3
Arsenic, dissolved	1.02 µg/L
Cadmium, dissolved	<0.03 µg/L
Chromium, dissolved	0.416 µg/L
Chromium, hexavalent, dissolved	0.086 µg/L
Copper, dissolved	1.43 µg/L
Lead, dissolved	0.064 µg/L
Mercury, dissolved	0.884 µg/L
Nickel, dissolved	0.604 µg/L
Selenium, dissolved	0.274 µg/L
Silver, dissolved	<0.025 µg/L
Thallium, dissolved	<0.025 µg/L
Zinc, dissolved	1.25 µg/L
Temperature	23.2 °C

II.C. Wastewater influent characterization

Camas WWTP reported the concentration of pollutants in the wastewater influent in the permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater influent from October 1, 2019 – October 31, 2024.

Table 3 - Wastewater influent characterization

Parameter	Units	# of Samples	Average value	Maximum value
Flow	MGD	1858	2.6	7.8
Biochemical Oxygen Demand (BOD_5)	mg/L	1154	120	314
Biochemical Oxygen Demand (BOD_5)	lbs/day	1154	2,552	6,160
Total Suspended Solids (TSS)	mg/L	1176	128	380
Total Suspended Solids (TSS)	lbs/day	1156	2,742	12,421

Parameter	Units	# of Samples	Average value	Maximum value
Ammonia, Total	mg/L	1155	41.7	59.6
Antimony, Total Recoverable	µg/L	20	0.3	0.67
Arsenic, Total Recoverable	µg/L	20	0.9	1.26
Cadmium, Total Recoverable	µg/L	20	0.1	0.26
Chromium, Total Recoverable	µg/L	20	2.6	4.13
Chromium, Hexavalent	µg/L	20	79.1	490
Copper, Total Recoverable	µg/L	20	42.5	81.7
Cyanide, Total Recoverable	µg/L	20	5.1	20.0
Lead, Total Recoverable	µg/L	20	0.8	4.70
Mercury, Total Recoverable	ng/L	20	10.2	19.2
Molybdenum, Total Recoverable	µg/L	20	5.9	10.5
Nickel, Total Recoverable	µg/L	20	3.8	7.50
Oil & Grease	mg/L	20	18.5	37.2
Petroleum Hydrocarbons	µg/L	20	167	250
Selenium, Total Recoverable	µg/L	20	0.5	1.00
Silver, Total Recoverable	µg/L	20	0.1	0.38
Sulfate	µg/L	20	178,924	334,000
Zinc, Total Recoverable	µg/L	20	77.1	269

Parameter	Units	# of Samples	Minimum value	Maximum value
pH	SU	1858	6.9	9.7

II.D. Wastewater effluent characterization

Camas WWTP reported the concentration of pollutants in the discharge in the permit application and in discharge monitoring reports. The tabulated data represents the quality of the wastewater effluent discharged from October 1, 2019 – October 31, 2024.

Table 4 - Wastewater effluent characterization

Parameter	Units	# of Samples	Average value	Maximum value
Flow	MGD	1,858	2.96	8.24
Biochemical Oxygen Demand (BOD_5)	mg/L	1,157	3.68	22.4
Biochemical Oxygen Demand (BOD_5)	lbs/day	1,157	93.8	1,527
Total Suspended Solids (TSS)	mg/L	1,158	3.68	28.2
Total Suspended Solids (TSS)	lbs/day	1,158	91.3	1,922
Ammonia, Total	mg/L	1,156	0.297	5.17
Antimony, Total Recoverable	µg/L	20	0.240	0.345
Arsenic, Total Recoverable	µg/L	20	0.660	0.95
Butyl benzyl phthalate	µg/L	3	0.11	0.27
Cadmium, Total Recoverable	µg/L	20	0.015	0.022

Parameter	Units	# of Samples	Average value	Maximum value
Chlorine	mg/L	3	0.023	0.030
Chloroform	µg/L	4	0.55	0.71
Chromium, Total Recoverable	µg/L	20	0.536	0.970
Chromium, Hexavalent	µg/L	20	92.0	490
Copper, Total Recoverable	µg/L	20	5.80	11.1
Cyanide, Total Recoverable	µg/L	20	7.58	20.0
di-n-octyl phthalate	µg/L	3	0.15	0.22
Diethyl phthalate	µg/L	3	0.59	1.1
Dissolved Oxygen	mg/L	3	4.95	5.12
Fluoride	µg/L	20	2,584	4,150
Hardness, as $CaCO_3$	mg/L	4	168	238
Total Kjeldahl Nitrogen	mg/L	61	2.89	21.4
Lead, Total Recoverable	µg/L	20	0.099	0.150
Mercury, Total Recoverable	ng/L	20	0.653	1.01
Molybdenum, Total Recoverable	µg/L	20	4.09	8.20
Naphthalene	µg/L	3	0.16	0.45
Nickel, Total Recoverable	µg/L	20	1.94	2.82
Oil & Grease	mg/L	24	4.11	17.2
Petroleum Hydrocarbons	µg/L	20	158	250
Phenol	µg/L	3	1.96	5.5
Phosphate, Ortho-phosphate	mg/L	61	7.15	10
Phosphorus, Total	mg/L	61	7.62	27.2
Selenium, Total Recoverable	µg/L	20	0.680	1.00
Silver, Total Recoverable	µg/L	20	0.015	0.020
Sulfate	µg/L	20	176,770	241,000
Temperature	°C	3,716	19.9	24
Total Phenolic Compounds	µg/L	4	0.244	1.07
Zinc, Total Recoverable	µg/L	20	21.1	28.4

Parameter	Units	# of Samples	Maximum Monthly Geometric Mean	Maximum Weekly Geometric Mean
Fecal Coliform	#/100 mL	1061	51	213

Parameter	Units	# of Samples	Minimum value	Maximum value
pH	SU	1858	6.9	8.70

II.E. Summary of compliance with previous permit issued September 25, 2015

The previous permit placed effluent limits on BOD_5, TSS, ammonia, pH and fecal coliform bacteria.

Camas WWTP has not consistently complied with the effluent limits and permit conditions throughout the duration of the permit issued on September 25, 2015.

Ecology assessed compliance based on its review of the facility's discharge monitoring reports (DMRs) and on inspections.

The following table summarizes the violations that occurred during the permit term.

Table 5 - Violations, October 1, 2019 – October 31, 2024

Violation date	Parameter type	Unit type	Max limit	Measurement value quantity	Statistical base type	Violation
10/28/2019	pH (Hydrogen Ion) Daily Min	Standard Units	6	5.9	Single Sample	Numeric effluent violation
04/01/2020						Late Submittal of DMRs
06/01/2020						Late Submittal of DMRs
10/01/2020	Cyanide	Micrograms/L (ug/L)			Average	Analysis not Conducted
10/28/2020	Cyanide	Micrograms/L (ug/L)			Single Sample	Analysis not Conducted
10/01/2020	Petroleum Hydrocarbons	Micrograms/L (ug/L)			Average	Analysis not Conducted
10/28/2020	Petroleum Hydrocarbons	Micrograms/L (ug/L)			Single Sample	Analysis not Conducted
01/01/2022	Chlorine	Milligrams/L (mg/L)			Average	Analysis not Conducted
12/06/2022	Chlorine	Milligrams/L (mg/L)			Single Sample	Analysis not Conducted
01/01/2022	Dissolved Oxygen	Milligrams/L (mg/L)			Average	Analysis not Conducted
12/06/2022	Dissolved Oxygen	Milligrams/L (mg/L)			Single Sample	Analysis not Conducted
11/14/2022	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
12/27/2022	Biochemical Oxygen	Percent			Single Sample	Analysis not Conducted

Violation date	Parameter type	Unit type	Max limit	Measurement value quantity	Statistical base type	Violation
	Demand (BOD_5)					
12/29/2022	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
12/27/2022	Biochemical Oxygen Demand (BOD_5)	Lbs/Day			Single Sample	Analysis not Conducted
12/27/2022	Biochemical Oxygen Demand (BOD_5)	Milligrams/L (mg/L)			Single Sample	Analysis not Conducted
02/01/2023	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
03/08/2023	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
04/05/2023	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*
05/06/2024	pH (Hydrogen Ion) Daily Min	Standard Units	6	4	Single Sample	Numeric effluent violation*
10/11/2024	pH (Hydrogen Ion) Daily Min	Standard Units	6	3	Single Sample	Numeric effluent violation*

*Note that the low pH excursions were related to instrumentation malfunction and not a true measurement of effluent pH.

The following table summarizes compliance with report submittal requirements over the permit term.

Table 6 - Permit submittals

Submittal name	Submittal status	Due date	Received date
Infiltration And Inflow Evaluation	Accepted	07/15/2016	07/15/2016
Infiltration And Inflow Evaluation	Accepted	07/15/2017	07/14/2017
Infiltration And Inflow Evaluation	Accepted	07/15/2018	07/13/2018
Infiltration And Inflow Evaluation	Accepted	07/15/2019	07/15/2019
Infiltration And Inflow Evaluation	Accepted	07/15/2020	06/10/2020
Infiltration And Inflow Evaluation	Submitted	07/15/2021	07/15/2021

Submittal name	Submittal status	Due date	Received date
Infiltration And Inflow Evaluation	Reviewed	07/15/2022	06/01/2022
Infiltration And Inflow Evaluation	Accepted	07/15/2023	06/21/2023
Infiltration And Inflow Evaluation	Accepted	07/15/2024	07/12/2024
Wasteload Assessment	Accepted	06/15/2016	06/14/2016
Wasteload Assessment	Accepted	06/15/2017	06/14/2017
Wasteload Assessment	Accepted	06/15/2018	06/15/2018
Wasteload Assessment	Accepted	06/15/2019	06/14/2019
Wasteload Assessment	Accepted	06/15/2020	06/12/2020
Wasteload Assessment	Accepted	06/15/2021	06/9/2021
Wasteload Assessment	Reviewed	06/15/2022	05/27/2022
Wasteload Assessment	Accepted	06/15/2023	05/24/2023
Wasteload Assessment	Accepted	07/15/2024	06/21/2024
O&M Manual Review Confirmation Letter	Accepted	10/15/2016	10/09/2015
O&M Manual Review Confirmation Letter	Submitted	10/15/2017	10/13/2017
O&M Manual Review Confirmation Letter	Accepted	10/15/2016	10/14/2016
O&M Manual Review Confirmation Letter	Accepted	10/15/2018	10/12/2018
O&M Manual Review Confirmation Letter	Reviewed	10/15/2019	10/14/2019
O&M Manual Review Confirmation Letter	Submitted	10/15/2020	10/13/2020
O&M Manual Review Confirmation Letter	Submitted	10/15/2021	10/11/2021
O&M Manual Review Confirmation Letter	Accepted	10/15/2022	09/27/2022
O&M Manual Review Confirmation Letter	Accepted	10/15/2023	10/03/2023
O&M Manual Review Confirmation Letter	Received	10/15/2024	10/17/2024
Industrial User Survey	Submitted	01/15/2017	01/14/2017
Industrial User Survey Update	Submitted	01/15/2019	01/15/2019
Industrial User Survey Update	Accepted	01/15/2021	01/15/2021
Industrial User Survey Update	Accepted	01/15/2023	01/13/2023
Local Limits Sampling & Evaluation Plan	Submitted	07/15/2017	07/14/2017
Local Limits Sampling & Evaluation Plan	Accepted	07/15/2017	09/22/2017
Results of Initial Screening	Accepted	12/01/2017	11/30/2017
Results of Local Limits Monitoring	Submitted	02/15/2019	02/08/2019
Local Limits Proposed for Ecology Approval	Submitted	07/15/2019	07/12/2019
Local Limits Proposed for Ecology Approval	Accepted	07/15/2019	10/2/2019

II.F. State environmental policy act (SEPA) compliance

State law exempts the issuance, 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 federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

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 Federal Water Quality Criteria Applicable to Washington (40 CFR 131.45).
- 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.

Ecology does not usually develop limits for pollutants not reported in the permit application but may be present in the discharge. The permit does not authorize discharge of the non-reported pollutants. During the permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent [40 CFR 122.42(a)]. Until Ecology modifies the permit to reflect additional discharge of pollutants, a permitted facility could be violating its permit.

III.A. Design criteria

Under WAC 173-220-150 (1)(g), flows and waste loadings must not exceed approved design criteria. Ecology approved design criteria for this facility's treatment plant in the General Sewer Plan/Wastewater Facility Plan prepared by Gray & Osborne, Inc (G&O, 2011). The table below includes design criteria from the referenced report.

Table 7 - Design criteria for Camas WWTP

Parameter	Design quantity
Maximum Month Design Flow (MMDF)	6.10 MGD
Monthly Average Dry Weather Flow	2.86 MGD
Peak Instantaneous Design Flow (PIDF)	13.44 MGD

Parameter	Design quantity
BOD_5 Loading for Maximum Month	5,616 lb/day
TSS Loading for Maximum Month	8,011 lb/day
Ammonia, Total as N for maximum month	1,956 lbs/day

III.B. Technology-based effluent limits

Federal and state regulations define some technology-based effluent limits for domestic wastewater treatment plants. These effluent limits are given in 40 CFR Part 133 (federal) and in chapter 173-221 WAC (state). Chapter 173-220-130 WAC requires that "effluent limitations shall not be less stringent than those based upon the treatment facility design efficiency contained in approved engineering plans and reports." The proposed permit includes technology-based limits based on the approved treatment facility design.

The table below identifies technology-based limits for pH and fecal coliform as listed in chapter 173-221 WAC. BOD_5 and TSS limits are based on design of the facility. Section III.F of this fact sheet describes the potential for water quality-based limits.

Table 8 - Technology-based limits

Parameter	Average Monthly	Average Weekly
BOD_5	20 mg/L	30 mg/L
BOD_5	The BOD_5 effluent concentration must not exceed fifteen percent (15%) of the average influent concentration	
TSS	20 mg/L	30 mg/L
TSS	The TSS effluent concentration must not exceed fifteen percent (15%) of the average influent concentration	

Parameter	Monthly Geometric Mean	Weekly Geometric Mean
Fecal coliform bacteria	200 organisms/100 mL	400 organisms/100 mL

Parameter	Daily Minimum	Daily Maximum
pH	6.0 standard units	9.0 standard units

Technology-based mass limits for BOD_5 and TSS are based on WAC 173-220-130(3)(b) and WAC 173 221-030(11)(b). Ecology calculated the monthly and weekly average mass limits for BOD_5 and TSS as follows:

Mass limit = CL x DF x CF, where:

CL = Technology-based concentration limit (mg/L)

DF = Maximum monthly average design flow (MGD)

CF = Conversion factor = 8.34

Technology-based mass limits for BOD_5 and TSS are based on WAC 173-220-130(3)(b), WAC 173 221 030(11)(b), WAC 173-220-130(1)(a) and (g), and WAC 173-221-040(1). Ecology calculated the monthly and weekly average mass limits for BOD_5 and TSS as follows:

Average monthly mass limit = Influent mass monthly design load (lbs/day) x 0.15

Average weekly mass limit = Average monthly mass limit x 1.5

Ecology uses the more stringent of the two methods for the mass limit in the proposed permit.

In previous permit cycles, the Camas WWTP was not held to the 85% removal requirement; however, the facility can now consistently meet this requirement given recent upgrades and reduction of I/I in the collection system. Therefore, Ecology will apply the 85% removal requirement to the discharge in this permit cycle.

Table 9 - Technology-based mass limits

Parameter	Concentration limit (mg/L)	Influent design load (lbs/day)	Mass limit (lbs/day)
BOD_5 Monthly Average	20		1,017
BOD_5 Weekly Average	30		1,525
BOD_5 Monthly Average		5,616	842
BOD_5 Weekly Average			1,264
TSS Monthly Average	20		1,017
TSS Weekly Average	30		1,525
TSS Monthly Average		8,011	1,202
TSS Weekly Average			1,802

III.C. 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).

1. Numeric criteria for the protection of aquatic life and recreation

Numeric 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 numeric 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.

2. Numeric criteria for the protection of human health

Numeric criteria for the protection of human health are promulgated in Chapter 173-201A WAC and 40 CFR 131.45. These criteria are designed to protect human health from exposure to pollutants linked to cancer and other diseases, 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.

3. Narrative criteria

Narrative water quality criteria (e.g., WAC 173-201A-240(1)) 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) and of all marine waters (WAC 173-201A-210) in the state of Washington.

4. Antidegradation

The purpose of Washington's Antidegradation Policy (WAC 173-201A-300-330) 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.

Facility specific requirements – 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.
- For waters that do not meet assigned criteria, or protect existing or designated uses, Ecology will take appropriate and definitive steps to bring the water quality back into compliance with the water quality standards.
- Ecology's analysis described in this section of the fact sheet demonstrates that the proposed permit conditions will protect existing and designated uses of the receiving water.

5. 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 doesn't 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 must not use more than 25% of the available width of the water body for dilution (WAC 173-201A-400 (7)).

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 derives 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. 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 4 means the effluent is 25% and the receiving water is 75% 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 and four tenths (2.4) liters/day for drinking water (increased from two liters/day in the 2016 Water Quality Standards update).
- 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:

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

The proposed permit specifies the size and location of the allowed mixing zone (as specified below).

b. 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 Camas WWTP meets the requirements of AKART (see "Technology-based Limits").

c. Ecology must consider critical discharge conditions.

Surface water quality-based limits are derived for the water body'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*** (Ecology, 2018) describes additional guidance on criteria/design conditions for determining dilution factors.

Table 10 - Critical conditions used to model the discharge

Critical condition	Value
Seven-day-average low river flow with a recurrence interval of ten years (7Q10)	81,400 cfs
River depth at the 7Q10 period	21 feet
River velocity	0.26 – 0.99 ft/sec
Maximum average monthly effluent flow for chronic and human health non-carcinogen	5.09 MGD

Critical condition	Value
Annual average flow for human health carcinogen	5.09 MGD
Maximum daily flow for acute mixing zone	10.04 MGD (Winter) 6.36 MGD (Summer)

Ecology obtained ambient data at critical conditions in the vicinity of the outfall from Ecology's ambient study conducted in 2007 from ambient station 28A100 located near the I-205 bridge at Vancouver, WA and the previous permit.

d. 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 discharge.

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.

e. 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 the discharge/receiving water mixture will not violate water quality criteria outside the boundary of the mixing zone if permit limits are met.

f. 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 mixes as it rises through the water column therefore much of the receiving water volume at lower depths in the mixing zone is not 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. 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 95th percentile pollutant concentration, the 90th 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.

g. Maximum size of mixing zone.

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

h. 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 the acute criteria will be met at 10% of the distance (or volume fraction) 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.

i. Overlap of Mixing Zones.

This mixing zone does not overlap another mixing zone.

III.D. Designated uses and surface water quality criteria

Applicable designated uses and surface water quality criteria are defined in chapter 173-201A WAC. The table included below summarizes the criteria applicable to this facility's receiving water and its designated uses.

1. Freshwater aquatic life uses and associated criteria

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 11 - Salmonid spawning, rearing, and migration

Criteria	Value
Temperature – Highest 7-DAD MAX	20.0°C (63.5°F)
Dissolved oxygen – Lowest 1-Day minimum	8.0 mg/L
Turbidity	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.
Total dissolved gas	Total dissolved gas must not exceed 110 percent of saturation at any point of sample collection.
pH	The pH must measure within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.

2. Recreational use and criteria

The recreational use for this receiving water is primary contact recreation. *E. coli* organism levels must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained within the averaging period exceeding 320 CFU or MPN per 100 mL.

3. Water supply uses

The water supply uses are domestic, agricultural, industrial, and stock watering.

4. Miscellaneous freshwater uses

The miscellaneous freshwater uses are wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics.

III.E. Water quality impairments

The Columbia and Lower Snake Rivers are listed on the state's polluted waters list for high water temperatures that are above Washington water quality standards and can harm salmon. Because the Columbia and Snake Rivers cross multiple state boundaries and span almost 900 miles, the federal Environmental Protection Agency (EPA) established the Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load (TMDL)[1] on May 20, 2020 (USEPA Region 10, 2021). The TMDL includes a waste load allocation for the Camas WWTP.

The other listing in the vicinity of the discharge includes a category 4A listing for total dissolved gas. The Total Dissolved Gas TMDL does not include a wasteload allocation for the Camas WWTP.

III.F. Evaluation of surface water quality-based effluent limits for narrative criteria

Ecology must consider the narrative criteria described in WAC 173-201A-260 when it determines permit limits and conditions. Narrative water quality criteria limit the toxic, radioactive, or other deleterious material concentrations that the facility may discharge which have the potential to adversely affect designated uses, cause acute or chronic toxicity to biota, impair aesthetic values, or adversely affect human health.

Ecology considers narrative criteria when it evaluates the characteristics of the wastewater and when it implements all known, available, and reasonable methods of treatment and prevention (AKART) as described above in the technology-based limits section. When Ecology determines if a facility is meeting AKART it considers the pollutants in the wastewater and the adequacy of the treatment to prevent the violation of narrative criteria.

[1] https://www.epa.gov/columbiariver/tmdl-temperature-columbia-and-lower-snake-rivers

In addition, Ecology considers the toxicity of the wastewater discharge by requiring whole effluent toxicity (WET) testing when there is a reasonable potential for the discharge to contain toxics. Ecology's analysis of the need for WET testing for this discharge is described later in the fact sheet.

III.G. Evaluation of surface water quality-based effluent limits for numeric criteria

1. Mixing zones and dilution factors

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.

The diffuser at Outfall 0001 is a 36-inch pipe which extends 850 feet from the North Bank of the Columbia River at river mile 121.2. The diffuser array is 150-feet long with a total of 16, 6-inch diameter Tideflex diffusers. The distance between ports is 10 feet and the diffuser depth is 21 feet below the Columbia River datum. Ecology obtained this information from the Dilution Ratio Study Report submitted in 2007 and refined in 2009 after the addition of the Tideflex valves.

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 mixing zone extends from the bottom to the top of the water column.

The chronic dilution factor below is based on a downstream distance of 318 feet.

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. The mixing zone extends from the bottom to the top of the water column.

The acute dilution factor below is based on a downstream distance of 32 feet.

Ecology determined the dilution factors that occur within these zones at the critical condition using the 2007 mixing zone study approved by Ecology. The dilution factors are listed below.

Table 12 - Dilution factors

Criteria	Acute	Chronic
Aquatic Life	23 (winter) 27 (summer)	121 (winter) 185 (summer)
Human Health, Carcinogen		185
Human Health, Non-carcinogen		185

Ecology determined the impacts of dissolved oxygen deficiency, pH, fecal coliform, ammonia, metals, other toxics, and temperature 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.

2. Dissolved Oxygen: BOD_5 and Ammonia Effects

Natural decomposition of organic material in wastewater effluent impacts dissolved oxygen in the receiving water at distances far outside of the regulated mixing zone. The 5-day Biochemical Oxygen Demand (BOD_5) of an effluent sample indicates the amount of biodegradable material in the wastewater and estimates the magnitude of oxygen consumption the wastewater will generate in the receiving water. The amount of ammonia-based nitrogen in the wastewater also provides an indication of oxygen demand in the receiving water.

Ecology modeled the impact of BOD_5 on the receiving water at critical condition and with the technology-based effluent limit for BOD_5 described under "Technology-Based Effluent Limits" above. The calculations to determine dissolved oxygen impacts are shown in Appendix D.

Ecology predicted no violation of the surface water quality standards for dissolved oxygen at the edge of the mixing zone due to the impacts of biochemical oxygen demand (BOD_5) under critical conditions. Therefore, the proposed permit contains the plant specific technology-based effluent limit for BOD_5. The permit also does not contain a limit on ammonia based on dissolved oxygen impacts (ammonia toxicity is examined elsewhere in this fact sheet).

3. pH

Ecology modeled the impact to receiving waters under critical conditions using technology-based limits for pH (6.0 – 9.0) and the *pH-mix-fresh* worksheet in Ecology's PermitCalc spreadsheet. Appendix D includes the model results. Model calculations predict no violation of the pH criteria under critical conditions.

4. Bacteria

In the previous permit cycle, Ecology modeled the number of fecal coliform by simple mixing analysis using the technology-based limit of 400 organisms per 100 mL and a dilution factor of 121. That analysis showed no violation of the fecal coliform recreational use criterion under critical conditions. The domestic technology-based limits for fecal coliform in WAC 173-221 are still in effect. Without effluent data for *E. coli*, Ecology cannot determine whether the discharge will violate the recreational use criterion for *E. coli*. Given that the characteristics of the receiving water and the discharge have not changed substantially since the analysis conducted in the previous permit cycle, and the transition is a change in bacterial indicator not more or less stringent than the previous criterion, the proposed permit will maintain the technology-based effluent limit for fecal coliform. In addition, the permittee will be required to monitor for both fecal coliform and *E. coli*. Ecology will then use this data to assess the reasonable potential to exceed the applicable recreational use criterion in the next iteration of this permit.

5. Turbidity

Ecology evaluated the impact of turbidity based on the range of turbidity in the effluent and turbidity of the receiving water. Ecology expects no violations of the turbidity criteria outside the designated mixing zone provided the facility meets its technology-based total suspended solids permit limits.

6. Toxic pollutants – aquatic life criteria

Federal regulations at 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. Ecology conducted a reasonable potential analysis (See Appendix D) on these parameters to determine whether it would require effluent limits in this permit.

Ammonia's toxicity depends on that portion which is available in the unionized form. The amount of unionized ammonia depends on the temperature and pH in the receiving freshwater. To evaluate ammonia toxicity, Ecology used the available receiving water information and Ecology spreadsheet tools.

Valid ambient background data were available for ammonia and heavy metals (See Table 2). Ecology used all applicable data to evaluate reasonable potential for this discharge to cause a violation of water quality standards. If no data was available, zero was used for background concentrations.

Ecology determined that ammonia pose no reasonable potential to cause or contribute to exceedances of the water quality criteria at the critical conditions using procedures given in the ***Technical Support Document for Water Quality-Based Toxics Control*** (EPA/505/2-90-001) (USEPA, 1991) (Appendix D) and as described above. Ecology's determination assumes that this facility meets the other effluent limits of this permit. However, the Camas WWTP has had an ammonia limit in the previous permit and therefore is subject to anti-backsliding provisions of the Clean Water Act since absent a limit, there is no assurance that treatment for ammonia would continue. Average weekly limits were added to satisfy 40 CFR 122.45(d) which requires effluent limits for continuous discharger be expressed in short- and long-term limits.

Ecology found that hexavalent chromium has a reasonable potential to cause or contribute to a violation of water quality standards. However, the POTW is not a source for this pollutant. Rather than assess an effluent limit for this pollutant in this permit cycle, Ecology has required the city to reevaluate its local limits and develop a local limit for hexavalent chromium. The facility must also sample influent and effluent for hexavalent chromium on a quarterly basis throughout the permit term. In the event that the city cannot control the source of hexavalent chromium in the collection system, Ecology will reopen the proposed permit and implement an effluent limit using methods from the ***Technical Support Document for Water Quality-Based Toxics Control*** (EPA/505/2-90-001) (USEPA, 1991).

7. Temperature

The state temperature standards (WAC 173-201A, WAC 173-201A-200, WAC 173-201A-600, and WAC 173-201A-602) include multiple elements:

a. Annual summer maximum threshold criteria (June 15 to September 15)
b. Supplemental spawning and rearing season criteria (September 15 to June 15)
c. Incremental warming restrictions
d. Guidelines on preventing acute lethality and barriers to migration of salmonids

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

a. Annual summer maximum and supplementary spawning/rearing criteria

Each water body has an annual maximum temperature criterion [WAC 173-201A-200(1)(c), and WAC 173-201A-602, 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 some fresh waters are expressed as the highest 1-Day annual maximum temperature (1-DMax).

b. 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)]. 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.

c. Guidelines to prevent acute lethality or barriers to migration of salmonids. These site-level considerations do not override the temperature criteria listed above.
   i. 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 two seconds after discharge.
   ii. General lethality and migration blockage: The temperature at the edge of a chronic mixing zone must not exceed either a 1DMax of 23°C or a 7DADMax of 22°C. When adjacent downstream temperatures are 3°C or cooler, the 1DMax at the edge of the chronic mixing zone must not exceed 22°C.
   iii. Lethality to incubating fish: The temperature must not exceed 17.5°C at locations where eggs are incubating.

Reasonable potential analysis

EPA has completed a temperature TMDL, Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load (TMDL)[2] and established a wasteload allocation for this discharge. The proposed permit includes an effluent limit for temperature derived from the completed TMDL.

[2] https://www.epa.gov/columbiariver/tmdl-temperature-columbia-and-lower-snake-rivers

III.H. Evaluation of human health-based water quality criteria

Washington's water quality standards include numeric human health-based criteria for priority pollutants that Ecology must consider when writing NPDES permits.

Ecology determined the effluent may contain chemicals of concern for human health, based on the facility's status as an EPA major discharger and data or information indicating the discharge contains regulated chemicals.

Ecology evaluated the discharge's potential to violate the water quality standards as required by 40 CFR 122.44(d) by following the procedures published in the ***Technical Support Document for Water Quality-Based Toxics Control*** (EPA/505/2-90-001) (USEPA, 1991) and Ecology's Permit Writer's Manual (Ecology, 2018) to make a reasonable potential determination. The evaluation showed that . the discharge has no reasonable potential to cause a violation of water quality standards, and an effluent limit is not needed.

III.I. 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[3].

Ecology determined that this discharge has potential to cause a violation of the sediment quality standards because the facility has not performed NPDES related sediment sampling and there is no sediment data available in the vicinity of the outfall. Furthermore, sediment sampling is recommended once over the permit lifetime for treatment plants with a discharge greater than 1MGD and less than 10 MGD. The proposed permit includes a Special Condition requiring Camas WWTP to demonstrate either:

- The point of discharge is not an area of deposition, or
- Toxics do not accumulate in the sediments even though the point of discharge is a depositional area.

III.J. Groundwater quality limits

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

The Camas WWTP does not discharge wastewater to the ground. No permit limits are required to protect groundwater.

[3] https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Sediment-cleanups

III.K. Whole effluent toxicity

The water quality standards for surface waters forbid discharge of effluent that has the potential to cause 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.

- Acute toxicity tests measure mortality as the significant response to the toxicity of the effluent. Dischargers who monitor their wastewater with acute toxicity tests find early indications of any potential lethal effect of the effluent on organisms in the receiving water.
- Chronic toxicity tests measure various sublethal toxic responses, such as reduced growth or reproduction. Chronic toxicity tests often involve either a complete life cycle test on an organism with an extremely short life cycle, or a partial life cycle test during a critical stage of a test organism's life. Some chronic toxicity tests also measure organism survival.

Laboratories accredited by Ecology for WET testing must use the proper WET testing protocols, fulfill the data requirements, and submit results in the correct reporting format according to the procedures in the ***Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria***, Publication 95-80 (Ecology, 2016). Ecology recommends that each regulated facility send a copy of the acute or chronic toxicity sections(s) of its NPDES permit to the laboratory.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water acute toxicity. The proposed permit will not include an acute WET limit. The City of Camas must retest the effluent before submitting an application for permit renewal.

- 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. The Camas WWTP may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing and/or chemical analyses after the process or material changes have been made. Ecology recommends that the Permittee check with it first to make sure that Ecology will consider the demonstration adequate to support a decision to not require an additional effluent characterization.
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased.

WET testing conducted during effluent characterization showed no reasonable potential for effluent discharges to cause receiving water chronic toxicity. The proposed permit will not include a chronic WET limit. The City of Camas must retest the effluent before submitting an application for permit renewal.

- 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
- If WET testing conducted for submittal with a permit application fails to meet the performance standards in WAC 173-205-020, Ecology will assume that effluent toxicity has increased. The Camas WWTP may demonstrate to Ecology that effluent toxicity has not increased by performing additional WET testing after the process or material changes have been made.

III.L. Comparison of effluent limits with the previous permit issued on September 25, 2015

Table 13 - Comparison of previous and proposed effluent limits – Outfall 0001

Limit	Basis of Limit	Existing permit limit	Proposed permit limit
Biochemical Oxygen Demand (5-day) – Average Monthly	Technology	20 mg/L;1,017 lbs/day; 74% Removal	20 mg/L;842 lbs/day; 85% Removal
Biochemical Oxygen Demand (5-day) – Average Weekly	Technology	30 mg/L; 1,525 lbs/day	30 mg/L; 1,264 lbs/day
Total Suspended Solids – Average Monthly	Technology	20 mg/L;1,017 lbs/day; 76% Removal	20 mg/L;1,017 lbs/day; 85% Removal
Total Suspended Solids – Average Weekly	Technology	30 mg/L; 1,525 lbs/day	30 mg/L; 1,525 lbs/day
Fecal Coliform Bacteria – Monthly Geometric Mean	Technology	200/100 mL	200/100 mL
Fecal Coliform Bacteria – Weekly Geometric Mean	Technology	400/100 mL	400/100 mL
pH – Daily Minimum	Technology	6.0	6.0
pH – Daily Maximum	Technology	9.0	9.0
Total Ammonia (June - September) – Average Monthly	WQ	20 mg/L	20 mg/L
Total Ammonia (June - September) – Average Weekly	WQ	n/a	30 mg/L
Total Ammonia (May - October) – Average Monthly	WQ	7 mg/L	7 mg/L
Total Ammonia (May - October) – Average Weekly	WQ	n/a	11 mg/L
Heat Load – Average Monthly (June 1 – September 30)	WQ	n/a	5.87×10^8 kcal/day

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.

If a facility uses a contract laboratory to monitor wastewater, it must ensure that the laboratory uses the methods and meets or exceeds the method detection levels required by the permit. The permit describes when facilities may use alternative methods. It also describes what to do in certain situations when the laboratory encounters matrix effects. When a facility uses an alternative method as allowed by the permit, it must report the test method, detection level (DL), and quantitation level (QL) on the discharge monitoring report or in the required report.

IV.A. Wastewater monitoring

The monitoring schedule is detailed in the proposed permit under Special Condition S2. Specified monitoring frequencies consider 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 92-109 (Ecology, 2018) for an activated sludge treatment plant, over 5 MGD maximum monthly average flow.

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 by EPA under 40 CFR 503.

Ecology has required monitoring of both fecal coliform and *E. coli* in the permit application. This dual monitoring will help inform both Ecology and City of Camas of the correlation between the two indicators. Dual monitoring requirements consist of splitting a sample once per month and analyzing that sample for fecal coliform and *E. coli.*

In addition, the proposed permit requires quarterly oil and grease and priority pollutant metals analyses for influent, effluent and biosolids. The proposed permit also requires annual priority pollutant analyses required for POTWs in the influent, effluent and biosolids.

IV.B. 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:

Table 14 - Accredited parameters

Parameter name	Category	Method name	Matrix description
Solids, Total Suspended	General Chemistry	SM 2540 D-2011	Non-Potable Water
pH	General Chemistry	SM 4500-H+ B-2011	Non-Potable Water
Ammonia	General Chemistry	Hach 10205 5th ED 2008 Method	Non-Potable Water
Dissolved Oxygen	General Chemistry	SM 4500-O G-2011	Non-Potable Water
Biochemical Oxygen Demand (BOD)	General Chemistry	SM 5210 B-2011	Non-Potable Water
Fecal coliform-count	Microbiology	SM 9222 D (mFC)-06	Non-Potable Water

V. Other permit conditions

V.A. Reporting and record keeping

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

V.B. 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 Camas WWTP to:

- Take the actions detailed in proposed permit Special Condition S4.
- Design and construct expansions or modifications before the treatment plant reaches existing capacity.
- Report and correct conditions that could result in new or increased discharges of pollutants.

Special Condition S4 restricts the amount of flow.

V.C. Operation and maintenance

The proposed permit contains Special Condition S5 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 Camas WWTP takes adequate safeguards so that it uses constructed facilities to their optimum potential in terms of pollutant capture and treatment.

Special Condition S5 requires facility name to review and update as needed an operation and maintenance manual as required by state regulation for the construction of wastewater treatment facilities (WAC 173-240-080). Implementation of the procedures in the operation and maintenance manual ensures the facility's compliance with the terms and limits in the permit.

V.D. Pretreatment

Ecology administers the National Pretreatment Program under the terms of the "National Pollutant Discharge Elimination System (NPDES) Memorandum of Agreement Between the State of Washington and the United States Environmental Protection Agency Region 10" (1986), including any revisions, modifications, or amendments to the Memorandum of Agreement, and 40 CFR Part 403.

Under this delegation of authority, Ecology will serve as either: a) the Control Authority for those industrial users who introduce pollutants into a POTW which has not been approved to have a Pretreatment Program or b) the Approval Authority for an approved Pretreatment Program.

The City of Camas does not have an approved pretreatment program. Therefore, Ecology acts as the Control Authority pursuant to 40 CFR Part 403.10(e). In the Camas sewer service area, in accordance with WAC 173-216, Ecology issues permits for the wastewater discharges from the nondomestic users identified in Table 15.

Table 15 - Permitted nondomestic users

Facility Name	Permit Number	Industrial User Type	Permit Effective-Expiration Dates
Analog Devices, Inc	ST0006154	Categorical – semiconductors and related devices	09/01/2020-08/31/2025
nLight Inc, Camas	ST0006270	Categorical-semiconductors and related devices	09/01/2021-08/31/2026
Northwest Paper Box Manufactures, Inc	ST0005027	Minor industrial user – ink formulation and printing	05/01/2024-04/30/2029
TSMC Washington, LLC	ST0006200	Categorical – semiconductor integrated circuit fabrication	03/1/2025 – 02/28/2030

1. Duty to enforce discharge prohibitions

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

- The first section prohibits the POTW from accepting pollutants which causes “pass through” or “interference”. This general prohibition is from 40 CFR §403.5(a). Appendix C of this fact sheet defines these terms.
- The second section reinforces specific state and federal pretreatment prohibitions found in 40 CFR §403.5(b) and WAC 173-216-060 . The POTW

may not accept wastes which violate the specific state and federal discharge prohibitions. Wastewaters with the following characteristics are prohibited:

- Wastewaters prohibited to be discharged by the Dangerous Waste Regulations in 173-303 WAC.
- 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.
- Heat in amounts that will inhibit biological activity at the POTW.
- 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.

- The third section reflects state prohibitions [WAC 173-216-060(2)(b)(vii)] 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.

2. Requirements for performing an industrial user survey

The Camas WWTP receives wastewater from the permitted significant industrial user(s) identified in Table 15. The Camas WWTP serves many other industrial and commercial users, some of which have the potential to be or become, with changed processes, significant industrial users [40 CFR §403.3(v)]. A significant industrial user is a nondomestic indirect discharger (user) subject to categorical pretreatment standards under 40 CFR §403.6 and 40 CFR Chapter I, Subchapter N or any other nondomestic indirect discharger that meets any of the following:

- Discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater).
- Contributes a process wastestream that makes up 5% or more of the average dry weather hydraulic or organic capacity of the POTW.
- Is designated as such by the Permittee or Ecology on the basis that the nondomestic indirect discharger has a reasonable potential to adversely affect the POTW's operation.

The purpose of the IU Survey is to identify all facilities that may be subject to pretreatment standards or requirements so that Ecology can take appropriate

measures to control these discharges. The steps the POTW must document in their IU Survey submittal include:

d. The POTW must develop a master list of nondomestic users (commercial and industrial).This list must be based on several sources of information including business licenses, and water and sewer billing records.
e. The POTW must canvas all the potential sources. The POTW must identify categories of nondomestic users and have potentially significant users complete a survey form.
f. The POTW must identify SIUs in all areas served by the POTW.

Ecology uses the industrial user survey as a major mechanism to determine which nondomestic users merit further controls, such as a state waste discharge permit. Ecology describes the information needed in the survey submittal to allow Ecology to make permitting decision in the manual “Performing an Industrial User Survey”. Where surveys are incomplete, Ecology may take such enforcement as appropriate and/or require the POTW to develop a fully delegated pretreatment program.

The proposed permit requires the city of Camas to conduct an industrial user survey to determine the extent of compliance of all industrial users of the sanitary sewer and wastewater treatment facility with federal pretreatment regulations [40 CFR Part 403 and CWA Sections 307(b) and CWA Section 308)], with state regulations (chapter 90.48 RCW and chapter 173-216 WAC), and with local ordinances.

3. Identification of new nondomestic wastewater sources and notification of permit requirements

The permit requires non-delegated POTWs to take “continuous, routine measures to identify and authorize nondomestic wastewater discharges. Examples of such routine measures include regular review of business license and building permit applications, advertisements, and personal reconnaissance. Collection system operators should be trained on what to look for so they can identify and report new industrial dischargers. The Camas WWTP may not allow SIUs to discharge prior to receiving a permit from Ecology and must notify all industrial users of their responsibility to apply for a State Waste Discharge Permit. The POTW must also notify Ecology.

4. Pretreatment Monitoring / Local Limits Evaluation

Pretreatment monitoring is required to determine if pollutants interfere with the treatment processes or pass through the plant to the biosolids or receiving water. Parameters required for pretreatment-related monitoring include priority pollutants [40 CFR Part 122 Appendix D], as well as parameters with environmental criteria. Monitoring requirements allow the POTW to comply with NPDES permit application monitoring [40 CFR 122.21(j)]. POTWs use this

monitoring data to also develop and evaluate local limits. POTWs with local limits are required to evaluate local limits after permit issuance or every 5 years, or when certain situations arise that are likely to affect POTW headworks loading or treatment efficiency.

The city of Camas developed local limits in the previous permit cycle for several pollutants of concern. The proposed permit requires the city to assess the efficacy of the existing local limits and to develop an additional local limit for hexavalent chromium. Ecology will use these reevaluated local limits as the basis for effluent limits in any pretreatment permit developed that discharges to the Camas WWTP.

V.E. Spill plan

This facility stores a quantity of chemicals on-site that have the potential to cause water pollution if accidentally released. Ecology can require a facility to develop best management plans to prevent this accidental release [Section 402(a)(1) of the Federal Water Pollution Control Act (FWPCA) and RCW 90.48.080].

The Camas WWTP developed a plan for preventing the accidental release of pollutants to state waters and for minimizing damages if such a spill occurs. The proposed permit requires the facility to review this plan and update as necessary. Any updates must be submitted to Ecology.

V.F. Solid waste

To prevent water quality problems the facility is required in permit Special 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 Clark County Health Department.

Requirements for monitoring sewage sludge and record keeping are included in this permit. Ecology will use this information, required under 40 CFR 503, to develop or update local limits.

V.G. Outfall evaluation

The proposed permit requires the city of Camas to conduct an outfall inspection and submit a report detailing the findings of that inspection (Special Condition S11). The inspection must evaluate the physical condition of the discharge pipe and diffusers and evaluate the extent of sediment accumulations in the vicinity of the outfall.

V.H. General conditions

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

VI. Permit issuance procedures

VI.A. Permit modifications

Ecology may modify this permit to impose numeric limits, if necessary to comply with water quality standards for surface waters, with sediment quality standards, or with water quality standards for groundwaters, after obtaining 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.

VI.B. Proposed permit issuance

This proposed permit includes 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 five years.

VII. References for text and appendices

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Washington State and Ecology website general reference links:

Laws and Regulations[4]

Permit and Wastewater Related Information[5]

[4] http://leg.wa.gov/LawsAndAgencyRules/Pages/default.aspx
[5] https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance

Appendix A – Public Involvement Information

Ecology proposes to reissue (or issue) a permit to Camas WWTP. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology placed a Public Notice of Application on June 11, 2020, and June 17, 2020, in the Battle Ground Reflector to inform the public about the submitted application and to invite comment on the reissuance (or issuance) of this permit.

Ecology will place a Public Notice of Draft on April 15, 2025, in the Columbian 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 (a local public library, the closest Regional or Field Office, posted on our website).
- Offers to provide the documents in an alternate format to accommodate special needs.
- Urges people to submit their comments, in writing, before the end of the Comment Period
- Tells how to request a public hearing of comments about the proposed NPDES permit.
- Explains the next step(s) in the permitting process.

Frequently Asked Questions about Effective Public Commenting[6]

You may obtain further information from Ecology by writing to the address listed below.

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

The primary author of this permit and fact sheet is **M. Eleanor Key Ott, P.E.**

[6] https://apps.ecology.wa.gov/publications/SummaryPages/0307023.html

Appendix B – Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. “Date of receipt” is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours as defined in WAC 371-08-305 and -335. “Notice of appeal” is defined in WAC 371-08-340.
- Serve a copy of your appeal and this permit on the Department of Ecology by mail, in person, or by email (see addresses below).
- You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

Filing with the PCHB

For the most current information regarding filing with the PCHB:
visit https://eluho.wa.gov/[7] or call 360-664-9160.

Service on Ecology

Street Address:

Department of Ecology
Attn: Appeals Processing Desk
300 Desmond Drive SE
Lacey, WA 98503

Mailing Address:

Department of Ecology
Attn: Appeals Processing Desk
PO Box 47608
Olympia, WA 98504-7608

E-Mail Address:

ecologyappeals@ecy.wa.gov

[7] https://eluho.wa.gov/

Appendix C – 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 time period, 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 RCW 90.48.520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate point of compliance – An alternative location in the groundwater from the point of compliance where compliance with the groundwater standards is measured. It may be established in the groundwater at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site-specific basis following an AKART analysis. An “early warning value” must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

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) – average of the daily flow volumes anticipated to occur over a calendar year.

Average monthly (intermittent) discharge limit – The average of the measured values obtained over a calendar months’ time taking into account zero discharge days.

Average monthly discharge limit – The average of the measured values obtained over a calendar months’ time.

Background water quality – The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of groundwater at a particular point in time upgradient of an activity that has not been affected by that activity, [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

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 five-day 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_5 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.

Categorical pretreatment standards – National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

Chlorine – A chemical 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.

Date of receipt – This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Days (compliance period interval) – When the compliance period is stated in days: (A) exclude the day of the event that triggers the period; (B) count every day, including intermediate Saturdays, Sundays, and legal holidays; and (C) include the last day of the period, but if the last day is a Saturday, Sunday, or legal holiday, the period continues to run until the end of the next day that is not a Saturday, Sunday, or legal holiday.

Detection level – or method detection limit means the minimum concentration of an analyte (substance) that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results as determined by the procedure given in 40 CFR part 136, Appendix B.

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%.

Distribution uniformity – The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early warning value – The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, groundwater, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement limit – The concentration assigned to a contaminant in the groundwater at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a groundwater criterion will not be exceeded, and that background water quality will be protected.

Engineering report – A document that 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 WAC 173-240-130.

Enterococci – 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 – A bacterium in the family Enterobacteriaceae named Escherichia coli and is a common inhabitant of the intestinal tract of warm-blooded animals, and its presence in water samples is an indication of fecal pollution and the possible presence of enteric pathogens.

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.

Groundwater – Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Immediate reporting – Report permit violations immediately without delay of any interval of time from the moment the permittee becomes aware of the violation. Priority should first be given to stopping an active noncompliance.

Industrial user – A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

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

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

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

Local limits – Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

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 limit (MDL) – See Detection level.

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 permit specifies the area of the authorized mixing zone that Ecology defines following procedures outlined in state regulations (chapter 173-201A WAC).

National pollutant discharge elimination system (NPDES) – Section 402 of the Clean Water Act, 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 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.

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

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.

Point of compliance – The location in the groundwater where the enforcement limit must not be exceeded, and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the groundwater as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

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

- Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day or;
- Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).

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

Quantitation level (QL) – also known as Minimum level (ML) – The term ‘‘minimum level’’ refers to either the sample concentration equivalent to the lowest calibration point in a method or a multiple of the method detection limit (DL), whichever is higher. Minimum levels may be obtained in several ways: They may be published in a method; they may be based on the lowest acceptable calibration point used by a laboratory; or they may be calculated by multiplying the DL in a method, or the DL determined by a laboratory, by a factor of 3. For the purposes of NPDES compliance monitoring, EPA considers the following terms to be synonymous: ‘‘quantitation limit,” ‘‘reporting limit,’’ and ‘‘minimum level’’.

Reasonable potential – A reasonable potential to cause or contribute to 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).

Sample Maximum – No sample may exceed this value.

Significant industrial user (SIU) –

- All industrial users subject to Categorical Pretreatment Standards under 40 CFR Chapter I, Subchapter N and 40 CFR 403.6 and;
- Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

Upon finding that the industrial user meeting the criteria in the second paragraph has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at

any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

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

Slug discharge – Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW's regulations and local limits.

Soil scientist – An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership. Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5, 3, or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

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.

Soluble BOD_5 – Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

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 stormwater drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-based effluent limit – A permit limit based on the ability of a treatment method to reduce the pollutant.

Total coliform bacteria – A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total dissolved solids – That portion of total solids in water or wastewater that passes through a specific filter.

Total maximum daily load (TMDL) – A determination of the amount of pollutant that a water body can receive and still meet water quality standards.

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

Upset – An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent 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 imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

Appendix D — Technical Calculations

Simple Mixing:

Ecology uses simple mixing calculations to assess the impacts of certain conservative pollutants, such as the expected increase in fecal coliform bacteria at the edge of the chronic mixing zone boundary. Simple mixing uses a mass balance approach to proportionally distribute a pollutant load from a discharge into the authorized mixing zone. The approach assumes no decay or generation of the pollutant of concern within the mixing zone. The predicted concentration at the edge of a mixing zone (C_{mz}) is based on the following calculation:

$C_{mz} = C_a + [(C_e – C_a)/DF]$

C_a = ambient concentration

C_e = effluent concentration

DF = dilution factor

Reasonable Potential Analysis:

Ecology uses spreadsheet tools to determine reasonable potential (to cause or contribute to violations of the aquatic life and human health water quality numeric standards) and to calculate effluent limits. The process and formulas for determining reasonable potential and effluent limits in these spreadsheets come from the Technical Support Document for Water Quality-based Toxics Control, (EPA 505/2-90-001) (USEPA, 1991).

Calculation of Water Quality-Based Effluent Limits:

Ecology calculates water quality-based effluent limits by the two-value wasteload allocation process as described on page 100 of the TSD (USEPA, 1991) and shown below.

1. Calculate the acute wasteload allocation WLA_a by multiplying the acute criteria by the acute dilution factor and subtracting the background factor. Calculate the chronic wasteload allocation (WLA_c) by multiplying the chronic criteria by the chronic dilution factor and subtracting the background factor.

WLA_a = (acute criterion x DF_a) – (background concentration x (DF_a – 1))

WLA_c = (chronic criterion x DF_c) – (background concentration x (DF_a – 1))

Where:

DF_a = acute dilution factor

DF_c = chronic dilution factor

2. Calculate the long-term averages (LTA_a and LTA_c) which will comply with the wasteload allocations WLA_a and WLA_c.

$LTA_a = WLA_a \times e^{(0.5\sigma^2 - z\sigma)}$

Where:

$\sigma^2 = \ln(CV^2 + 1)$

$z = 2.326$

CV = coefficient of variation = standard deviation/mean

$LTA_c = WLA_c \times e^{(0.5\sigma^2 - z\sigma)}$

Where:

$\sigma^2 = \ln(CV^2/4 + 1)$

$z = 2.326$

3. Use the smallest LTA of the LTA_a or LTA_c to calculate the maximum daily effluent limit (MDL) and the monthly average effluent limit (AML).

$MDL = LTA \times e^{(z\sigma - 0.5\sigma^2)}$

Where:

$\sigma^2 = \ln(CV^2 + 1)$

$z = 2.326$ (99th percentile)

LTA = limiting long-term average

$AML = LTA \times e^{(z\sigma - 0.5\sigma^2)}$

Where:

$\sigma^2 = \ln(CV^2/n + 1)$

n = number of samples per month

$z = 1.645$ (95th percentile)

LTA = limiting long-term average

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	Camas WWTP
Receiving Water	Columbia River

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?	Dilution Factors

	Max Dilution Factor Allowed
Aquatic Life - Acute	23.0
Aquatic Life - Chronic	121.0
HH-Non-Carcinogen	185.0
HH-Carcinogen	185.0
Whole river at 7Q10	

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25.7	23.2
pH, s.u. (for ammonia and pHmix)	7.3	8.1
pH, s.u. (for pentachlorophenol)	6.6	7.29
Alkalinity, mg/L as CaCO3	100	74
Hardness, mg/L CaCO3	168	66.2
Salinity, psu		0
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	70.6	23.3	8.0
Chronic Zone Boundary	67.0	23.2	8.1
Whole river at 7Q10			

Reasonable Potential Calculation

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	66.2 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	23.0	121.0
Human Health Carcinogenic		185.0
Human Health Non-Carcinogenic		185.0

Pollutant, CAS No. & NPDES Application Ref. No.			AMMONIA, Criteria as Total NH3	ANTIMONY (INORGANIC) 7440360 1M	ARSENIC (dissolved) 7440382 2M	BUTYLBENZYL PHTHALATE 85687 15B	CADMIUM - 7440439 4M Hardness dependent	CHLOROFORM 67663 11V	CHROMIUM(TRI) - 16065831 5M Hardness dependent	CHROMIUM(HEX) 18540299	COPPER - 744068 6M Hardness dependent	CYANIDE 57125 14M	DIETHYL PHTHALATE 84662 24B
Effluent Data	# of Samples (n)		1156	20	20	3	20	4	20	20	20	20	3
	Coeff of Variation (Cv)		2.02	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)		1,455		0.95	0.27	0.022	0.71	0.97	420	8.3	20	1.1
	Calculated 50th percentile Effluent Conc. (when n>10)			0.237							5.47	7.5	
Receiving Water Data	90th Percentile Conc., ug/L		183		0		0.015		0.416	0.086	1.43	0	
	Geo Mean, ug/L			0		0		0			0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	4,641	-	360	-	2.36749	-	391.424	15	11.5366	22	-
		Chronic	589	-	190	-	0.75995	-	126.974	10	7.97908	5.2	-
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	0.013	-	100	-	-	1300	9	200
	Metal Criteria Translator, decimal	Acute	-	-	1	-	0.943	-	0.316	-	0.996	-	-
		Chronic	-	-	1	-	0.943	-	0.86	-	0.996	-	-
	Carcinogen?		N	N	Y	N	N	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	
s	$s^2=\ln(CV^2+1)$	1.275	0.555	0.555	0.555	0.555	0.555	0.555	
Pn	$Pn=(1\text{-confidence level})^{1/n}$	0.997	0.861	0.861	0.861	0.861	0.861	0.861	
Multiplier		1.00	1.36	1.36	1.36	1.36	1.36	1.36	
Max concentration (ug/L) at edge of...	Acute	238	0.056	0.016	0.416	25.000	1.858	1.187	
	Chronic	194	0.011	0.015	0.422	4.822	1.511	0.226	
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	

Aquatic Life Limit Calculation

# of Compliance Samples Expected per month		4	
LTA Coeff. Var. (CV), decimal		0.6	
Permit Limit Coeff. Var. (CV), decimal		0.6	
Waste Load Allocations, ug/L	Acute	343.108	
	Chronic	1199.68	
Long Term Averages, ug/L	Acute	110.166	
	Chronic	632.751	
Limiting LTA, ug/L		110.166	
Metal Translator or 1?		1.00	
Average Monthly Limit (AML), ug/L		**171.0**	
Maximum Daily Limit (MDL), ug/L		**343.1**	

Human Health Reasonable Potential

s	$s^2=\ln(CV^2+1)$	0.55451	0.55451	0.55451	0.55451	0.55451	0.55451
Pn	$Pn=(1\text{-confidence level})1/n$	0.861	0.368	0.473	0.861	0.861	0.368
Multiplier		0.54811	1.20486	1.03846	0.54811	0.54811	1.20486
Dilution Factor		185	185	185	185	185	185
Max Conc. at edge of Chronic Zone, ug/L		0.00128	0.00176	4.0E-03	0.02957	0.04054	0.00716
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 2

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	66.2 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	23.0	121.0
Human Health Carcinogenic		185.0
Human Health Non-Carcinogenic		185.0

Pollutant, CAS No. & NPDES Application Ref. No.			LEAD - 7439921 7M Dependent on hardness	MERCURY 7439976 8M	NAPHTHALENE 91203 39B	NICKEL - 7440020 9M - Dependent on hardness	PHENOL 108952 10A	SELENIUM 7782492 10M	SILVER - 7740224 11M dependent on hardness.	ZINC- 7440666 13M hardness dependent			
Effluent Data	# of Samples (n)		20	20	3	20	3	20	20	20			
	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)		0.15	0.00091		2.82	5.5	1	0.02	28.4			
	Calculated 50th percentile Effluent Conc. (when n>10)			0.00067		2		1		20.9			
Receiving Water Data	90th Percentile Conc., ug/L		0.064	0.00088		0.604		0.274	0.025	1.25			
	Geo Mean, ug/L			0		0	0	0		0			
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	41.1023	2.1	-	998.452	-	20	1.69705	80.6898			
		Chronic	1.6017	0.012	-	110.886	-	5	-	73.6821			
	WQ Criteria for Protection of Human Health, ug/L		-	0.14	-	80	9000	60	-	1000			
	Metal Criteria Translator, decimal	Acute	0.466	0.85	-	0.998	-	-	0.85	0.996			
		Chronic	0.466	-	-	0.997	-	-	-	0.996			
	Carcinogen?		N	N	N	N	N	N	N	N			

Aquatic Life Reasonable Potential

Effluent percentile value			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
Pn	$Pn=(1-\text{confidence level})^{1/n}$		0.861	0.861		0.861		0.861	0.861	0.861
Multiplier			1.36	1.36		1.36		1.36	1.36	1.36
Max concentration (ug/L) at edge of...		Acute	0.065	0.001		0.745		0.321	0.025	2.874
		Chronic	0.064	0.001		0.631		0.283	0.025	1.559
Reasonable Potential? Limit Required?			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

s	$s^2=\ln(CV^2+1)$	0.55451	0.55451	0.55451	0.55451		0.55451
Pn	$Pn=(1-\text{confidence level})^{1/n}$	0.861	0.861	0.368	0.861		0.861
Multiplier		0.54811	0.54811	1.20486	0.54811		0.54811
Dilution Factor		185	185	185	185		185
Max Conc. at edge of Chronic Zone, ug/L		3.6E-06	0.01081	0.03582	5.4E-03		0.11297
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

Calculation of Dissolved Oxygen at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	121.0
Receiving Water DO Concentration, mg/L	8.1
Effluent DO Concentration, mg/L	5.1
Effluent Immediate DO Demand (IDOD), mg/L	2
Surface Water Criteria, mg/L	*8*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**8.06**
DO decrease caused by effluent at chronic boundary, mg/L	**0.04**

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

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	Test low effluent pH at the Chronic Boundary	Test high effluent pH at the Chronic Boundary
1. Dilution Factor at Mixing Zone Boundary	121.0	121.0
2. Ambient/Upstream/Background Conditions		
Temperature (deg C):	23.20	23.20
pH:	8.1	7.3
Alkalinity (mg CaCO3/L):	74.00	74.00
3. Effluent Characteristics		
Temperature (deg C):	25.70	25.70
pH:	6.0	9.0
Alkalinity (mg CaCO3/L):	100.00	100.00
4. Aquatic Life Use Designation	ther species (salmonid/redband trout/warmwater specie	
OUTPUT		
1. Ionization Constants		
Upstream/Background pKa:	6.36	6.36
Effluent pKa:	6.35	6.35
2. Ionization Fractions		
Upstream/Background Ionization Fraction:	0.98	0.90
Effluent Ionization Fraction:	0.31	1.00
3. Total Inorganic Carbon		
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	75	83
Effluent Total Inorganic Carbon (mg CaCO3/L):	322	100
4. Condtions at Mixing Zone Boundary		
Temperature (deg C):	23.22	23.22
Alkalinity (mg CaCO3/L):	74.21	74.21
Total Inorganic Carbon (mg CaCO3/L):	77.39	82.66
pKa:	6.36	6.36
5. Allowable pH change	0.50	0.50
RESULTS		
pH at Mixing Zone Boundary:	7.7	7.3
pH change at Mixing Zone Boundary:	0.37	0.00
Is permit limit needed?	NO	NO

Freshwater Un-ionized Ammonia Criteria Calculation

Based on Chapter 173-201A WAC, amended November 20, 2006

		mixed @ Acute Boundary	mixed @ Chronic Boundary	mixed @ Whole River
INPUT				
1. Receiving Water Temperature (deg C):	23.2	23.3	23.2	#VALUE!
2. Receiving Water pH:	8.1	8.0	8.1	#VALUE!
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?	no			
Ratio	13.500	13.500	13.500	#VALUE!
FT	1.400	1.400	1.400	#VALUE!
FPH	1.000	1.007	1.000	#VALUE!
pKa	9.302	9.299	9.301	#VALUE!
Unionized Fraction	0.059	0.047	0.056	#VALUE!
Unionized ammonia NH3 criteria (mg/L as NH_3)				
Acute:	0.333	0.326	0.000	#VALUE!
Chronic:	0.042	0.042	0.042	#VALUE!
RESULTS				
Total ammonia nitrogen criteria (mg/L as N):				
Acute:	4.641	5.754		#VALUE!
Chronic:	0.589		0.620	#VALUE!

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

INPUT			
1. EFFLUENT CHARACTERISTICS			
Discharge (cfs):			9.44
$CBOD_5$ (mg/L):			5
NBOD (mg/L):			3
Dissolved Oxygen (mg/L):			5
Temperature (deg C):			24
2. RECEIVING WATER CHARACTERISTICS			
Upstream Discharge (cfs):			81400
Upstream $CBOD_5$ (mg/L):			1.5
Upstream NBOD (mg/L):			0.2
Upstream Dissolved Oxygen (mg/L):			9
Upstream Temperature (deg C):			23
Elevation (ft NGVD):			75
Downstream Average Channel Slope (ft/ft):			0.00088
Downstream Average Channel Depth (ft):			21
Downstream Average Channel Velocity (fps):			0.98
3. REAERATION RATE (Base e) at 20 deg C (day^{-1}):			0.13
Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	0.07
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.13
Owens	0.1 - 6	1 - 2	0.08
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.99
4. BOD DECAY RATE (Base e) AT 20 deg C (day^{-1}):			0.07
(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value -->*			0.04

OUTPUT	
1. INITIAL MIXED RIVER CONDITION	
$CBOD_5$ (mg/L):	1.5
NBOD (mg/L):	0.2
Dissolved Oxygen (mg/L):	9.0
Temperature (deg C):	23.0
2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)	
Reaeration (day^-1):	0.14
BOD Decay (day^-1):	0.08
3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU	
Initial Mixed CBODU (mg/L):	2.2
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.4
4. INITIAL DISSOLVED OXYGEN DEFICIT	
Saturation Dissolved Oxygen (mg/L):	8.555
Initial Deficit (mg/L):	-0.44
5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	11.48
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	184.06
7. CRITICAL DO DEFICIT (mg/L):	0.55
8. CRITICAL DO CONCENTRATION (mg/L):	**8.00**

Appendix E — Response to Comments

No comments were received during the public comment period.

APPENDIX I

EVALUATION OF THE WASTEWATER TREATMENT FACILITY REPORT

General Sewer Plan

Evaluation of the Wastewater Treatment Facility



March 2026 / DRAFT

Carollo

General Sewer Plan

Evaluation of the Wastewater Treatment Facility

March 2026 / DRAFT

This document is released for the purpose of information exchange review and planning only under the authority of Matthew M. Huang, March 12, 2026, State of Washington PE No. 54002.

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Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
AAD	annual average day
AADF	annual average day flow
AAF	average annual flow
ADF	average day flow
AOR	Actual (field) oxygen requirement
aSRT	aerobic solids retention time
aSRT	aerobic solids retention times
BNR	biological nutrient removal
BOD5	five-day biochemical oxygen demand
BODrem	Five-day biochemical oxygen demand removed (in biological process)
Ca	calcium
$CaCO_3$	calcium carbonate
Carollo	Carollo Engineers
$cBOD_5$	five-day carbonaceous biochemical oxygen demand
cf	cubic feet
CFU	colony-forming unit
CFU/100 mL	colony-forming units per 100 milliliters
CFU/mL	colony-forming units per milliliter
CIP	Capital Improvement Program
City	City of Camas
CMP	corrugated metal pipe
COD	chemical oxygen demand
DO	dissolved oxygen
DS	dry solids
DSHT	Digested Sludge Holding Tank
DT/d	dry ton per day
Ecology	Washington Department of Ecology
EOPCC	Engineer's Opinion of Probable Cost of Construction
f	filtered
ff	filtered and flocculated
gpd	gallons per day
gpd/sf	gallons per day per square foot
gpm	gallons per minute
GSP	General Sewer Plan

hp	horsepower
HST	high speed turbo
IR	internal recycle
ISS	inert suspended solids
kcal/d	kilocalories per day
kVA	kilovolt-amperes
kW	kilowatt
lb H20/hr	pounds of water per hour
lb SS/lb	pounds of suspended solids per pound
lbs/hr	pounds per hour
MADF	monthly average day flow
MCC	motor control center
MCRT	minimum mean cell residence time
MD	maximum day
MDDL	maximum day design mass load
MDF	maximum day flow
mg	milligrams
Mg	magnesium
MG	million gallons
mg/L	milligrams per liter
MG/yr	million gallons per year
mgd	million gallons per day
mL	milliliter
ML	mixed liquor
mL/g	milliliters per gram
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
mm	millimeters
MMAD	maximum month average day
MMDF	maximum month average day design flow
MMF	maximum month flow
MSL	mean sea level
MWAD	maximum week average day
MWDF	maximum week design flow
MWDL	maximum week average day design mass load
MWF	maximum week flow
N	nitrogen
N/A	not applicable
N/L	nitrogen per liter

NFPA	National Fire Protection Association
NH3	ammonia
NH4	ammonium
No.	number
NPDES	National Pollutant Discharge Elimination System
NPW	non-potable water
O&M	operations and maintenance
OP	ortho-phosphorus
OTE	oxygen transfer efficiency
P/L	phosphorus per liter
PFAS	per- and polyfluoroalkyl substances
PHDF	peak hour design flow
PHDL	peak hour design mass load
PHF	peak hour flow
PHL	peak hour loading
PIDF	peak instantaneous design flow
PLC	programmable logic controller
ppd	pounds per day
ppd/sf	pounds per day per square foot
psig	pounds per square inch gauge
RAS	return activated sludge
RDT	rotary drum thickener
RPA	Reasonable Potential Analysis
S/L	solids per liter
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
sf	square feet
SLR	solids loading rate
SOR	surface overflow rate
SOTE	standard oxygen transfer efficiency
SPA	state point analysis
SRT	solids retention time
STEP	septic tank effluent pump
SU	standard units
SVI	sludge volume index
SWBD	switch board
SWD	side water depth
TDH	total dynamic head
TKN	total Kjeldahl nitrogen

TP	total phosphorus
TS	total solids
TSS	total suspended solids
UV	ultraviolet
UVT	ultraviolet transmittance
VFA	volatile fatty acids
VFD	variable frequency drive
VSR	volatile solids reduction
VSS	volatile suspended solids
WAS	waste activated sludge
WRF	water reclamation facility
WWTF	wastewater treatment facility

SECTION 1 INTRODUCTION

The City of Camas (City) serves the water quality needs of approximately 8,500 residential, industrial, and commercial accounts by maintaining and operating its wastewater treatment facility (WWTF), which has the design treatment capacity and influent loadings summarized in Table 1. The City's sewer service area covers approximately 7,600 acres.

Table 1 Existing Treatment Design Capacity and Pollutant Loadings

Flow Parameter	Value
AAF(2)	5.3 mgd
MADF(1)	2.73 mgd
MMDF(2)	6.1 mgd
PIDF(2)	13.44 mgd
5-day Biochemical Oxygen Maximum Month Loading(2)	5,616 ppd
TSS Maximum Month Loading(2)	8,011 ppd
TKN, as N Maximum Month Loading(2)	2,573 ppd

Notes:
(1) Historical monthly average day flow from 2022-2024 plant data.
(2) Design values from 2014 - Phase 2B WWTF Improvements Record Drawings.
AAF - average annual flow; mgd - million gallons per day; MADF - monthly average day flow; MMDF - maximum month design flow; N - nitrogen; PIDF - peak instantaneous design flow; ppd - pounds per day, TKN - total Kjeldahl nitrogen; TSS - total suspended solids.

To support the development of the City's 2025 General Sewer Plan (GSP), a unit process analysis was conducted to identify shortfalls in plant capacity that could prevent the City from reliably treating and disposing of projected flows and loadings through the planning period (i.e., year 2045). To address these deficiencies, an alternatives analysis of the most viable improvement options was completed, resulting in the development of several projects to be incorporated into the 2025 GSP's Capital Improvement Program (CIP).

This report summarizes the methods and results of these tasks, defining the condition and capacities of the WWTF's unit processes and presenting sequenced recommendations that will enable the City to reliably and cost-effectively serve its customers now and into the future.

SECTION 2 CURRENT NPDES PERMIT

The treated and disinfected effluent is discharged from the WWTF into the Columbia River through a 36-inch corrugated metal pipe that extends approximately 850 feet into the river channel. The City's WWTF effluent must comply with limits on five day biochemical oxygen demand (BOD_5), TSS, ammonia, pH, and fecal coliform bacteria as required under its National Pollutant Discharge Elimination System (NPDES) permit. The current permit (No. WA0020249) was issued by the Washington Department of Ecology (Ecology) on August 1, 2025. The City will continue to work with Ecology to ensure compliance with the discharge limits summarized in Table 2.

A Reasonable Potential Analysis (RPA) was prepared to identify any new reasonable potential for the projected 2035 discharges to cause or contribute to any excursions above state water quality standards with the current design effluent water quality. This updated RPA used spreadsheets developed by Ecology with the projected maximum daily discharge and no other changes compared to the RPA prepared for the current NPDES permit. The updated RPA was conducted to identify any new reasonable potentials that would require infrastructure or process modifications to be addressed in the current capital improvement planning. The updated RPA, included in Appendix A, did not identify any new reasonable potentials.

Table 2 NPDES Permit Effluent Limits for Permit No. WA0020249

Parameter	Average Monthly	Average Weekly
Biological oxygen demand (BOD_5)	▪ 20 mg/L ▪ 842 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,264 ppd
TSS	▪ 20 mg/L ▪ 1,017 ppd ▪ 85% removal	▪ 30 mg/L ▪ 1,525 ppd
Ammonia (NH_3 as N) during summer(1)	▪ 20 mg/L	▪ 30 mg/L
Ammonia (NH_3 as N) during winter(2)	▪ 7 mg/L	▪ 11 mg/L
Parameter	**Minimum**	**Maximum**
pH	• 6 SU	• 9 SU
Parameter	**Monthly Geometric Mean**	**7-Day Geometric Mean**
Fecal coliform bacteria	▪ 200/100 mL	▪ 400/100 mL
Heat Load during summer(1)	▪ $5.87x10^8$ kcal/d	

Notes:
(1) Summer months include June through September.
(2) Winter months include October through May (inclusively).
kcal/d - kilocalories per day; mg/L - milligrams per liter; mL - milliliter; NH_3 - ammonia; SU - standard units.

SECTION 3 PAST EVALUATION OF REUSE

In the 2010 iteration of the general sewer plan, the City explored their potential to practice wastewater reclamation, or the production and beneficial use of reclaimed water. As such, an evaluation was completed to understand the feasibility of reusing effluent from the WWTF or constructing a new water reclamation facility (WRF) to treat wastewater for reuse.

The evaluation determined that, though environmental and social benefits are difficult to quantify and assess, the City and their surrounding communities can benefit indirectly from the use of reclaimed water in the following ways:

- Development of additional outdoor recreational sites for the community.
- Irrigation of parks and playfields, which can potentially increase property values.
- Conservation of the quality and quantity of the City's water resources.
- A flexible and reliable alternative water source for industrial water customers.

The previous study identified peak day demands of 0.338 mgd of reclaimed water irrigation and an annual irrigation demand of 46 million gallons per year (MG/yr).

However, the evaluation also confirmed that the production of reclaimed water is only economically feasible if the cost of producing reclaimed water is less than or equal to the cost of purchasing water or developing additional water rights.

Capital, operation, and maintenance costs for two alternative approaches to implementing reuse were taken from the 2010 GSP and converted from 2006 dollars to 2025 dollars. The two alternatives are: 1) Modify existing WWTF and 2) construct satellite WRF. A new 20-year present worth analysis was conducted with the updated values. Both the 2010 GSP and the current 20-year present worth analysis found that neither the costs to modify the existing WWTF nor construct a satellite WRF were less than or equal to the cost of developing additional water rights, which are available at notably lower costs. The cost to develop and acquire additional water rights was expected to not exceed 5 million dollars in 2006, which would be 15 million dollars in 2025.

Comparisons of the two alternatives are shown in Table 3. Alternative 1 has a 20-year present worth of $30.5 million dollars and Alternative 2 has a 20-year present worth of $81.7 million dollars. Even for Alternative 1, at a $30.5 million cost and an irrigation demand of 46 MG/yr, over a 20 year period, the cost of the reclaimed water is over $33,000 per million gallons (MG) produced, which is far more expensive than the cost to develop and acquire additional water rights. Therefore, water reclamation and reuse were determined to be economically infeasible at this time and not pursued at the City's WWTF.

Chapter 10 of the *2010 General Sewer/Wastewater Facility Plan* (Gray & Osbourne, Inc. 2010) documents the feasibility evaluation of reuse in further detail.

Table 3 Reuse Alternative Cost Comparison

	Alternative 1 Modify Existing WWTF	Alternative 2 Construct Satellite WRF
Capital Cost(1)	$24,414,000	$68,235,000
Annual O&M Cost(2)	$317,000	$705,000
20-year Present Worth(3)	$30,457,000	$81,662,000

Notes:
(1) 2010 general sewer plan used 2006 costs. The Handy-Whitman Index for the Pacific Region in July 2006 and July 2025 were used.
(2) 2010 general sewer plan reported 2004 costs. Costs were updated using the Handy-Whitman Index for the Pacific Region in January 2004.
(3) Discount rate assumed 5% bond repayment rate and 4% inflation for a total rate of 1%.
O&M - operations and maintenance.

SECTION 4 REVIEW OF PLANT HISTORICAL DATA

Carollo Engineers (Carollo) reviewed three years of plant operating data from January 2022 through December 2024. Historical flows and loadings were used to establish current operating conditions as well as design criteria for the projected 2045 flows and loads.

Tables 4 and 5 summarize the historical influent and primary effluent flows, pollutant concentrations, and loadings.

Table 4 Historical Plant Influent and Primary Effluent Summary(1)

Parameter	Flow (mgd)	BOD_5 (mg/L)	TSS (mg/L)	NH_4 (mg/L)
Plant Influent Average	2.73	122	134	40.2
Plant Influent Minimum	1.33	48.8	39.0	9.7
Plant Influent Maximum	7.80	314	380	59.3
Primary Effluent Average	-	66.6	38.6	-
Primary Effluent Minimum	-	17.7	10.0	-
Primary Effluent Maximum	-	801	201	-

Notes:
(1) Based on plant data from 2022 to 2024.
NH_4 - ammonium.

Table 5 Historical Plant Influent and Primary Effluent Pollutant Loadings Summary

Parameter	2022 Average	2023 Average	2024 Average	2022-2024 Average
Plant Influent Flow, MG	2.71	2.64	2.85	2.73
Plant Influent BOD_5 Mass Loading, ppd	2,500	2,770	2,770	2,680
Plant Influent TSS Mass Loading, ppd	2,870	3,150	2,910	2,977
Plant Influent TKN Mass Loading, ppd(1)	1,320	1,240	1,210	1,257
Primary Effluent BOD_5 Mass Loading, ppd	2,100	1,550	1,550	1,733
Primary Effluent TSS Mass Loading, ppd	1,380	921	829	1,043

Notes:
(1) TKN loadings based on assumed NH_4/TKN ratio of 0.70.

4.1 Additional Influent Wastewater Sampling

The City conducted additional influent wastewater sampling on three separate days - May 14, 2025, June 25, 2025, and July 23, 2025. Influent samples were tested for TSS, volatile suspended solids (VSS), volatile fatty acids (VFA), cBOD5, TKN, NH_3-N, ortho-phosphorus (OP), and total phosphorus (TP) during the sampling effort.

Tables 6 and 7 present summaries of the special sampling conducted in May, June, and July 2025 to characterize the influent wastewater and some of the in-plant recycle streams.

Table 6 Additional Influent Wastewater Sampling Summary (May 14, June 25, and July 22, 2025)

Parameter	Units	May 14, 2025	June 25, 2025	July 22, 2025	Average Concentration
Influent Temperature	°C			23.6	23.6
Influent pH	pH units			7.33	7.33
Influent Alkalinity	mg/L as $CaCO_3$	267	241	276	261
Influent COD	mg/L	200	228	241	223
Influent fCOD	mg/L	118	132	136	129
Influent ffCOD	mg/L	78.1	71.3	78.9	76.1
Influent TKN	mg/L	48.8	51.6	49.7	49.2

Parameter	Units	May 14, 2025	June 25, 2025	July 22, 2025	Average Concentration
Influent TP	mg/L	4.88	15.1	31.5	17.1
Influent Mg	mg/L	21.4	9.46	12.2	14.3
Influent Ca	mg/L	76.2	67	59	67.4
Influent Acetic acid	mg/L	4.5	3.3	2.8	3.5
Total VFAs	mg/L	4.5	3.3	2.8	3.5

Notes:
°C - degrees Celsius; Ca - calcium; $CaCO_3$ - calcium carbonate; COD - chemical oxygen demand; f - filtered; ff - filtered and flocculated; Mg - magnesium.

Table 7 Additional Operational Data from Special Sampling Days (May 14, June 25, and July 22, 2025)

Parameter	Average BOD_5 Concentration	Average Ammonia Concentration	Average TSS Concentration	Average VSS Concentration
Influent Wastewater (mg/L)	124	46.8	140	126
Primary Clarifier Effluent (mg/L)	89		60	50
Plant Effluent (mg/L)	4.3	2.5	3.2	3.0
Plant Drain Pump Station No. 1 (mg/L)		148.5		
Plant Drain Pump Station No.2 (mg/L)		7.3		
RDT Filtrate (mg/L)	116		297	88.5
Centrate (mg/L)	69			
RAS (mg/L)			5,687	4,497

Notes:
No. - number; RAS - return activated sludge; RDT - rotary drum thickener.

4.2 Historical Plant Performance

Table 8 summarizes the historical plant performance data from January 2022 through December 2024.

Table 8 Historical Plant Performance Data (January 2022 through December 2024)

Parameter	Average	Minimum	Maximum
Primary Effluent BOD_5 (mg/L)	65	18	169
% Removal, Primary Clarifiers, BOD_5	47%	46%	64%
Primary Effluent TSS (mg/L)	39	10	201
% Removal, Primary Clarifiers, TSS	71%	47%	74%
Aeration MLSS (mg/L)	2,356	1,250	11,130
Aeration MLVSS (mg/L)	1,816	1,110	2,480
MLVSS:MLSS ratio, %	77%		
Aeration SVI (mL/g)	91		162(2)
Aerobic Sludge Retention Time, SRT, days	6		
Total Sludge Retention Time, SRT, days	10.4		
RAS TSS (mg/L)	6,201	1,540	14,500
Effluent BOD_5, mg/L	3.7	1.7	22.2

Parameter	Average	Minimum	Maximum
Effluent TSS (mg/L)	3.6	1.9	28.2
Effluent TKN (mg/L)	0.4	0	7.4
Effluent NH_3-N (mg/L)	0.3	0	5.2
Effluent pH (SU)	7.1	6.5	7.5
Effluent Wastewater Temperature (°C)	19	13	
Effluent Fecal Coliform, CFU/100 mL	32.8	1	1,510
Effluent Alkalinity, mg/L as $CaCO_3$	244	242	247
Effluent UVT (%)	75	43	85
Magnesium Hydroxide usage (gpd)	370	34	600

Notes:
(1) TKN loadings based on assumed NH_4/TKN ratio of 0.70.
(2) 90th percentile of daily data.
CFU/100 mL - colony-forming units per 100 milliliters; gpd - gallons per day; mL/g - milliliters per gram; MLSS - mixed liquor suspended solids; MLVSS - mixed liquor volatile suspended solids; SRT - solids retention time; SVI - sludge volume index; UVT - ultraviolet transmittance; WAS - waste activated sludge

SECTION 5 PLANT UNIT PROCESSES AND UNIT OPERATIONS

This section presents an evaluation of each unit treatment process, comparing the rated or installed capacity with the treatment requirements under current and projected flows and loadings through the 2045 planning year. Any deficiencies or limitations in the plant's installed capacity to meet regulatory and operational requirements by 2045 are also summarized.

To this end, the unit process analysis was completed through the following sequential tasks:

- Compiled and analyzed three years of WWTF data (January 2022 through December 2024).
- Developed a hydraulic model of the collection system to estimate future ADF, maximum month flow (MMF), maximum day flow (MDF), and peak hour flows (PHF) at the WWTF.
- Estimated future flows and mass loadings anticipated through the planning year 2045.
- Prepared spreadsheet-based capacity estimates of existing liquid and solids processes to meet anticipated permit conditions under current and future influent characteristics.
- Updated and recalibrated hydraulic and BioWin models with recent plant data (May to June 2025) to assess future flow and loading impacts on facility performance. Both models were originally developed for the 2024 GSP and were updated and recalibrated using recent plant data. Monthly operating data from May 2025 was used to calibrate the BioWin model.
- Conducted plant tours in June 2025 to review and update prior condition assessments prepared as part of the 2024 GSP and identify any limitations.
- Using both the spreadsheet-based capacity assessment and the results of the calibrated hydraulic and BioWin models, determined future treatment capacities required for each unit process and estimated the optimal timing of necessary plant improvements.

The following sections highlight key points and findings from the above tasks.

5.1 Projected Plant Influent Flows and Loads

Table 9 summarizes the past year (2024) and projected (2045) flows and loads that must be treated and discharged to the Columbia River. These projections were developed based on historical influent flows and raw wastewater pollutant concentrations, typical septage and septic tank effluent pump (STEP) system characteristics, population growth projections, and industrial flow contributions. Projected future flows are based on Comprehensive Plan 2045 land uses and wastewater flow factors developed for the various land uses as part of the 2025 GSP. Chapter 3 Basis of Planning provides details on the methods used to develop these flow and load projections.

Table 9 Year 2045 Projected Flows and Estimated Influent Pollutant Characteristics

Parameter	Criteria	Units	Year 2045 Value
Influent Flow	AAF	mgd	5.36
	Maximum Month Peaking Factor	----	1.4
	MMF	mgd	7.5
	Maximum Week Peaking Factor	----	1.4
	MWF	mgd	8.6
	Maximum Day Peaking Factor	----	2.0
	MDF	mgd	10.7
	Peak Hour Peaking Factor	----	3.80
	PHF	mgd	20.4
	Peak Instantaneous Design Peaking Factor	----	4.15
	PIDF	mgd	22.2
$cBOD_5$[(1)]	AAD	mg/L	135
	AAD Mass	ppd	6,035
	MMAD Peaking Factor	----	1.25
	MMAD Mass	ppd	7,544
	MWAD Peaking Factor	----	1.4
	MWAD Mass	ppd	8,449
	MD Peaking Factor	----	1.5
	MD Mass	ppd	9,052
TSS	AAD	mg/L	130
	AAD Mass	ppd	5,811
	MMAD Peaking Factor	----	1.25
	MMAD Mass	ppd	7,264
	MWAD Peaking Factor	----	1.4
	MWAD Mass	ppd	8,136
	MD Peaking Factor	----	1.6
	MD Mass	ppd	9,298

Parameter	Criteria	Units	Year 2045 Value
TKN	AAD	mg/L	55
	AAD Mass	ppd	2,459
	MMAD Peaking Factor	----	1.15
	MMAD Mass	ppd	2,827
	MWAD Peaking Factor	----	1.20
	MWAD Mass	ppd	2,950
	MD Peaking Factor	----	1.4
	MD Mass	ppd	3,442

Notes:
AAD - annual average day; MD - maximum day; MMAD - maximum month average day; MWAD - maximum week average day; MWF - maximum week flow.

5.2 Spreadsheet Based Assessment of Activated Sludge Treatment Capacity

A spreadsheet-based desktop capacity analysis of the existing activated sludge treatment process was performed using current and projected influent wastewater characteristics to evaluate compliance with the effluent permit conditions. The analysis used the future flows and loads summarized in Table 9. Five-day carbonaceous biochemical oxygen demand ($cBOD_5$) values were increased by 10 percent for the purpose of sizing the activated sludge process. This was done to account for the effect of the nitrification inhibitor used in standard $cBOD_5$ tests.

Table 10 presents the process assumptions used for the desktop capacity analysis.

Table 10 Process Assumptions for Capacity Check of the Activated Sludge Process

Parameter	Criteria	Units	Value
Water Temperature	Minimum	°C	15.0
	Maximum	°C	26.0
Air Temperature	Minimum	°C	1.0
	Maximum	°C	35.0
Relative Humidity	Minimum (during summer)	%	60
	Maximum (during winter)	%	90
Site Elevation		Feet above MSL	40
Oxygen demand peak factor	Peak Loading	----	2.0
Process DO concentration (1)		mg/L	0.5 – 2.0
Aerobic SRT	Nitrification Safety Factor	----	2.0
	Minimum	days	8.0
Net Yield	MMAD	lb SS/lb $cBOD_5$	0.9
Clarifier Settling	SVI (98th Percentile)	mL/g	160
	SVI Formula	----	Diagger-Roper
	Clarifier Safety Factor	----	1.3
	Peak Surface Overflow Rate	gpd/sf	1,200

Parameter	Criteria	Units	Value
No. of Aeration Basins			3
Total Volume of Aeration Basins	All 3 Basins Combined	MG (cf)	2.263 (302,580)
	Anaerobic Selector Volume (2)	MG (cf)	0.133 (17,801)
	Anoxic Volume (2)	MG (cf)	0.810 (108,367)
	Aeration Volume (2)	MG (cf)	1.319 (176,412)
Primary Clarifier BOD_5 and TSS Removals	AAD	% (BOD_5/TSS)	30/54(3)
	MMAD		26/47
	MWAD		25/44
	MD		19/34
No. of Secondary Clarifiers			3(4)
Diameter of Secondary Clarifiers		feet	75

Notes:
(1) Spatial DO concentration in the aerobic zone. The maximum is 2.0 mg/L assumed during typical average day conditions and 0.5 mg/L at peak oxygen demand condition.
(2) Total Volume for all three Basins.
(3) The average BOD_5 removal of the existing primary clarifiers is ~46%.
(4) One of the secondary clarifiers (No. 1) is offline and needs to be demolished and rebuilt.
cf - cubic feet; DO - dissolved oxygen; lb SS/lb - pounds of suspended solids per pound; MSL - mean seal level.

The City's WWTF does not use Secondary Clarifier No. 1 because its flat bottom severely limits the withdrawal of settled mixed liquor, thereby negatively affecting RAS rates and the associated treatment capacity.

Activated sludge capacity curves are a graphical tool that can be used to estimate the treatment capacity of an activated sludge process. The operating MLSS concentration is the one parameter that is common to establishing the integrated or combined capacity of the biological reactors and the secondary clarifiers. Capacity curves use the MLSS concentration to graphically illustrate this integrated capacity of both unit processes as a function of the MLSS concentration. The capacity of the biological reactors increases linearly with increasing MLSS concentration while the clarifier capacity is an exponential function that increases with decreasing MLSS concentration. Therefore, the intersection of the aeration tank and clarifier curves represents the maximum capacity of the integrated process under the assumptions used to construct the graph (SRT, net yield, SVI, safety factors, etc.). However, the activated sludge process can operate successfully at any point on the capacity graph that is under both the aeration tank curve and the clarifier curve.

Figure 1 presents a capacity chart for the current operating conditions with two secondary clarifiers in service, based on the average values summarized in Table 8 for plant performance. The current capacity is estimated to range from approximately 3.1 to 4.6 mgd, depending on the SVI, using the maximum week organic loading for the biological reactors and the peak hour flow for secondary clarifier capacity, in accordance with Table G2-1 of the *Criteria for Sewage Works Design* (August 2008, Ecology).

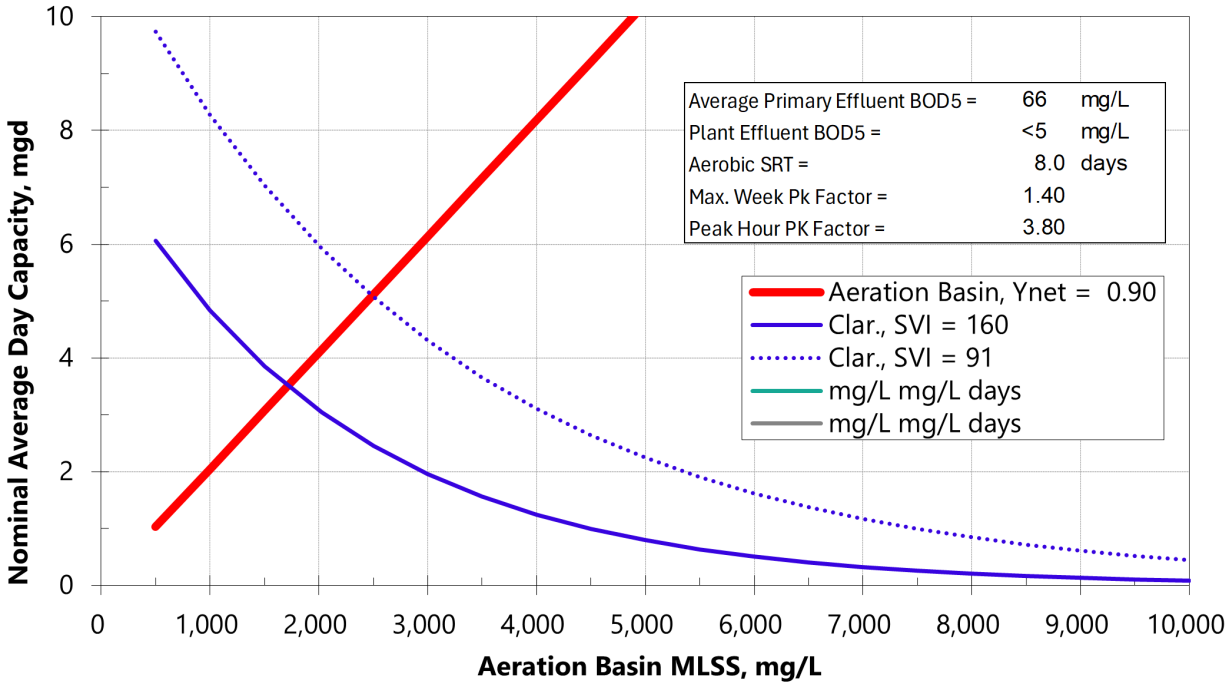


Figure 1 Capacity Chart - Current Operations with Three Aeration Tanks and Two Secondary Clarifiers

Capacity curves (and steady-state process simulation models) assume or predict the biomass inventory and the resulting MLSS concentration that results from a constant uniform plant influent flow with the assumed pollutant concentrations, thus these capacity estimates are relatively conservative. Peak flows and influent loads to wastewater treatment facilities are dynamic, short duration events during which both flow and pollutant mass loads vary. For maximum day and peak hour events, the MLSS concentration remains near the pre-storm MLSS concentration and not at the much higher concentration that would develop if the peak loads lasted for multiple days. While the MLSS concentrations will increase over the course of maximum week events, dynamic simulations are required to quantify the expected increase in MLSS concentrations and the resulting effect on treatment capacity.

In addition, during wet weather periods activated sludge processes can be operated at lower SRTs with lower MLSS concentrations to reduce the stress on the secondary clarifiers.

Secondary clarifiers will experience different behavior during peak flow events that cannot be accurately predicted using steady-state methods. Secondary clarifiers perform normally until the solids loading rate exceeds the capacity of the clarifier(s) at which time the sludge blanket will begin to propagate upwards in the clarifier. Depending on the magnitude and duration of the peak flows, the depth of the sludge blanket may or may not increase enough to result in large concentrations of TSS leaving in the clarifier effluent. Again, dynamic models can provide much better predictions of wet weather performance and thus help to size the treatment facilities appropriately.

For the reasons discussed above, common industry practice when using steady-state methods evaluates the capacity of activated sludge processes using the maximum month mass loadings and either maximum day or PHFs. This better portrays the condition that the secondary clarifiers will experience during peak flow events. Under maximum month organic loads and MDFs, the existing WWTF has an estimated capacity between about 4.4 and 6.3 mgd with three aeration tanks and two secondary clarifiers in service.

5.3 State Point Analysis

The relationship between MLSS concentrations, plant flows, and clarifier capacity can also be illustrated by another graphical method commonly called state point analysis as described below.

A clarifier state point analysis determines the effect of operating conditions on secondary clarifier capacity by comparing the actual solids loading to the theoretical maximum solids loading rate in pounds per day per square foot (ppd/sf) of the clarifier surface area as a function of the MLSS concentration. Key factors in a state point analysis are the MLSS concentration, the flow fed to the clarifiers, and the settling velocity of the MLSS as predicted by the selected correlation between SVI and settling velocity. State point analyses are very useful for predicting the ability of secondary clarifiers to operate successfully under peak flow conditions.

The state point diagram is constructed by drawing overflow and RAS underflow lines on a graph of MLSS concentration versus clarifier solids loading rate together with a solids flux curve. The solids flux curve represents the maximum possible solids loading rate to the clarifier as a function of MLSS concentration while maintaining the desired solids separation efficiency. The overflow line starts from the origin, with a slope equal to the overflow rate on the clarifiers in gallons per day per square foot (gpd/sf). The RAS line is drawn from the intersection of the overflow line and the MLSS concentration to the RAS concentration on the horizontal axis. The intersection of the overflow and RAS underflow operating lines (or state point) represents the operating point for the clarifier. If the operating point is underneath the solids flux curve and the RAS line remains below the falling limb of the solids flux curve, the clarifier is in a safe operating mode. Secondary clarifiers must operate successfully under design maximum day and peak hour flows without failing.

A state point analysis of the secondary clarifiers at the WWTF was conducted, and the results for peak flow conditions are shown in Figure 2. The state point diagram represents estimated settling characteristics based on the Daigger and Roper correlation between SVI and MLSS settling velocity. While a clarifier safety factor of 1.3 is typically used, the analysis indicates that with four secondary clarifier s online, the facility will be able to treat the 2045 design PHF of 20.4 mgd at a maximum MLSS concentration of 2,800 mg/L with no clarifier safety factor (SF = 1.0).

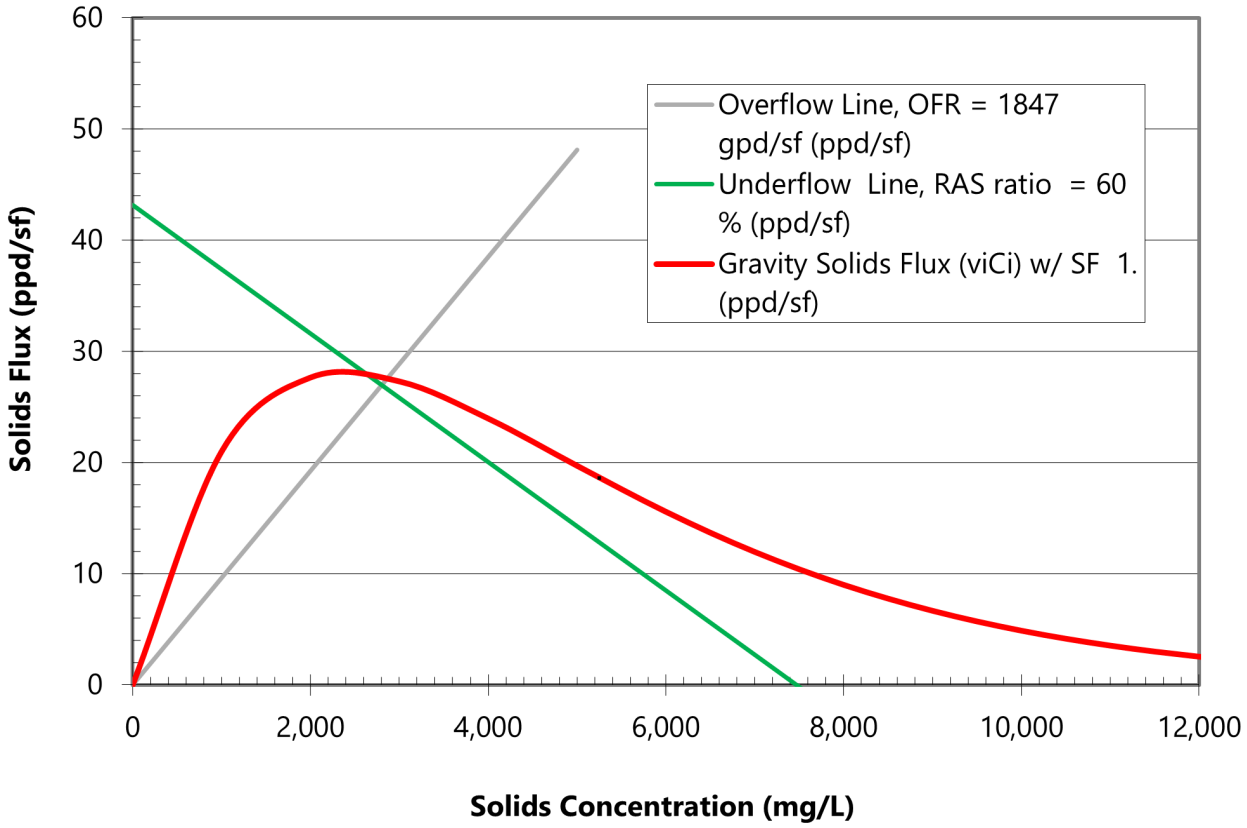


Figure 2 State Point Analysis - 2045 Peak Hour Flow with Four Secondary Clarifiers On-line

The desktop analysis indicates that the City should reconstruct Secondary Clarifier No. 1 with a new sloped bottom and spiral scraper mechanism identical to the existing Secondary Clarifier No. 3, as well as constructing a fourth Secondary Clarifier (No. 4) in the future (by 2040) to provide adequate capacity to treat flows and loads through 2045 and beyond.

The statistical evaluation of historical plant data revealed periodic occurrences of sludge bulking in the BNR process. For the three years of data examined there were three periods where the SVI's exceeded the proposed design SVI of 160. A chronological chart of daily SVIs and a frequency of occurrence chart are provided in Appendix B.

Although these periods present less than 10 percent of the days in that two-year period, they are a concern as they indicate that the current method of bulking control (chlorination) takes weeks to be effective. All three episodes occurred in winter or early spring when peak wet weather flows typically occur. The secondary clarifiers could fail in the future (when both plant flow and peak flows are projected to be higher than existing flows) if the peak flows occur during a bulking episode.

There have been significant advances in the last decade in the use of selectors and other methods of obtaining a densified activated sludge that provides lower and more stable operating SVIs. It is recommended that the WWTF evaluate the causes of the bulking including identification of the causative organisms and evaluate the feasibility of implementing at least one of the methods before or during the next design and construction project at the WWTF.

5.4 Process Simulation (BioWin Modeling)

For this update to the GSP the BioWin process simulation model developed for the previous version of the GSP was updated and calibrated with new data. Process simulation models like BioWin and others are computer applications consisting of simplified, mathematical representations of real-world physical, chemical, and biological treatment processes. They represent the state-of-the-art for the evaluation of biological wastewater treatment processes like those used at the City WWTF.

All process modeling was done with the BioWin Process Simulator Version 6.3 developed by EnviroSim Associates Ltd. BioWin simulates biological, chemical, and physical reactions using an integrated process model, and provides simulation results in user defined tables and charts. BioWin can model 82 different processes with up to 50 state variables and nine types of biomasses. This typically results in reliable predictions of expected performance for most commonly used biological wastewater treatment systems.

This calibration of the BioWin model for the WWTF used model defaults and assumptions refined using four categories of plant information including:

- Physical Plant Data - This is the dimensional data (e.g., volume, surface area) and configuration of the unit treatment processes.
- Influent Data - This is the influent flow and concentration data, including characterization of influent wastewater composition in terms of various fractions such as the particulate, colloidal, and soluble fractions of organic materials.
- Plant Operational Data - This includes RAS and WAS flow and mass rates, mixed liquor recycle rates, and DO concentrations in the aeration basins, etc.
- Kinetic and Stoichiometric Coefficients - For typical domestic wastewater modification of kinetic and stoichiometric coefficients is not necessary.

For this update to the GSP the BioWin model was calibrated using existing treatment facility operational data from January 2022 through December 2024 supplemented by data obtained from the special sampling events, and by running a dynamic simulation using the daily plant influent and effluent values (BOD_5, TSS, NH_3) and MLSS concentrations from May 2025.

Once the calibration effort was deemed acceptable, parameters were established for future conditions under which the WWTF must operate. Specifically, this effort adopted the flows and load projections presented in Tables 4 and 5 while assuming that effluent limits on ammonia would be as low as 7 mg/L for all scenarios. This is the highest allowable average monthly winter concentration of ammonia. Monthly averages are calculated from the sum of the measured daily discharge concentrations divided by the sum of the number of measurements over a calendar month.

5.4.1 Model Configuration

Figure 3 provides the process flow diagram used for the process simulations for the existing WWTF.

The key geometric features of the process as input to the model are summarized in Tables 11, 12, and 13. Detailed information on the proposed tank geometry from which the model input was derived are provided in Appendix C along with the geometry input to the model.

Table 11 Summary Geometry for the Bioreactors in the BioWin Model of the Wastewater Treatment Facility(1)

Zone	2025		2045	
	Zone Volume (MG)	Fraction Total (%)	Zone Volume (MG)	Fraction Total (%)
Selector	0.088	5.8%	0.066	2.9%
Anoxic(2)	0.270	17.9%	0.876	38.7%
Aeration	1.149	76.2%	1.320	58.4%
Total	1.507	100.0%	2.262	100.0%
Total anoxic(2)	0.238	23.8%	0.942	41.6%
Total aerobic	0.762	76.2%	1.320	58.4%

Notes:
(1) Simulations of 2025 conditions assumed two bioreactors and two secondary clarifiers in service; simulations of 2045 conditions assumed three bioreactors and four secondary clarifiers in service.
(2) For simulations of 2045 conditions the mixed liquor recycle was directed to the first anoxic zone and the second anoxic zone was simulated as an aerated bioreactor. The same, modified configurated was used for all bioreactors.

Table 12 Tank Geometry for Additional Unit Processes Used in the Wastewater Treatment Facility Process Simulation Model

Tank/Zone	No.	Diameter (feet)	Depth (feet)	Unit Area (sf)	Unit Volume (MG)	Total Area (sf)	Total Volume (MG)
Primary clarifiers	2	60.00	10.00	2,827	0.21	5,655	0.42
Secondary clarifiers(1)(2)	2/4	75.00	14.00	4,418	0.46	8,836	0.92
Anaerobic digesters	2	32.00	29.50	804	0.177	1,608	0.355
Gravity sludge thickener	1	30.00	10.00	707	0.053	707	0.053

Notes:
(1) Models of the existing process assumed two of the three existing secondary clarifiers were in service. Models simulating 2045 MMAD operation assumed four clarifiers in service.
(2) All model simulations used a clarifier depth of 14 feet. However, all existing clarifiers have different SWD. New clarifiers (No. 1 and No. 4) would be 75 foot diameter and have a 17 foot SWD to match existing clarifier No. 2. Clarifier No. 3 is shallower at 14 feet SWD.
sf - square feet; SWD - side water depth.

For simulations of 2025 conditions the WAS flow rate was controlled to match the historical mixed liquor suspended solids concentrations in the biological nutrient removal (BNR) process. For the 2045 simulations the WAS flow rate was controlled to provide the desired aerobic solids retention time (aSRT).

For all simulations, the RAS flow rate was held constant at a flow ratio of 0.6: 1 relative to the influent flow to match the historical data.

For both the 2025 and 2045 simulations the Internal mixed liquor recycle flow was held constant at 9 mgd to match the reported capacity of the internal recycle pumps. This is a total mixed liquor recycle ratio of 3.2: 1 relative to the current influent flow at 2.8 mgd and about 1.7: 1 for 2045 ADF. For the 2025 calibration the mixed liquor recycle was split with about half directed to the first selector zone and half to the third selector zone. For the simulations of future conditions, the mixed liquor recycle was directed to the first anoxic zone.

Supplemental alkalinity was assumed to be provided by adding magnesium hydroxide with a concentration of 7.7 pounds per gallon or 923,593 mg/L. For modeling purposes, magnesium hydroxide

was used for supplemental alkalinity as this is the chemical currently used by the plant. However, adding magnesium to the process increases the potential for struvite formation. It is recommended that the plant evaluate the use of an alternative source of supplemental alkalinity. No supplemental carbon was added in the simulations since the WWTF does not have a limit on oxidized nitrogen. However, maximizing denitrification in the BNR process through operation changes should recover a fraction of the alkalinity consumed by nitrification and reduce the need for supplemental alkalinity.

Assumed solids recoveries used in the model for the solids processing units and filters are provided in Table 13. The solids recovery for the sludge thickeners was adjusted to approximate the historical thickened sludge concentrations. Effluent filtration was simulated using the BioWin Separator – Dewatering unit with an assumed 55 percent removal of suspended solids to match historical performance. The filter backwash flow rate was set to 2 percent of the influent flow.

Table 13 Solids Recovery Assumed in Process Simulation Model

Unit Process	Assumed Solids Recovery (%)	
	May 2025 Calibration	2045 Average Day Maximum Month
Primary Clarifiers(1)	70	34 - 54
Gravity Thickener	95	95
Rotary Drum Thickener	85	85
Centrifuge	88	88
Dryer	95	95
Tertiary Filters(2)	35	55

Notes:
(1) Primary clarifier TSS removal was varied as a function of the surface loading rate using a common correlation between SLR and TSS removal.
(2) In the BioWin model, tertiary filtration was simulated using the solids separation module. As this module uses a constant TSS removal percentage regardless of influent flow or TSS, the assumed TSS removal by the filters in the model was adjusted so that the predicted TSS in the filter effluent would be consistent with expected performance.

Aeration was modeled in the BNR train by setting the operating DO concentrations and letting the model predict airflow and the actual oxygen transfer rates (AOR). The model default values were used for alpha (0.50) and beta (0.95) for the calibration runs and changed to 0.55 and 0.99 for the 2045 simulations. Both sets of values are conservative estimates of the ability to transfer oxygen in the mixed liquor of a BNR process using typical 9-inch circular fine pore diffusers. The aeration profile is provided in Table 14.

Table 14 Dissolved Oxygen Input for Biological Nutrient Removal Train in Process Simulation Model

Element	2025	2045
Selector 1	Unaerated	Unaerated
Selector 2	Unaerated	Unaerated
Selector 3	Unaerated	Unaerated
Anoxic 1	Unaerated	Unaerated
Anoxic 2	Unaerated	2.0
Aeration 1	0.5	2.0
Aeration 2	1.0	2.0
Aeration 3	1.0	2.0

5.4.2 Influent Wastewater Characteristics

The flows and concentrations input to the model were developed from the statistical analysis of the historical data from 2022 through 2024 and the special sampling data (presented previously in Tables 6 and 7) and are shown in Table 15. The BioWin Influent Specifier was used to estimate the values for the influent parameters and characteristic fractions needed for the process simulations but not typically measured. For the 2045 simulations the estimated influent fractions from May, June and July 2025 were averaged.

All May 2025 simulations were done using the reported daily mixed liquor temperatures while all the 2045 simulations assumed a wintertime wastewater temperature of 15°C.

Table 15 BioWin Model Influent Parameters(1)

Name	Units	2025	2045
Flow	mgd	2.8	7.5
COD	mg COD/L	260	300
TKN	mg N/L	60	55
TP	mg P/L	4.5	3.0
TS	mg S/L	10	62
Nitrate	mg N/L	0	0
pH	SU	7.2	7.3
Alkalinity	mg $CaCO_3$/L	260	260
ISS	mg ISS/L	34	13
Ca	mg/L	60	67.4
Mg	mg/L	10	14.3
DO	mg/L	0	0
Water Temperature	°C	15	15

Notes:
(1) For 2025, these are the average values for May 2025. For 2045 these are the design average day maximum month values.
ISS - inert suspended solids; mg - milligrams; N/L - nitrogen per liter; P/L - phosphorus per liter; S/L - solids per liter; TS - total solids.

The process configuration used in the BioWin model is presented in Figure 3 for the existing WWTF. The future configuration is identical with the exception that all the internal mixed liquor recycle is returned to the first pre-anoxic zone.

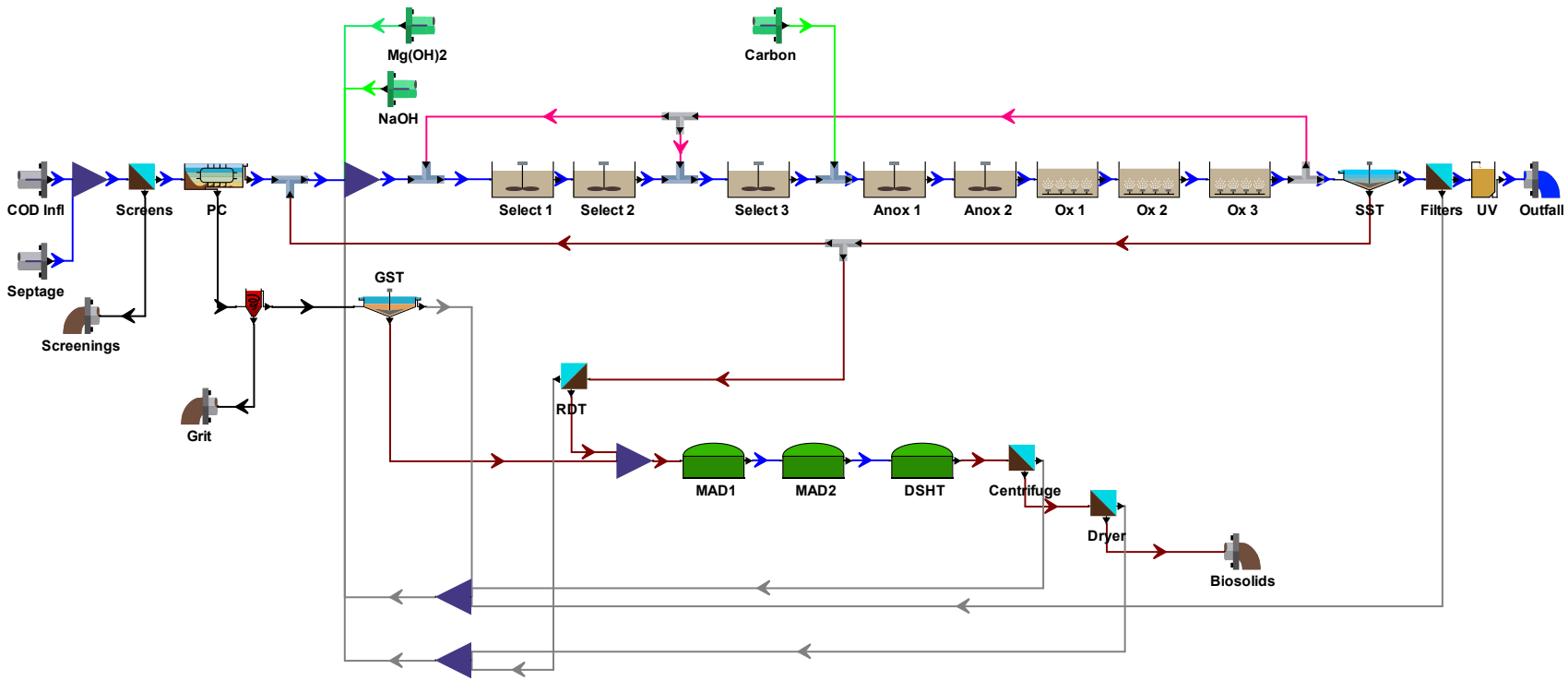


Figure 3 Process Flow Diagram Used in the BioWin Model of the Existing Camas Wastewater Treatment Facility

5.4.3 Model Kinetic and Stoichiometric Parameters

Model default values were used for kinetic and stoichiometric parameters except for the maximum specific growth rates for ordinary heterotrophic organisms and ammonia oxidizing bacteria. The values for these two parameters were set at 2.0 day^{-1} and 0.70 day^{-1} respectively to better match the predicted effluent $cBOD_5$ and ammonium concentrations to reported concentrations. This suggests that there may be one or more toxic compounds in the raw wastewater that inhibit the growth of both heterotrophs and nitrifiers. This is typical of the semiconductor industry.

The settling coefficients for the Modified Vesilind equation used in BioWin were changed to be representative of a mixed liquor with a SVI of 160 using the Daigger correlation between SVI and mixed liquor settling velocities. The values used were 0.340 feet per minute for the maximum Vesilind settling velocity and 0.418 liters per gram for the Vesilind hindered zone settling parameter.

5.4.4 Model Results

Model calibration simulations were performed at existing average daily flows and pollutant concentrations for May 2025 were applied for several purposes including:

- Checking predicted effluent quality.
- Checking historical MLSS for May 2025 against predicted performance.
- Checking predicted MLSS for 2045 average day maximum month mass loads at the desired minimum aerobic solids retention time of eight days.
- Preparing a mass balance for the treatment plant for the 2045 average day maximum month mass loads.

For the 2045 simulations, the main purpose of the simulations was to verify that proposed improvements would result in a robust facility that treats the projected future flows and mass load while meeting the current NPDES permit requirements.

Summaries of the actual and predicted effluent concentrations for the key effluent parameters from the May 2025 calibration simulations are provided in Tables 16 and 17. For those parameters that are monitored by the plant, the predicted effluent concentrations are close to those measured. As can be seen in Table 16, the predicted concentrations match the measured values reasonably well.

Table 16 Summary of Predicted Effluent Concentrations(1)

Parameters	Predicted Concentration (mg/L)(2)	Reported Concentration (mg/L)
Alkalinity (mg $CaCO_3$/L)	256	244
BOD – Total	2.5	3.3
COD - Total	26	---
TSS	3.6	2.8
N - Ammonia	0.19	0.31
N - TKN	2.2	0.44
N - Nitrate	37	---
N - Nitrite + Nitrate	37	---

Parameters	Predicted Concentration (mg/L)(2)	Reported Concentration (mg/L)
N - Nitrite	0.06	---
N - Total inorganic N	37.2	---
TP	4.6	---
pH	7.0	7.3

Notes:
(1) For May 2025
(2) At 19.4 °C, 8.7-day aerobic SRT, IR ratio = 3.2: 1, RAS ratio = 0.6: 1.

The solids balance produced by the BioWin simulation for May 2025 did not match the available operating data in one key aspect. There is a notable difference between the model predictions for the mass of WAS and the value reported by the plant in the historical data.

This discrepancy in the predicted versus measured waste sludge values also shows when comparing the predicted net sludge yield with that calculated from the plant data. The net sludge is the mass of suspended solids wasted from an activated sludge process divided by the mass of $cBOD_5$ removed in the process. This parameter provides a simple way to check or estimate the mass of sludge produced in an activated sludge process and the value is generally in the range of 0.6 to 1.0. The net sludge yield predicted by the process model is about 0.7 to 0.9 while the value calculated from the plant data is about 1.5.

There could be several reasons causing this difference between the predicted and measured WAS. These include the following:

- A historically non-representative sample location for the WAS.
- An inaccurate measurement of WAS mass. Many facilities have difficulty accurately measuring the WAS mass because they use total daily WAS flow but a TSS measurement from one grab sample to calculate mass. Since WAS TSS concentrations typically vary on a diurnal cycle this introduces the potential for error in the mass calculation.
- Inefficient operation of unit processes used to treat the solids generated by the treatment process. Low solids capture in a thickener or dewatering unit can recycle significant quantities of TSS which results in the need to operate with higher WAS rates.

5.4.5 Process Simulations

Finally, the BioWin model was used to model performance of the entire WWTF under the following anticipated future conditions:

- TSS removal rates of 54, 47, 44 and 34 percent were assumed for the primary clarifiers under 2045 AAD conditions, MMAD and MWAD and MD conditions.
- A minimum aSRT of 8.0 days under maximum month conditions and 6.05 days under maximum week conditions. These aerobic SRT result in nitrification safety factor of 2.9 and 2.2 under maximum month and maximum week flow conditions, respectively.
- A SVI, which is a quantification of MLSS settling velocity, of 160 mL/g.

The final clarifiers are expected to perform satisfactorily under the peak hour flow of 20.4 mgd at MLSS concentrations up to about 2,800 mg/L. Under maximum month mass loads, which will produce the maximum MLSS concentrations sent to the final clarifiers, the predicted MLSS concentration is about 3,000 mg/L with two primaries in service (~44 percent TSS removal). In addition to the process considerations, operating with two primaries under the predicted future PHFs, is expected to cause overflows in the headworks.

Although the plant should operate satisfactorily during anticipated future peak flows, due to the uncertainties inherent in predicting influent and operating conditions 20 years in the future, it is recommended to add a third primary clarifier. This will provide the following benefits to the WWTF:

- Maintain or increase primary clarifier BOD_5 and TSS removal efficiency.
- Decrease operating MLSS concentrations in the BNR process thus putting less stress on the final clarifiers during peak flows. With three primaries in operation, the predicted maximum month MLSS concentration drops to about 2,500 mg/L.
- Decrease process airflow demands thus facilitating the replacement of the existing multistage centrifugal blowers in the existing blower room.
- Lower process air power demands and thus reduce power consumption.
- Increase organic loadings to the anaerobic digesters thus increasing gas production and potentially lowering supplemental gas needed for the dryer.

Due to the decrease in primary clarifier performance with increasing surface loading rates, the maximum mass of primary sludge produced and the maximum concentrations of BOD5 and TSS in the primary effluent are expected to occur under maximum day loading.

5.5 Hydraulic Modeling

Carollo Engineers' Hydraulix® modeling software was used to establish the hydraulic capacities of individual unit processes and water surface elevations under 2045 peak flows. The model was built as part of previous GSP and modifications were made to the model based on the improvements made at the facility since the model was originally created in 2019. Hydraulic improvements shown in Figure 3 were implemented in the model to accommodate 2045 PIDF. More specifically, this software modeled the flow through the WWTF by calculating both the energy grade lines and hydraulic grade lines according to the head loss and velocity at each hydraulic element under various influent flow conditions identified in Table 17.

Table 17 Hydraulic Modeling Assumptions (Year 2045 Peak Instantaneous Day Flow)

Unit Process	2045 PIDF (22.3 mgd)	Assumptions
Plant Headworks	11.15 mgd per screen with 30% blinding and maximum headloss of 10 inches	Need minimum 12 inches freeboard at PIDF.
Primary Clarifiers	7.4 mgd/clarifier (3 online)	Flow split evenly between primary clarifiers. Bypass pipe available if one primary clarifier is out of service.
Aeration Basin Influent Flow Splitter Box	22.2 mgd + 60% RAS + 0.72 mgd (drain pump station 1) + 0.72 mgd (pump station 2) = 35.9 mgd	Replacement of aeration basin splitter box.

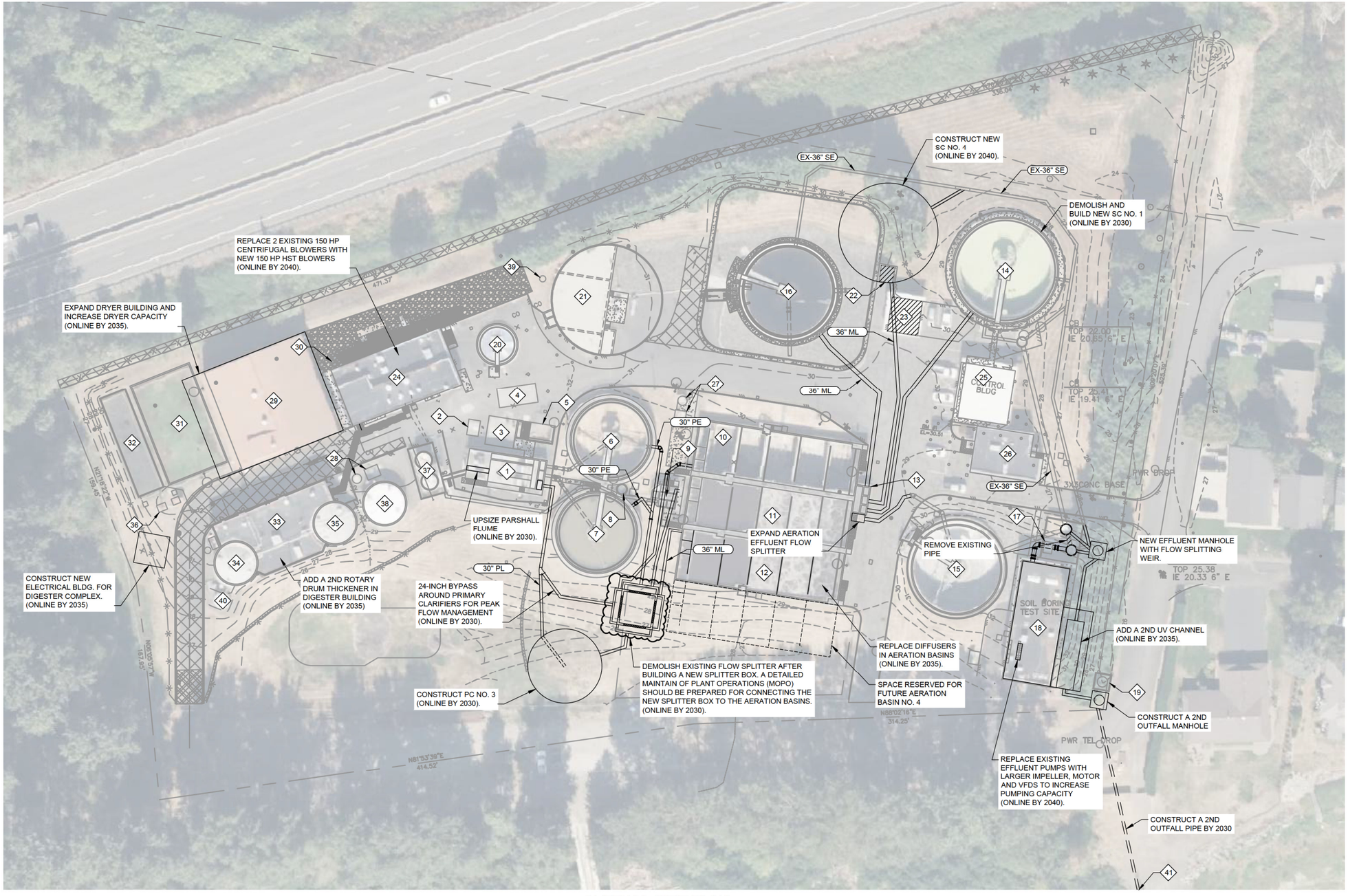
Unit Process	2045 PIDF (22.3 mgd)	Assumptions
Aeration Basins	7.4 mgd/basin (3 online) + 4.5 mgd IR/basin = 11.9 mgd/basin	Capacity of IR capped at 3,125 gpm (4.5 mgd)
Secondary Clarifiers	7.8 mgd/clarifier (3 online)	With Plant Drain Pump Stations online.
Tertiary Filters	2 filters online (each at 3 mgd) with 12 inches of headloss	Existing filter bypass utilized for flow over 6 mgd.
UV Disinfection	11.1 mgd (channel)	New UV channel. Upstream new effluent manhole with flow splitting weir to split flow between tertiary treatment.
Columbia River Outfall	11.1 mgd/outfall	Columbia River Water Elevation is assumed to be 15.0 feet.

Notes:
gpm - gallons per minute; IR - internal recycle; UV – ultraviolet.

Each individual unit process was considered "at risk" when the model indicated less than 18 inches of freeboard in a structure or less than six inches of fall from flow over a weir to the downstream water surface. A unit process was considered "overloaded," or as having a true hydraulic limitation when the model indicated less than 12 inches of freeboard or a weir was submerged. Less than 12 inches of freeboard in an open channel puts the WWTF at risk of flow overtopping a structure.

The following improvements are recommended to accommodate the 2045 peak flows. Refer to the proposed site plan showing new facilities (Figure 4 and 5) and details presented in Section 7:

1. Add a new secondary parallel UV disinfection channel with 3 UV banks identical to the ongoing UV improvements by 2040.
2. Construct a second outfall pipe and new effluent manhole for flow from new UV channel
3. Reconfigure secondary effluent piping to new effluent manhole with flow splitting weir to split flow between the two UV channels.
4. Demolish and construct existing Secondary Clarifier No. 1 and construct a new Secondary Clarifier No. 4.
    a. Upsize secondary clarifier influent piping to 36 inch mixed liquor (for all four secondary clarifiers).
    b. Expand secondary clarifier influent splitter box to accommodate for Secondary Clarifier No. 4.
5. Construct a new aeration basin influent flow splitting structure as shown on the site plan.
    a. Construct new 36 inch mixed liquor piping to the aeration basins between the aeration basin splitter box structure.
    b. Upsize primary clarifier effluent piping to 30 inch primary effluent and connect to new aeration basin splitter box.
6. Construct Primary Clarifier No. 3 and 30 inch primary clarifier bypass pipe from the headworks effluent box to the new aeration basin splitter box structure.
7. Upsize the Parshall Flume throat size in the existing headworks structure.



0 20' 40' 80'

SCALE: 1" = 40'

LEGEND:

1. HEADWORKS
2. SEPTAGE RECEIVING VALVE VAULT
3. SEPTAGE RECEIVING TANKS
4. SEPTAGE TRUCK UNLOADING PAD
5. VACTOR TRUCK UNLOADING PAD
6. PRIMARY CLARIFIER NO. 1
7. PRIMARY CLARIFIER NO. 2
8. PRIMARY CLARIFIER SCUM PUMP STATION
9. AERATION BASIN SPLITTER BOX
10. AERATION BASIN NO. 1
11. AERATION BASIN NO. 2
12. AERATION BASIN NO. 3
13. SECONDARY CLARIFIER SPLITTER BOX
14. SECONDARY CLARIFIER NO. 1
15. SECONDARY CLARIFIER NO. 2
16. SECONDARY CLARIFIER NO. 3
17. EFFLUENT FLOW METER VAULT
18. UV DISINFECTION / EFFLUENT PUMP STATION
19. EFFLUENT MANHOLE
20. GRAVITY THICKENER
21. SEPTAGE / CENTRATE / WAS STORAGE TANKS
22. STORAGE SHED (DEMOLISHED)
23. GARAGE (DEMOLISHED)
24. EQUIPMENT BUILDING
25. CONTROL BUILDING NO. 1
26. CONTROL BUILDING NO. 2
27. PLANT DRAIN PUMP STATION NO. 1
28. PLANT DRAIN PUMP STATION NO. 2
29. MODIFIED BIOSOLIDS DRYER BUILDING
30. SUCTION / DISCHARGE DRAIN MANHOLE
31. BIOFILTER NO. 1
32. BIOFILTER NO. 2
33. DIGESTER BUILDING
34. ANAEROBIC DIGESTER NO. 1
35. ANAEROBIC DIGESTER NO. 2
36. WASTE GAS BURNER
37. ALKALINITY CONTROL SYSTEM
38. DIGESTED SLUDGE HOLDING TANK
39. LOOP SEAL MANHOLE
40. DIGESTER GAS SCRUBBING SYSTEM
41. OUTFALL

OVERALL SITE PLAN

SCALE: 1" = 40'-0"

Figure 4
Proposed Site Plan Showing Hydraulic Improvements at City of Camas Wastewater Treatment Facility

carollo

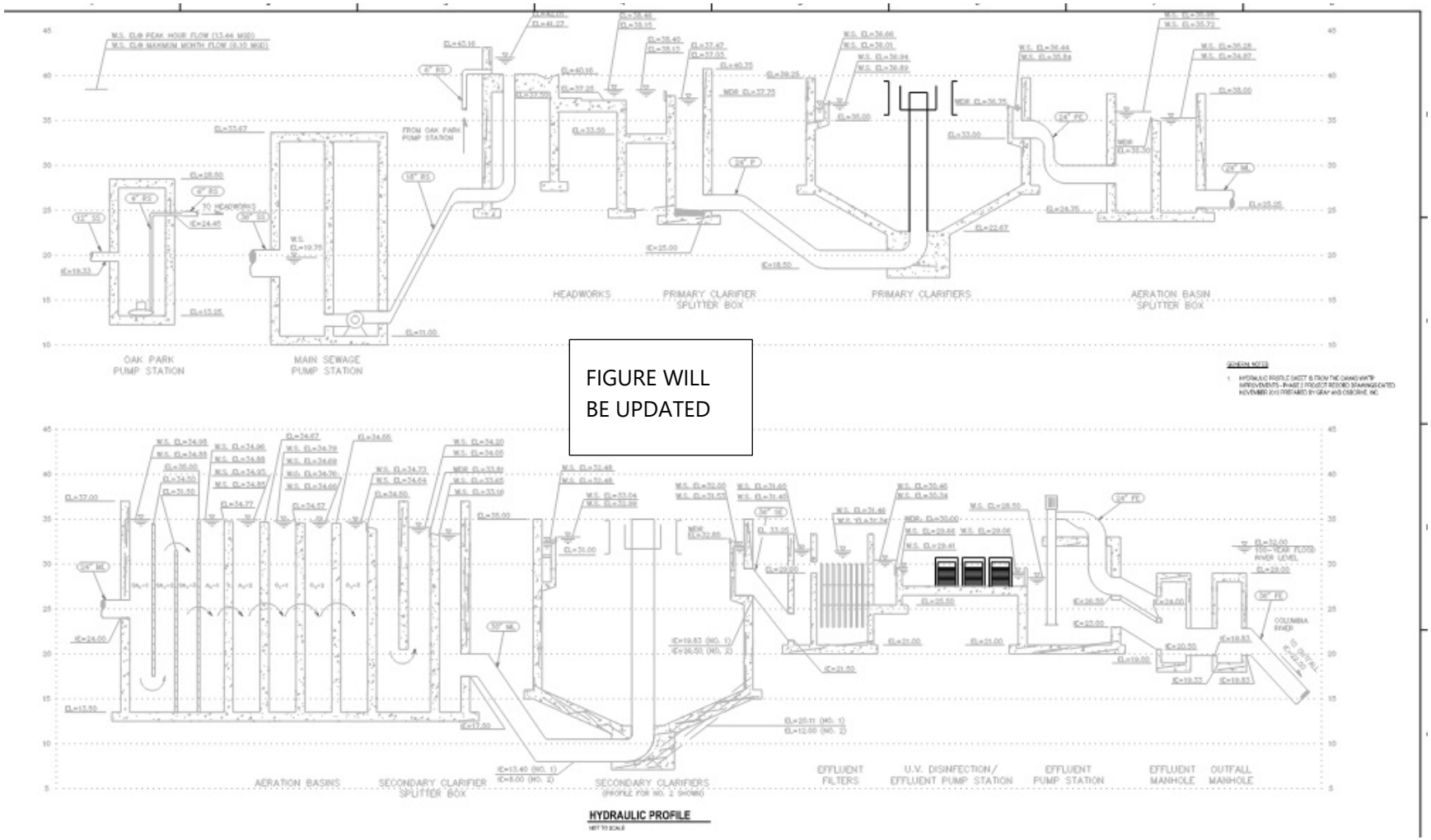


Figure 5 2045 Hydraulic Profile at Peak Instantaneous Design Flow

SECTION 6 CONDITION ASSESSMENT

A condition assessment was conducted as part of the 2024 GSP to identify major facility deficiencies and establish general priority ratings for mechanical equipment, treatment units, structures, and electrical, instrumentation, and control systems. The compiled information was updated during the plant tours conducted in June 2025 as part of the 2025 GSP to determine which portions of the facility can be retained, which require major upgrades, and which should be abandoned or replaced.

To begin, the assessment team reviewed drawings and design criteria for each unit process, including the recommended WWTF redundancy criteria for flows and loads as published in the *Criteria for Sewage Works Design* (August 2008, Department of Ecology) and summarized in Table 2.4 of Chapter 2.

Table 18 summarizes each key WWTF component's condition and rated capacity.

Next, the team discussed maintenance history, plant shortcomings, and general operational issues with City staff, who also accompanied the team on walk-through inspections of the WWTF following the general occurrence of the processes and associated major equipment in the direction of flow.

Table 18 2025 Condition Assessment Summary

WWTF Component	Rated Capacity	2019 Condition Assessment associated with 2024 GSP[1]	2025 Condition Assessment
Plant Headworks			
Influent Pipe	▪ N/A	▪ Headworks influent pipe configuration occasionally causes upstream overflow at the Parshall Flume during high flows.	▪ Same observation as in 2024 Condition Assessment. Influent piping should be modified by installing a rigid plate or concrete cover.
Influent Screens and associated washer/compactors	▪ Two mechanical screens. 7 mgd per screen, total 14 mgd. ▪ Washer/compactors are rated for 10 cf per hour.	▪ No significant condition issues identified.	▪ One of the influent screens needs a bearing replacement, and the plant is planning on doing this repair in-house.
Manual Bar Rack	▪ One manual bar rack.	▪ No significant condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Slide Gates	▪ Seven slide gates.	▪ No significant condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Primary Clarifiers	▪ 60 foot diameter, 10 foot SWD. ▪ SOR - 3,608 gpd/sf at PHF with both units operational.	▪ No significant condition issues identified.	▪ Severe corrosion of clarifier mechanisms; city replacing internals of both clarifiers as part of ongoing project
Aeration Basin Influent flow splitter box	▪ N/A	▪ N/A	▪ One shaft mixer was non-operational; staff noted the structure's freeboard is limited during high-flow events.
Aeration Basins	▪ Three aeration basins – 120 feet long, 40 feet wide and 21 feet SWD. ▪ ~3.9 to 5.7 mgd on max. week loading (3 aeration basins, 3 secondary clarifiers at SVI of 90 - 160 mL/g).	▪ Flow split between the 3 basins is uneven. ▪ Weir walls between the zones are uneven. Wooden walls in anaerobic zones	▪ Same observation as in 2024 Condition Assessment. Also, the internal recycle from the end of the aerobic zone is sent to the end of the anaerobic zone.
Secondary Clarifiers	▪ Three 75 foot diameter secondary clarifiers, 15 foot SWD.	▪ Secondary Clarifier. No. 1 is non-operational due to its flat bottom	▪ Same observation as in 2024 Condition Assessment.
Aeration System	▪ Four 150 hp centrifugal blowers. ▪ Firm capacity of 4,890 scfm at 10 psig.	▪ Unable to control blowers when operating multiple in parallel	▪ Same observation as in 2024 Condition Assessment. City is replacing two 150 hp blowers with 100 hp high speed turbos ; however, the new and old blowers will not be able to operate together.
Effluent Filters	▪ Two Cloth disk filters (10 micron). 3 mgd per filter, total 6 mgd.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment. Plant staff indicated the filters are backwashing 30% of the time, which is higher than the anticipated 20% or less.
UV Channel	▪ Four UV banks. ▪ 13.7 mgd at 65% UVT.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment. City is replacing the existing UV system with new UV system as part of an ongoing project.
Effluent Transfer Pumps	▪ Three 4,550 gpm at 16 feet TDH, 30 hp pumps. Firm Capacity is 13.09 mgd	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Non-potable Water Transfer Pumps	▪ Three 200 gpm at 185 feet TDH, 15 hp pumps.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment. City is replacing the motors for these pumps with new motors and variable frequency drives as part of an ongoing project.
RAS Pumps	▪ Each SC has two RAS pumps. ▪ Secondary Clarifier No. 1 has two pumps 1,000 gpm each. ▪ Secondary Clarifier No. 2 has two pumps 1,050 gpm each. ▪ Secondary Clarifier No. 3 has two pumps 1,400 gpm each.	▪ No condition issues identified. Secondary Clarifier No. 1 is not operation.	▪ Same observation as in 2024 Condition Assessment. ▪ City is replacing the VFD for a couple of RAS pumps as part of an ongoing project.
WAS Pumps	▪ Each Secondary Clarifier has one WAS pump. ▪ Secondary Clarifier No. 1 has one pump 85 gpm. ▪ Secondary Clarifier No. 2 has one pump 85 gpm. ▪ Secondary Clarifier No. 3 has one pump 240 gpm.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Primary Sludge Pumps	▪ Two pumps. Each 220 gpm.	▪ No condition issues identified.	▪ One of the PS pumps was making a very loud noise.
Internal Recycle Pumps	▪ Each Aeration Basin has one submersible pump. 3,125 gpm.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.

WWTF Component	Rated Capacity	2019 Condition Assessment associated with 2024 GSP[1]	2025 Condition Assessment
Degritting Cyclone ang grit classifier	▪ Two units. Each 220 gpm.	▪ End of useful life.	▪ Same observation as in 2024 Condition Assessment. City is replacing both units with new as part of an ongoing project.
Gravity Thickener	▪ One unit. 30 feet diameter, 10 feet SWD.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Thickened Primary Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Rotary Drum Thickener	▪ One unit. 100-300 gpm.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Thickened WAS Pumps	▪ Two units. Progressive Cavity pumps, 50 gpm each.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Anaerobic Digesters and Digested Sludge Holding Tank (DSHT)	▪ Two anaerobic digester tanks. 32 feet diameter, 29 feet SWD. ▪ One DSHT tank. 32 feet diameter, 29 feet SWD.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Anaerobic Digester mixing and heating equipment	▪ Each digester has one draft tuber mixer and spiral heat exchanger. ▪ One hot water boiler with hot water pumps.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Digested Sludge Pumps	▪ Two units. Progressive Cavity pumps, 130 gpm each.	▪ N/A	▪ N/A
Dewatering Centrifuge	▪ One unit. 130 gpm at 2-2.5% solids.	▪ Near end of useful life.	▪ No issues observed with the existing unit. ▪ City is adding one new centrifuge (second unit) as part of an ongoing project.
Sludge Thermal Dryer	▪ One complete belt-drying system.	▪ No condition issues identified.	▪ Same observation as in 2024 Condition Assessment.
Plant Drain Pump Station No. 1	▪ Two submersible pumps. 250 gpm each.	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2024 Condition Assessment.
Plant Drain Pump Station No. 2	▪ Two submersible pumps. 450 gpm each.	▪ Shows signs of concrete corrosion and pumps at the end of useful life.	▪ Same observation as in 2024 Condition Assessment.
Electrical Components			
Utility Transformer No. 1	▪ 500 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ Utility Transformer No.1 shows some signs of rusting but no major concerns.
UV Electrical Room MDS-UV MCC-D1 MCC-D2 MCC-D3	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing the UV system and associated power distribution panels and a new automatic transfer switch.
Old Controls Building MCC-A PLC-A Network Rack Transformer TL and Panel L	▪ N/A	▪ N/A	▪ The main concern in this building is the working clearance around electrical equipment seems low increasing likelihood of tripping hazard.
Utility Transformer No. 2	▪ 1000 kVA	▪ N/A	▪ Owned and maintained by power utility. ▪ Utility Transformer No. 2 shows some signs of rusting but no major concerns.
Equipment Blower Building MDS-EB MCC-C1/C1A MCC-C2/C2A Blower VFDs	▪ N/A	▪ N/A	▪ No major issues observed. ▪ City is replacing as part of an ongoing project the following: ▪ Two blowers and associated VFDs. ▪ New centrifuge control panels and VFDs

WWTF Component	Rated Capacity	2019 Condition Assessment associated with 2024 GSP(1)	2025 Condition Assessment
Emergency Generator	▪ 250 kW	▪ N/A	▪ City is replacing with new 450 kW generator as part of an ongoing project.
Digester Electrical Building SWBD-F MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820. ▪ City is adding a new MCC-F as part of the ongoing project.
Biosolids Electrical Building SWBD-F MCC-F	▪ N/A	▪ N/A	▪ Main concern in this room is that it seems to be sharing walls with process areas. As such, it is very important to understand hazardous area classification of the area per NFPA 820.
Instrumentation and Controls			
SCADA system	▪ N/A	▪ N/A	▪ The current control system operates on standalone desktop PCs. When the remote display interface is engaged, control functionality on the primary desktop becomes inaccessible. This configuration presents a single point of failure and limits operational flexibility. To address this, a transition to a multi-user control architecture is recommended. Additionally, the system must support routine Windows updates without requiring downtime of the primary control workstation, which currently manages all plant operations.
PLC Infrastructure and Upgrade Status	▪ N/A	▪ N/A	▪ Progress on PLC upgrades have progressed. Several PLC components in use have reached end-of-life status, posing reliability and supportability risks. It is strongly advised to prioritize the replacement of these legacy PLCs to ensure continued system integrity and maintainability.

Notes:
(1) Condition Assessment performed as part of the 2024 GSP.
DSHT - Digested Sludge Holding Tank; hp - horsepower; kVA - kilovolt-amperes; kW - kilowatt; MCC - motor control center; N/A - not applicable; NFPA - National Fire Protection Association; PLC - programmable logic controller; psig - pounds per square inch gauge; SCADA - supervisory control and data acquisition; scfm - standard cubic feet per minute; SOR - surface overflow rate; SWBD - switch board; VFD - variable frequency drive; TDH - total dynamic head.

SECTION 7 RECOMMENDATIONS FOR CAPITAL IMPROVEMENTS

Based on the projected 2045 flows and loads, the following paragraphs provide a summary of the comprehensive analysis of each unit process and recommendations for improvements. Opinions of probable construction cost will be developed and included in the GSP.

7.1 Preliminary Treatment

The preliminary treatment facilities consist of a headworks structure with influent flow measurement through a Parshall flume, followed by in-channel fine screening. Two mechanically cleaned perforated plate screens with 6 millimeters (mm) openings are provided, each rated for a capacity of 7 mgd. One screen was installed as part of the Phase 1 improvements (2002), and the second was added during the Phase 2 improvements (2012). Each screen includes a washer/compactor to reduce the volume and weight of screenings before discharge into a dumpster located at grade level. A manual bar rack is installed in the bypass channel.

The Parshall flume (2 foot throat) measures influent flow to the treatment plant and was observed to be operating properly. An automatic flow-proportional sampler located near the flume collects raw influent wastewater samples.

Table 19 provides the design criteria for Plant Headworks for 2045 GSP.

Table 19 Plant Headworks Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - PIDF Organic or Solids Loading - N/A
Class 1 Reliability Criteria	1 backup screen required
2045 PIDF	22.2 mgd
Parshall Flume	2 foot wide throat with Ultrasonic level sensor
No. of Influent Mechanical Screens	2
Flow per Mechanical Screen	11.1 mgd
Opening Size	6 mm
% Blinding	30%
Downstream Water Level at PIDF	2.4 feet
Maximum Headloss at PIDF and 30% Blinding	10 inches
No. of Washer/Compactors	2 (1 per screen)
Capacity of Washer/Compactor	70 cubic feet per hour
No. of Manual Bar Rack	1
Opening Size	3/4 inch

Recommendations for Improvements

1. Address the influent piping orientation at the headworks to prevent spraying of the influent wastewater during peak flow events. Add a concrete cap over the portion of the channel where the influent pipe enters vertically into the structure upstream of the Parshall Flume.
2. Conduct a structural investigation and perform required structural repairs and add appropriate coatings to the channels.
3. Remove the existing influent channel and Parshall flume. Replace the Parshall flume with the next larger size (3.0 feet throat) along with the influent channel.
4. Given the age and current condition of the screens, it is recommended to replace the two screens and associated washer/compactors by 2030. Based on correspondence with the screen manufacturer (Kusters Water Division - Zima Corporation), the existing screens have sufficient capacity to handle the 2045 PIDF of 22.2 mgd with both mechanical screens operating (11.1 mgd per screen) at the design blinding of 30 percent. If one of the screens is out of service, the bypass channel should be able to process the remaining flow. A budget proposal was requested to prepare a cost estimate to replace the two mechanical screens with new screens.
5. Replace all seven slide gates at the same time as replacing the influent screens.
6. It is recommended that the City collect appropriate samples to measure incoming TKN and NH_3 as well as influent alkalinity daily.

7.2 Septage Receiving Station

The Camas WWTF is equipped to receive septage from septage and vactor trucks. The septage receiving station has concrete unloading pads which convey the septage to a screening channel. The channel includes a mechanical screen with a dewatering chamber. The screened septage flows into a below grade concrete receiving tank equipped with submersible pumps.

Recommendations for Improvements

1. The City is replacing the septage screening equipment as part of an ongoing project. Therefore, no recommendations for further improvements are made at this time.

7.3 Primary Treatment

The screened wastewater flows through the plant headworks to the primary treatment splitter box downstream of the screens. The splitter box directs the flow towards two circular primary clarifiers (No. 1 and No. 2). A third splitter box segment is available to direct the flow to a future primary clarifier (No. 3).

Table 20 provides the design criteria for Primary Clarifiers for 2045 GSP

Table 20 Primary Clarifiers Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - PHDF + Recirculation Organic or Solids Loading - PHDL (TSS)
Class 1 Reliability Criteria	50% of PHF with largest unit out of service
Surface Overflow Rate – SOR (Table T2-2, *Criteria for Sewage Design Works, August 2008*)	AADF - 800 to 1,200 gpd/sf PHF - 2,000 to 3,000 gpd/sf

WWTF Component and Parameter	2045 Design Criteria
2045 AADF	5.36 mgd
2045 MWAD Flow	7.5 mgd
2045 PHDF	20.4 mgd
2045 Average Day Influent TSS Loading	5,811 ppd
2045 Maximum Week Influent TSS Loading	8,136 ppd
2045 Maximum Day Influent TSS Loading	16,853 ppd
No. of Primary Clarifiers	3
Diameter of Primary Clarifier	60 feet
Effective settling area, each	2,827 sf
Effective settling area, total	8,482
SOR at AADF all Primary Clarifier s in service	632 gpd/sf
SOR at MWAD all Primary Clarifier s in service	1,011 gpd/sf
SOR at PHF all Primary Clarifier s in service	1,011 gpd/sf
SOR at 50% of PHF with 1 unit of service	2,401 gpd/sf
TSS removal in Primary Clarifier at 2045 ADF(1)	63%
TSS removal in Primary Clarifier at 2045 Max Week Flow (1)	52%
TSS removal in Primary Clarifier at 2045 Max Day Flow (1)	28%
2045 Minimum Primary Sludge(2)	1,500 ppd
2045 Maximum Primary Sludge(3)	4,5 ppd
2045 Minimum Primary Sludge(2)	5,000 gpd at 1%
2045 Maximum Primary Sludge(3)	40,000 gpd at 3.0%
Gravity Thickener Surface Area	707 sf
2045 Maximum Gravity Thickener Overflow rate	220 gpd/sf

Notes:
(1) Extrapolated from literature data for removal of TSS in primary clarifiers at various SORs with no recirculation and chemical addition.
(2) Calculated using 40% of 2045 estimated average day primary sludge production.
(3) Calculated using 2045 Maximum Week TSS loading and TSS removal in PC
(4) Calculated using the 2045 minimum primary sludge at 3.0% TS.
(5) Calculated using the 2045 maximum primary sludge at 1.0% TS.
AADF - annual average day flow; ADF - average day flow; PHDF - peak hour design flow; PHDL - peak hour design mass load.

Recommendations for Improvements

1. Add a weir, dropbox and piping as needed to construct a bypass around the primary clarifiers. This bypass will direct all flows greater than the maximum day flows (~10.7 mgd) around the primary clarifiers. A bypass is required whether or not a third primary clarifier is constructed because the new riser pipes being installed in the existing primary clarifiers under the current construction project do not have the needed hydraulic capacity for future peak flows.
2. To allow for robust operations during peak flow conditions and facilitate passing design peak hydraulic flows, a third primary clarifier should be added. This will maintain high removals of BOD_5 and TSS during normal operation and allow operation of the aeration tanks at lower MLSS concentrations during maximum month organic loadings. The lower operating MLSS concentrations

will in turn improve the ability of the secondary clarifiers to pass peak hour flows without significant degradation in performance. Adding a third primary clarifier will also reduce oxygen demands in the BNR process and increase gas production in the digesters, both of which will help to minimize power consumption in the future. Lower design oxygen demands will also facilitate the replacement of the existing multi-stage centrifugal blowers in the existing blower room.

7.4 Secondary Treatment

The primary clarifier effluent flows to the aeration basin influent flow splitter box. This splitter box also receives RAS and in-plant recycle flows from Plant Drain Pump Stations No. 1 and 2, which primarily consist of filtrate from the sludge thickeners and centrate from the dewatering centrifuges.

The secondary treatment process consists of three aeration basins with anaerobic selector zones, anoxic zones, and aerobic zones. Each basin is equipped with an IR pump that conveys nitrates formed in the aerobic zones back to the anoxic zones for partial nitrogen removal. The aerobic zones contain fine-pore diffusers, with air supplied by aeration blowers located in the Equipment Building.

Flow from the aeration basins is distributed to three circular secondary clarifiers via a flow-splitting structure. In the clarifiers, the MLSS are separated from the treated water, and the settled sludge is returned to the AB influent splitter box as RAS while the effluent flows downstream to the filters and UV disinfection.

Table 21 provides the design criteria for the Secondary Treatment (aeration basin and secondary clarifier) for 2045 GSP. The spreadsheet based activated sludge calculations as presented in Table 13 and the State Point Analysis presented previously indicate that a fourth secondary clarifier must be added to handle the 2045 peak flows (peak SOR < 1,200 gpd/sf).

Table 21 Secondary Treatment Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Aeration Basin Hydraulic - MWDF Organic or Solids Loading - MWDL (BOD) Secondary Clarifier Hydraulic - PHDF + Recirculation Organic or Solids Loading - PHDL (TSS)
Class 1 Reliability Criteria	Minimum 2 aeration basins of equal size 75% of PHF with largest unit out of service
Surface Overflow Rate - SOR (Table T3-2, *Criteria for Sewage Design Works, August 2008*)	MLSS - 1,500 to 3,000 mg/L; SVI- 150 mL/g PHF - 1,200 gpd/sf
2045 AADF	5.36 mgd
2045 MWAD	8.6 mgd
2045 PHDF	20.4 mgd
Primary Clarifier Average Effluent BOD_5	60 - 90 mg/L
2045 Maximum Week BOD loading to Aeration Basins	5,300 ppd
Minimum Wastewater Temperature	15 °C

WWTF Component and Parameter	2045 Design Criteria
Aeration Basins	
No. of aeration basins	3
Total Volume	2.26 MG (302,400 cf)
Total Anaerobic Volume	0.13 MG (17,640 cf)
Total Anoxic Volume	0.41 MG (54,180 cf)
Total Aerobic Volume	1.725 MG (230,555 cf)
MLSS Concentration	~1,500 to 3,000 mg/L
aSRT	8 days
Net Yield	0.9 lb TSS/lb BOD
Average Day WAS produced	3,700 ppd
Maximum Week WAS produced	5,400 ppd
Secondary Clarifiers	
No. of Secondary Clarifiers	4
Secondary Clarifier Diameter	75 feet
Secondary Clarifier SWD	15 feet
RAS Rate	60%
Effective Settling Area per Secondary Clarifier	4,418 sf
SOR at AADF all Secondary Clarifiers in service	303 gpd/sf
SOR at PHF all Secondary Clarifiers in service	1,153 gpd/sf
SOR at 75% PHF with 1 unit out of service	1,153 gpd/sf
SLR at PHF	28.8 lb/sf/d

Notes:.
MWDF - maximum week design flow; MWDL - maximum week average day design mass load; SLR - solids loading rate.

- **RAS Pumping**: Each secondary clarifier has two RAS pumps (one duty/one standby). Secondary Clarifier No. 1 has two RAS pumps, each with capacity of 1,000 gpm. Secondary Clarifier No. 2 has two RAS pumps, each with capacity of 1,050 gpm. Secondary Clarifier No. 3 has two RAS pumps, each with capacity of 1,400 gpm. The current total RAS flow capacity is 6,900 (9.92 mgd) with firm capacity, with one pump per clarifier in operation, is 3,450 gpm (4.96 mgd). To achieve a design RAS rate of 60 percent of influent flow, the RAS flow of 12.2 mgd (8,500 gpm) is required at the 2045 peak flows. With four secondary clarifiers, a total of six RAS pumps, each with a capacity of 1,400 gpm will be sufficient to meet these criteria.
- **Internal Recycle Pumping**: Each aeration basin has a submersible IR pump with a capacity of 3,125 gpm (4.5 mgd). With three aeration basins, and assuming an even flow split, each aeration basin will receive a maximum week flow of 2.86 mgd. The IR rate at this flow will be 2.5 times the average day influent flow. Ideally the IR rate should be between 2.5 to 4 Q to achieve good denitrification, provided sufficient carbon and adequate anoxic volume are available. The BOD_5:TKN ratio in the influent flow to the aeration basins is 1.3:1 which is significantly deficient for any denitrification. Therefore, supplemental carbon will be required to achieve good denitrification and recover some alkalinity. For this evaluation, no changes to the IR rate or pumps are recommended.

Recommendations for Improvements:

1. By Year 2030:
    a. Relocate the internal recycle piping such that the recycle is introduced just upstream of the first of the two anoxic zones and not in the last anerobic zone for the three existing aeration basins.
    b. The baffle walls that divide the zones within the existing aeration basins' should be repoured to a smooth level. Plywood baffle walls in the anaerobic selector zone should be removed and replaced with 316 stainless steel baffle plates for rigidity.
    c. In conjunction with the replacement of the selector walls, the ability to improve the settling characteristics of the mixed liquor by reconfiguring the selector zones should be evaluated, and modifications implemented if deemed advantageous.
    d. Demolish and rebuild Secondary Clarifier No. 1 to match the size, slope, and other criteria of Secondary Clarifier No. 3. Install new RAS, WAS, and Scum pumps matching the size of those serving Secondary Clarifier No. 3. This Secondary Clarifier No. 1 should be constructed by 2030.
    e. Replace the RAS pumps for Secondary Clarifier No. 2 to match the size (1,400 gpm) as that of Secondary Clarifier No. 3 by 2030.
    f. Implementing hydraulic SRT control - a simpler hydraulic SRT control system should be programmed in the plant PLC using the following formula to estimate the aSRT:

$$\mathrm{aSRT} = \frac{V_a}{Q_w} \cdot \frac{R + {Q_w}/{Q}}{1+R}$$

Where:
Q_w = wasting rate, mgd.
V_a = online aeration basin volume, MG.
Q = averaged forward flow, mgd.
R = RAS recycle ratio, unitless.
aSRT = desired aSRT, days.

From this formula, the required wasting rate can be calculated based on the online aeration volume, the plant forward (influent) flow, the RAS recycle ratio (R), and the desired aSRT without measuring the MLSS concentration or the return activated sludge suspended solids concentration.

2. By year 2035:
    a. Replace the diffusers in the existing three aeration basins by 2035. Add diffusers to the second of the two anoxic zones in each aeration basin to convert it to a swing zone. Supports for diffusers in the swing zone should be adequately designed to withstand the forces exerted by the existing submersible mixers.
3. By year 2040:
    a. Construct a new Secondary Clarifier No. 4 with new RAS, WAS and scum pumps matching the size of that of Secondary Clarifier No. 3. This Secondary Clarifier No. 4 should be constructed by 2040.
    b. Construct a new Aeration Basin No. 4 with fine bubble diffusers and aeration piping and IR pump matching the size of the existing aeration basin. With four aeration basins, the plant can take one of the aeration basins out of service for cleaning and preventative maintenance and still maintain an 8-day SRT necessary for stable complete nitrification using three aeration basin with adding air to the swing zone and operating all four secondary clarifiers.

7.5 Aeration Blowers

There are four aeration blowers, multistage centrifugal blowers, each providing an airflow of 1,630 scfm at ~10 psig with 150 hp motors. The firm capacity of these blowers is 4,890 scfm with one unit out of service. Based on discussions with the plant staff, there are issues operating more than 2 blowers in parallel without overloading the motors.

The City is planning to replace two existing blowers with new high-speed turbo (HST) blowers, each providing an airflow from 667 to 1,334 scfm with a 100 hp motor. As part of this project, the blower controls will also be revised to allow parallel operation of the four blowers. With this upgrade, the firm capacity of the blower system will drop to 4,300 scfm at ~10 psig.

Table 22 provides the design criteria for the aeration blowers and diffusers for 2045 GSP.

Table 22 Aeration Blowers Design Criteria

WWTF Component and Parameter	2045 Annual Average Design Criteria	2045 Maximum Week Design Criteria	2045 Maximum Day Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	PHDL (BOD and TKN loading)		
2045 BOD loading to Aeration Basins	4243	5,400	9,421
2045 TKN loading to Aeration Basins	2,600	3,700	5268
AOR (ppd)	13,800	19,300	23,300
Standard Oxygen Demand (SOR) (ppd)	35,300	49,300	50,800
Diffuser submergence (feet)	20	20	20
Spatial DO Concentration (mg/L)	2.0	2.0	0.5
AOR/SOR	0.39	0.39	0.46
SOTE, %/foot	2.3%	2.2%	2.2%
SOTE, %	46.3%	44.9%	44.3%
Field OTE, %	18.2%	17.6%	20.3%
Total airflow (scfm)	3,100	4,500	4,600
Total No. of Diffusers	2,000	2,000	2,000
Airflow per diffuser	1.25	1.8	2.2
AT/AD (assuming 9-inch diffusers)	16.6	16.6	16.6
Aeration Blowers			
No. of Blower	4	4	4
Capacity of 2 HSTs (1)	2,667	2,667	2,667
Capacity of new 2 HSTs (2)	4,666	4,666	4,666
Firm Capacity w/ largest unit out of service	5,000	5,000	5,000

Notes:
(1) City is planning to replace two of the existing centrifugal blowers with HST blowers.
(2) Assumes the remaining two existing centrifugal blowers will also be replaced with HST blowers in the future.
AOR - actual oxygen demand; OTE - oxygen transfer efficiency; SOTE - standard oxygen transfer efficiency.

While the governing design criteria is the peak hour loading (PHL) for BOD and TKN, the proposed design assumes that the aeration equipment will be sized to handle the maximum week loadings. During PHL which only would last for an hour or so, it is assumed that the BOD and TKN loading will be significantly diluted and the PHL will be less than or equal to the maximum week loadings.

Recommendations for Improvements

1. Remove and replace the two existing 150 hp multistage centrifugal blowers with two 150 hp HST blowers. It is assumed that all four blowers will need to be on-line to satisfy the 2045 peak oxygen demand.

7.6 Tertiary Filtration

The filtration system consists of two parallel cloth disk, inside-out, filters, located in the UV Disinfection/Effluent Pump Station building. In the future as peak flows increase, it has been decided to bypass flows above the capacity of the existing filters (about 6.0 mgd) directly to the outfall. This is feasible as tertiary filtration is believed not to be necessary to meet the ammonia and TSS requirements of the NPDES permit if other modifications are made to the WWTP as discussed in this report.

Table 23 provides the design criteria for tertiary filtration for 2045 GSP.

Table 23 Tertiary Filtration Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic – Pass all flows requiring tertiary treatment Organic or Solids Loading - N/A
2045 AADF	5.36 mgd
2045 PHDF	20.4 mgd
2045 PIDF	22.2 mgd
2045 Annual Average Secondary Clarifier Effluent TSS	10 mg/L
2045 Maximum Secondary Clarifier Effluent TSS	20 mg/L
2045 Maximum Filtered Effluent TSS	5 mg/L
Filter Submerged Area per Unit	470 sf
Filter Submerged Area, Total	940 sf
Maximum filter hydraulic loading	4.43 gpm/sf
Filter Capacity, per Unit	3.0 mgd
Filter Capacity, Total	6.0 mgd
Maximum headloss (PHF) for each filter	12 inches

Notes:
(1) Proposal was requested from Kruger. They recommend three filter units, Model HPF2230-IF (2 duty/1 standby), each with a filtration area of 1,990 sf (submerged are 1,294 sf).

Recommendations for Improvements

1. As the existing tertiary filters approach the end of their useful life, they should be replaced with similar units.

7.7 UV Disinfection

The UV disinfection system consists of an open-channel horizontal gravity flow system with a weighted weir control gate on the downstream side of the UV disinfection banks, located in the UV Disinfection/Effluent Pump Station building. The City is planning to replace the existing UV Trojan 3000+ system with a new Trojan 3000+ system as part of an ongoing project.

Table 24 provides the design criteria for the UV disinfection system for 2045 GSP.

Table 24 UV Disinfection System Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - Pass all flows Organic or Solids Loading - NA
2045 AADF	5.36 mgd
2045 PHDF	20.4 mgd
2045 PIDF	22.2 mgd
Maximum Influent TSS	5 mg/L
Minimum UVT	65%
Effluent temperature	33 °F (minimum) and 85 °F (maximum)
Effluent fecal coliforms	200 CFU/mL, monthly geometric mean of daily grab samples
No. of UV channel	1 (existing) + 1 (new)
No. of UV banks per channel	3
Type of UV	Trojan UV 3000+ (low pressure high intensity lamps)

Notes:
°F - degrees Fahrenheit; CFU/mL - colony-forming units per milliliter.

Recommendations for Improvements

1. Construct a new second UV channel outside the existing building on the west to allow disinfection of the entire plant effluent at PHF (22.2 mgd). These improvements are anticipated to be needed by 2040 if not sooner.

7.8 Effluent Pump Station and Pumps

Following the UV disinfection, treated effluent discharges to the effluent pump wet well in the UV Disinfection Building, and eventually through the 36-inch outfall pipe to the Columbia River. The effluent wet well is divided into two compartments by a sluice gate. The UV disinfection channel discharges into the first compartment. Under gravity discharge conditions, effluent discharges from the first compartment to the effluent wet well through a 36-inch pipe to the effluent manhole. This manhole contains a flap gate to prevent the river water backing up into the effluent wet well during high river flow conditions. Effluent then flows by gravity from the effluent manhole to the Outfall manhole through a 36 inch pipe.

Under high river water level conditions, when the headloss is too great for gravity flow to the Columbia River, the effluent is pumped using three vertical propeller effluent pumps, located in the second compartment of the effluent wet well. Each pump has a capacity of 4,550 gpm (6.54 mgd). The total capacity of the effluent transfer pump station is 19.6 mgd with a firm capacity of 13.09 mgd.

Table 25 provides the design criteria for upgrades to the Effluent Pumps for 2045 GSP.

Table 25 Effluent Pump Station Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	Hydraulic - Pass all flows Organic or Solids Loading - NA
2045 AADF	5.35 mgd
2045 PHDF	19.3 mgd
2045 PIDF	22.2 mgd
No. of Pumps	3
Capacity of each pump required	7.4 mgd (5,145 gpm)
TDH	21 feet

Recommendations for Improvements

1. The process implications of exceeding the effluent pumps' capacity are catastrophic, under the high river level conditions., Such conditions could quickly submerge upstream plant processes. Therefore, it is recommended to replace the existing pumps with larger impeller, motor, and associated VFDs to allow pumping of the entire plant effluent (PIDF of 22.2 mgd).

7.9 Solids Treatment

7.9.1 Primary Sludge Pumping, Degritting and Thickening

The two primary clarifiers are equipped with three primary sludge pumps (two duty/one standby), each with a capacity of 220 gpm. These pumps are sufficiently sized for the 2045 flows and loads (2045 primary sludge volume is estimated to be in the range of 6,000 gpd to 50,000 gpd at 1.0 to 3.0 percent total solids). These units pump the primary sludge settled at the bottom of the primary clarifiers to a degritting system, located in the Equipment Building.

The degritted primary sludge is thickened using a gravity thickener. The thickener is a below grade circular concrete tank, 30 feet diameter, 10 feet side water depth. Thickened primary sludge is pumped using two progressive cavity pumps, each 130 gpm to the anaerobic digesters. During the site visit in June 2025, one of the thickened primary sludge was dismantled for repairs.

Recommendations for Improvements

The City is planning to replace the two primary sludge degritting equipment (hydrocyclones and classifiers) with new. Sludge Pumping equipment should last for 10 to 15 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. No additional recommendations for any primary sludge and degritting equipment are made at this time.

1. Anaerobic digesters perform best when a constant and consistent feed rate is maintained. Based on the observations from previous GSP, the thickened primary sludge pumps are too large for the system. As such, the existing units are recommended for replacement with new, appropriately sized, 70 gpm progressive cavity pumps.

7.9.2 WAS Pumping and Thickening System

There are three plunger type WAS pumps for Secondary Clarifier Nos. 1 and 2, located in the existing Control Building, each rated at a capacity of 85 gpm. Secondary Clarifier No. 3 has a submersible centrifugal WAS pump near the clarifier rated for 240 gpm. These pumps convey the WAS from the three secondary clarifiers to a WAS storage tank, which is subsequently thickened using a RDT. Alternatively, the WAS can be transferred to the gravity thickener to be co-thickened with the primary sludge, during periods when the RDT is not operational. Thickened WAS is pumped to the anaerobic digesters.

Table 26 provides the design criteria for WAS pumping and thickening for 2045 GSP.

Table 26 Waste Activated Sludge Pumping and Thickening System Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	MDDL (BOD_5 loading)
2045 Average Day Influent BOD_5 Loading	6,000 ppd
2045 Maximum Day Influent BOD_5 Loading	8,500 ppd
BOD_5 Removal in Primary Clarifier at 2045 ADF(1)	35%
BOD_5 Removal in Primary Clarifier at 2045 Maximum Day Flow (1)	29%
2045 Annual Average Day BOD_5 Loading to Aeration Basins	4,200 ppd
2045 Maximum Day BOD_5 Loading to Aeration Basins(2)	6,000 ppd
Net Yield	0.9 lb TSS/lb BODrem
WAS concentration (% TS)	0.50%
2045 Average Day WAS Sludge	81,400 gpd
2045 Maximum Day WAS Sludge	126,000 gpd
Capacity of Existing WAS Storage Tank	145,000 gallons
Hydraulic Detention Time, 2045 Average Day WAS	1.8 days
Hydraulic Detention Time, 2045 Maximum Day WAS	1.2 days
RDT Feed Pump capacity	250 gpm
RDT Feed Rate	100-300 gpm
Thickened WAS concentration (%TS)	5%
2045 Average Day Thickened WAS	6,900 gpd
2045 Maximum Day Thickened WAS	10,700 gpd

Notes:
BODrem - five-day biochemical oxygen demand removed (in biological process); MDDL - maximum day design mass load.

Recommendations for Improvements

Sludge Pumping equipment should last for 10 to 15 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. No recommendations for any WAS pumping equipment are made at this time.

1. There is only one RDT for WAS thickening. The RDT has been in service for more than 10 years. The previous GSP recommended adding a second RDT for redundancy and reliability. During the 2025 Condition Assessment walkthrough, a concern with the existing Digester Complex electrical room was raised, which is that it shares walls with process areas. As such, it may not meet the hazardous area

classification of the area per NFPA 820. It is therefore proposed that a new electrical building be constructed to the west of the Digester complex serving all the digester equipment as shown in Figure 4. This will allow space to relocate and add the second RDT for reliability and redundancy.

7.9.3 Anaerobic Digestion and Waste Gas Flare

The WWTF currently has two anaerobic digesters and one digested sludge holding tank. Each digester is a cylindrical concrete tank, 32 feet diameter with 29.5 feet SWD and a volume of 177,000 gallons. The digesters have fixed steel cover and a top mounted draft tube mixer. Gas produced by the digester is used as fuel for the hot water boiler while remaining gas is also used for the sludge dryer. There is a gas flare for flaring excess gas. There are three digester recirculation rotary lobe pumps, each with a capacity of 200 gpm (1 for each digester with a common standby pump). These pumps recirculate the digester sludge through a spiral heat exchanger.

The digested sludge holding tank is also a cylindrical concrete tank, 32 feet diameter, 14 feet SWD and volume of 84,000 gallons.

The digesters receive thickened primary and waste activated sludge and primary and secondary scum. The digesters are operated in a mesophilic temperature range to produce minimum Class B biosolids with a minimum volatile solids reduction of 38 percent or by achieving a geometric mean of 7 fecal coliform samples ≤ 2,000,000 most probable number or CFU per gram total solids (dry weight basis) by operating the digesters at a minimum mean cell residence time (MCRT) of 15 days at 35°C.

Table 27 provides the design criteria for Anaerobic Digesters for 2045 GSP. 2045 Design Criteria are projected loadings.

Table 27 Anaerobic Digestion System Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	MDDL (BOD_5 loading)
2045 Average Day Primary Sludge	3,600 ppd
2045 Maximum Day Primary Sludge	4,200 ppd
2045 Average Day Thickened Primary Sludge	13,500 gpd
2045 Maximum Day Thickened Primary Sludge	9,700 gpd
2045 Average Day Thickened WAS	2,900 ppd
2045 Maximum Day Thickened WAS	4,500 ppd
2045 Average Day Thickened WAS	6,900 gpd
2045 Maximum Day Thickened WAS(1)	10,500 gpd
2045 Average Day Combined (Thickened Primary Sludge +WAS)	6,300 ppd
2045 Maximum Day Combined (Thickened Primary Sludge +WAS)	8,400 ppd
2045 Average Day Combined (Thickened Primary Sludge +WAS)	15,000 gpd
2045 Maximum Day Combined (Thickened Primary Sludge +WAS)	20,200 gpd
Volume of each Anaerobic Digester	177,000 gallons
Total Volume of Anaerobic Digesters	354,000 gallons
MCRT 2045 Average Day Condition	23.6 days
MCRT 2045 Maximum Day Condition	17.5 days

Notes:
(1) Maximum day waste activated sludge production estimated from steady-state BioWin simulation using 2045 design maximum week biological nutrient removal influent mass loads.

Recommendations for Improvements

Digester equipment should last for 20 to 25 years depending on the amount of grit and wear and tear they experience. Pumps should be repaired and replaced as needed. The digester tanks should last for 50 years. No recommendations for the Anaerobic Digestion system are made at this time.

7.9.4 Dewatering Centrifuge

The WWTF currently has one dewatering centrifuge. The centrifuge has a hydraulic capacity of 160 gpm (230,400 gpd) to process digested sludge with a feed concentration range of 2.0 to 2.5 percent solids. The centrifuge is designed to produce a dewatered cake with a minimum 20 percent total solids and at 90 percent solids capture ratio. Polymer solution is added to the sludge for chemical conditioning and help with dewatering.

Table 28 provides the design criteria for dewatering centrifuges for 2045 GSP.

Table 28 Centrifuge Dewatering Design Criteria

WWTF Component and Parameter	2045 Design Criteria
Design Requirement (Table G2-1, *Criteria for Sewage Design Works, August 2008*)	MDDL (BOD_5 loading)
2045 Average Day Combined (Thickened Primary Sludge +WAS)	6,300 ppd
2045 Maximum Day Combined (Thickened Primary Sludge +WAS)	8,400 ppd
VSS:TSS ratio	0.75
Minimum VSR in Digester No. 6	38%
2045 Average Day Digested Sludge	3,000 ppd
2045 Maximum Day Digested Sludge	4,300 ppd
Digested sludge minimum % solids	2.5%
2045 Average Day Digested sludge	14,100 gpd
2045 Maximum Day Digested sludge	20,600 gpd
Centrifuge hydraulic capacity	160 gpm
2045 Average Day Centrifuge operation	1.5 hours
2045 Maximum Day Centrifuge operation	3.6 hours
Dewatered Cake	20%
2045 Average Day Dewatered Cake	6.3 wet tons per day
2045 Maximum Day Dewatered Cake	10.8 wet tons per day
2045 Average Day Dewatered Cake(1)	200 cf/d
2045 Maximum Day Dewatered Cake(1)	300 cf/d

Notes:
(1) Assumes 60 lb/cf for density of dewatered cake.
VSR - volatile solids reduction.

Recommendations for Improvements

The City is planning to add a second dewatering centrifuge as part of an ongoing project. With two dewatering centrifuges, the plant should be able to process the anaerobically digested sludge for the foreseeable future and therefore no recommendations are made at this time.

7.9.5 Biosolids Belt Dryer

The WWTF currently has one sludge belt drying system. The dryer uses the 20 percent dewatered cake to produce 92 percent dried pellets. The pellets are sold to a local farmer as fertilizer. The digester gas and natural gas are used for the drying of solids.

Table 29 provides the design criteria for dewatering centrifuges for 2045 GSP.

Table 29 Sludge Belt Dryer Design Criteria

WWTF Component and Parameter	2045 Design Criteria
2045 Average Day Sludge Production	1.3 DT/d
2045 Maximum Day Sludge Production	1.8 DT/d
2045 Average Day Sludge Production	2,500 ppd
2045 Maximum Day Sludge Production	6,100 ppd
Design Cake Dryness	20% DS
Dryer Operations	7 days per week
Hours of Operation	24 hours per day
2045 Average Day Dryer Cake Feed	930 wet lb/hr
2045 Maximum Day Dryer Cake Feed	1,200 wet lb/hr
Final Product Dryness	92% DS
2045 Average Day Final Product	200 wet lb/hr
2045 Maximum Day Final Product	270 wet lb/hr
2045 Average Day Evaporation Rate	730 lb H2O/hr
2045 Maximum Day Evaporation Rate	980 lb H2O/hr
Maximum Evaporation Rate for the existing Belt Dryer	1,100 lb H2O/hr
Dryer Capacity Utilization	89%

Notes:
DS - dry solids; DT/d - dry ton per day; lb H20/hr - pounds of water per hour; lbs/hr - pounds per hour.

Recommendations for Improvements

The sludge dryer will need to be operated 7 days a week, 24 hours a day to process the maximum day sludge produced. Alternatively, if the capacity of the dryer is exceeded, the cake can be diverted for off-site disposal. The sludge dryer was installed in 2014 and is about 10+ years old. Typical sludge drying equipment will need major overhaul in the next 10 years (20-year life). City should plan to replace the dryer in the next 10 to 15 years. However, for the 2025 GSP, a firm recommendation is not made as some of the regulations, in particular with respect to per- and polyfluoroalkyl substances (PFAS) in biosolids are still evolving.

7.9.6 Plant Drain Pump Stations

7.9.6.1 Plant Drain Pump Station No. 1

This station is in the yard between Primary Clarifier No. 1 and the Aeration Basins on the north side. It is equipped with two submersible pumps, each rated for 250 gpm, installed in a pre-cast reinforced concrete wet well. The pump station collects floor drains and process water from several treatment units including centrate from the dewatering centrifuges, gravity thickener overflow, grit classifier overflow, and effluent filter backwash.

Recommendations for Improvements

The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Pump Station No. 1 be rehabilitated by:

- Replacing the pumps with larger capacity pumps (500 gpm each).
- Installing a liner in the wet-well to extend the line of the existing structure.
- Replacing control panel, pump guide rails, and discharge piping within the wet well.
- Adding a totalizing flow meter and composite sampler.

7.9.6.2 Plant Drain Pump Station No. 2

This station is in the yard between the digested sludge holding tank and the headworks. It is equipped with two submersible pumps, each rated for 450 gpm, installed in a pre-cast reinforced concrete wet-well. The pump station collects floor drains and process water from several treatment units including drains from the digester building, the abandoned Biofilters No. 1 and No. 2, and filtrate from the RDT.

Recommendations for Improvements

The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Pump Station No. 2 be rehabilitated by:

- Replacing the pumps (500 gpm each).
- Installing a liner in the wet well to extend the line of the existing structure.
- Replacing control panel, pump guide rails, and discharge piping within the wet well.
- Adding a totalizing flow meter and composite sampler

7.9.7 Non-potable Water Pumps

The non-potable water (NPW) is pumped from the compartment of the effluent wet well downstream of the UV disinfection and are located in the UV Disinfection Building. Three vertical turbine pumps, each with a capacity of 200 gpm at 185 feet TDH (80 pounds per square inch) lift the disinfected effluent out of the wet well to a NPW distribution system. The combined pump discharge line to the surge tank is equipped with a duplex-type strainer, flow meter, and a pressure switch.

Recommendations for Improvements

The City is planning to install new VFDs for each of the three NPW pumps and a new motorized strainer as part of an ongoing project. No recommendations are made at this time.

7.9.8 WWTF Electrical System Upgrades

The plant operates with two separate utility feeds. The first, a 500 kVA service ("UT1"), is located on the southwest side of the UV Building and supplies power to the main distribution switchboard MDS-UV and MCC-A in the Old Controls Building. The second, a 1000 kVA service ("UT2"), is located on the north side of the Equipment/Blower Building and feeds the second main distribution switchboard, MDS-EB. Each switchboard has its own 250 kW standby generator, which provides backup power for most—but not all—connected loads. MCC-A, MCC-D3, SWBD-F, and SWBD-G are not currently supported by generator backup.

The plant was originally built in 1972, with major electrical upgrades completed in 1992, 2002, and 2012. MDS-UV distributes power to MCC-D1, MCC-D2, MCC-D3, and the UV systems serving the secondary and tertiary treatment areas on the east side. MDS-EB supplies power to blowers, MCC-C1, MCC-C2, SWBD-F, and SWBD-G, which support influent, aeration, digester, and solids processes on the west side. The 2002 upgrades included installation of MDS-UV, MDS-EB, the standby generators, MCC-D1, MCC-D2, MCC-D3, MCC-C1, and MCC-C2, while the 2012 upgrades included SWBD-F, MCC-F, SWBD-G, and MCC-G.

MCC-A appears to be the only remaining major electrical gear from before the 2002 upgrade, likely from the 1992 installation. It currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. Carollo recommends removing MCC-A from the plant's distribution system and refeeding its remaining loads from nearby sources. Also, the Old Controls building houses MCC-A, which is also likely controlling the loads fed from MCC-A. Carollo recommends removing PLC-A, and controlling the current PLC-A loads from another nearby PLC. This would allow the Old Controls Building to be fully repurposed as a maintenance and workshop area, which reflects its current use. The electrical equipment installed in 2002 remains in generally good condition and does not require immediate replacement; upgrades should instead coincide with future plant process improvement projects to minimize repeated modifications. However, when replacing gear in the UV or Equipment Building electrical rooms, updated layouts will likely be required to meet current National Electrical Code working clearance standards. Electrical gear from 2012 remains in excellent condition and does not need replacement in the near term.

During the site visit, it was also noted that the water utility has no in-house electrician or instrumentation technician and no on-call agreements with outside specialists. Carollo recommends establishing either internal staffing or on-call contracts with qualified electricians and system integrators to ensure prompt response to electrical and controls issues.

No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety.

The owner also reported that the last major flood affecting the plant occurred in 1997. Carollo recommends a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience.

Electrical rooms from the 2002 upgrade were found to be dusty, poorly ventilated, and not fully sealed from adjacent areas. These conditions can accelerate equipment degradation and lead to premature failures of PLCs, VFDs, and network components. Carollo recommends installing dedicated ventilation

systems, sealing the rooms from process and generator areas, and performing heating, ventilation, and air conditioning load calculations to determine whether air-handling units or cooling systems are needed to manage internal temperatures.

Throughout the plant, exposed network hardware, wiring, and cables were also observed, leaving them at risk of accidental damage. Carollo recommends installing dedicated, wall-mounted network enclosures and routing all cables through conduits for better protection and organization.

To ensure regulatory compliance, and safety, Carollo further recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code.

Lastly, extensive corrosion was noted on outdoor conduits and equipment enclosures at several locations, including the influent/screens structure and biological basins. Carollo recommends replacing these components with PVC-coated or corrosion-resistant materials to enhance reliability and reduce any potential disruptions to plant operations due to power or control failures.

7.9.9 Facility Control Systems, Including the PLC and Central SCADA

Multiple network switches are currently installed in operational areas where they are exposed to environmental conditions. To mitigate risks associated with dust, moisture, and physical damage, it is strongly recommended that these switches be relocated into protective enclosures, consistent with best practices already implemented elsewhere on site. As a short term fix to minimize the risks to the network switches, it is recommended that dust filter foam be placed over vents on the switches to reduce the intrusion of dust. Additionally, placing tape over unused network ports on the face of the switch is recommended until an enclosure is provided for the switches.

It was observed that the centrifuge cannot initiate operations when the system is in Automatic mode. Manual intervention is required to start the centrifuge, after which the system can be returned to Automatic. This behavior indicated a controls problem and should be investigated and resolved.

The Magnesium Oxide tank level sensors are ultrasonic instruments. These are highly susceptible to condensate in the tank and will provide false readings. This sensor should be replaced with a Guided Wave Radar level instrument to eliminate the noise caused by condensate.

APPENDIX A

REASONABLE POTENTIONAL ANALYSIS

PROJECT MEMORANDUM

CITY OF CAMAS

General Sewer Plan Update

Project No.: 203710
Date: January 7, 2026
Prepared By: Y. Yerbich-Louman
Reviewed By: Matt Huang
Subject: Reasonable Potential Analysis

The Washington State Department of Ecology (DOE) drafted a proposed National Pollutant Discharge Elimination System (NPDES) Permit WA0020249 for the City of Camas wastewater treatment plant (WWTP) with an effective date of August 1, 2025. As a part of these efforts, DOE conducted a reasonable potential analysis (RPA) for the predicted WWTP discharge in 2045 using a maximum daily discharge value of 10.04 million gallons per day (mgd).

The maximum daily discharge in planning year 2045 is projected to be 10.70 mgd. The DOE-developed *Spreadsheets for Water Quality-Based NPDES Permit Calculations* was used to generate an updated RPA with the projected maximum daily discharge and no other changes compared to the original RPA prepared for the draft permit. The updated RPA was conducted to identify any new reasonable potentials as a result of the updated maximum daily discharge value that would require infrastructure or process modifications to be addressed in capital improvement planning.

The updated RPA indicated that no new reasonable potentials were identified. The updated RPA results are provided in the following pages.

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	Camas WWTP
Receiving Water	Columbia River

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	5.36	7.5	10.7
Facility Flow, cfs (calculated)	8.29	11.60	16.55

	Condition	Receiving Water Flow, cfs	Allowable % of river flow	Max Dilution Factor Allowed
Aquatic Life - Acute	7Q10	81400	0.0042	**21.7**
Aquatic Life - Chronic	7Q10	81400	0.0229	**113.6**
HH-Non-Carcinogen	30Q5	113960	0.02508	**173.7**
HH-Carcinogen	Harmonic Mean	244200	0.0117	**173.6**
Whole river at 7Q10	7Q10	81400		

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25.7	23.2
pH, s.u.	7.3	7.7
Alkalinity, mg/L as CaCO3	100	66.2
Hardness, mg/L CaCO3	168	74
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		

Instructions

Reasonable Potential Calculation

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	21.7	113.6
Human Health Carcinogenic		173.7
Human Health Non-Carcinogenic		173.6

10

Pollutant, CAS No. & NPDES Application Ref. No.			1 AMMONIA, Criteria as Total NH3	2 ANTIMONY (INORGANIC) 7440360 1M	3 ARSENIC (dissolved) 7440382 2M	4 BUTYLBENZYL PHTHALATE 85687 15B	5 CADMIUM - 7440439 4M Hardness dependent	6 CHLOROFORM 67663 11V	7 CHROMIUM(TRI) -16065831 5M Hardness dependent	8 CHROMIUM(HEX) 18540299 - Dissolved	9 COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M	DIETHYLPHTHALATE 84662 24B
Effluent Data	# of Samples (n)		1156	20	20	3	20	4	20	20	20	20	3
	Coeff of Variation (Cv)		2.02	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)		1,455		0.95	**0.27**	**0.22**	0.71	0.97	420	8.3	20	1.1
	Calculated 50th percentile Effluent Conc. (when n>10)			0.237							5.47	7.5	
Receiving Water Data	90th Percentile Conc., ug/L		183	0	0	**0**	**0.015**	0	0.416	0.086	1.43	0	
	Geo Mean, ug/L			0		**0**		0		0	0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	#REF!	-	360	-	**2.67143**	-	428.811	**15**	12.813	22	-
		Chronic	#REF!	-	190	-	**0.82523**	-	139.102	**10**	8.7758	5.2	-
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	**0.013**	-	100	-	-	1300	9	200
	Metal Criteria Translator, decimal	Acute	-	-	1	-	0.943	-	0.316	-	0.996	-	-
		Chronic	-	-	1	-	0.943	-	0.86	-	0.996	-	-
	Carcinogen?		N	N	Y	N	N	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
s	$s^2=\ln(CV^2+1)$		1.275		0.555		0.555	0.555	0.555	0.555	0.555	0.555
Pn	Pn=(1-confidence level)$^{1/n}$		0.997		0.861		0.861	0.861	0.861	0.861	0.861	0.861
Multiplier			1.00		1.36		1.36	1.36	1.36	1.36	1.36	1.36
Max concentration (ug/L) at edge of…		Acute	242		0.060		0.027	0.416	26.549	1.885	1.260	
		Chronic	194		0.011		0.017	0.422	5.130	1.517	0.240	
Reasonable Potential? Limit Required?			**#REF!**		**NO**		**NO**	**NO**	**YES**	**NO**	**NO**	

Aquatic Life Limit Calculation										
# of Compliance Samples Expected per month							4			
LTA Coeff. Var. (CV), decimal							0.6			
Permit Limit Coeff. Var. (CV), decimal							0.6			
Waste Load Allocations, ug/L		Acute					323.030515			
		Chronic					1126.43826			
Long Term Averages, ug/L		Acute					103.719676			
		Chronic					594.12121			
Limiting LTA, ug/L							103.719676			
Metal Translator or 1?							1.00			
Average Monthly Limit (AML), ug/L							**161.0**			
Maximum Daily Limit (MDL), ug/L							**323.0**			

Human Health Reasonable Potential								
s	$s^2=\ln(CV^2+1)$	0.554513029	0.55451303	0.55451		0.5545	0.5545	0.5545
Pn	Pn=(1-confidence level)1/n	0.861	0.368	0.473		0.861	0.861	0.368
Multiplier		0.548111032	1.20486058	1.03846		0.5481	0.5481	1.2049
Dilution Factor		173.6066127	173.606613	173.666		173.61	173.61	173.61
Max Conc. at edge of Chronic Zone, ug/L		0.001365155	0.00187385	4.2E-03		0.0315	0.0432	0.0076
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**		**NO**	**NO**	**NO**

Instructions

Reasonable Potential Calculation - Page 2

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:
Aquatic Life
Human Health Carcinogenic
Human Health Non-Carcinoge

Pollutant, CAS No. & NPDES Application Ref. No.			11 LEAD - 7439921 7M Dependent on hardness	12 MERCURY 7439976 8M	13 NAPHTHALENE 91203 39B	14 NICKEL - 7440020 9M - Dependent on hardness	15 PHENOL 108952 10A	16 SELENIUM 7782492 10M	17 SILVER - 7740224 11M dependent on hardness.	18 ZINC- 7440666 13M hardness dependent
Effluent Data	# of Samples (n)		20	20	3	20	3	20	20	20
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		0.15	0.0009	2.07	2.02	5.5	1	0.02	26.4
	Calculated 50th percentile Effluent Conc. (when n>10)			0.0007		2		1		20.9
Receiving Water Data	90th Percentile Conc., ug/L		0.064	0.0009	0	0.604		0.274	0.025	1.25
	Geo Mean, ug/L			0	0	0	0	0		0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	46.461	2.1	-	1097.1	-	20	2.05541	88.676
		Chronic	1.8105	0.012	-	121.84	-	5	-	80.975
	WQ Criteria for Protection of Human Health, ug/L		-	0.14	-	80	9000	60	-	1000
	Metal Criteria Translator, decimal	Acute	0.466	0.85	-	0.998	-	-	0.85	0.996
		Chronic	0.466	-	-	0.997	-	-	-	0.996
	Carcinogen?		N	N	N	N	N	N	N	N

Aquatic Life Reasonable Potential										
Effluent percentile value			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
Pn	Pn=(1-confidence level)$^{1/n}$		0.861	0.861		0.861		0.861	0.861	0.861
Multiplier			1.36	1.36		1.36		1.36	1.36	1.36
Max concentration (ug/L) at edge of…		Acute	0.065	0.001		0.703		0.324	0.025	2.849
		Chronic	0.064	0.001		0.623		0.284	0.025	1.555
Reasonable Potential? Limit Required?			**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								
s	$s^2=\ln(CV^2+1)$		0.5545		0.5545	0.55451	0.55451	0.5545
Pn	Pn=(1-confidence level)1/n		0.861		0.861	0.368	0.861	0.861
Multiplier			0.5481		0.5481	1.20486	0.54811	0.5481
Dilution Factor			173.61		173.61	173.607	173.607	173.61
Max Conc. at edge of Chronic Zone, ug/L			4E-06		0.0115	0.03817	5.8E-03	0.1204
Reasonable Potential? Limit Required?			**NO**		**NO**	**NO**	**NO**	**NO**

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	113.6
Receiving Water Fecal Coliform, #/100 ml	
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*14*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**4**
Difference between mixed and ambient, #/100 ml	4

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	113.6
Receiving Water DO Concentration, mg/L	8.1
Effluent DO Concentration, mg/L	5.1
Effluent Immediate DO Demand (IDOD), mg/L	2
Surface Water Criteria, mg/L	*8*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**8.06**
DO decrease caused by effluent at chronic boundary, mg/L	**0.04**

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

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	113.6	113.6
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	21.5 °C	12.6 °C
3. 7DADMax Effluent Temperature (95th percentile)	22.0 °C	16.0 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	22.0 °C	
OUTPUT		
5. Temperature at Chronic Mixing Zone Boundary:	21.5 °C	12.6 °C
6. Incremental Temperature Increase or decrease:	0.0 °C	0.0 °C
7. Maximum Allowable Incremental Temperature Increase:	1.0 °C	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	22.0 °C	12.9 °C
A. If ambient temp is warmer than WQ criterion		
9. Does temp fall within this warmer temp range?	NO	YES
10. Temperature Limit if Required:	---	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?	NO	---
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?	YES	---
14. Temp increase allowed at mixing zone boundary, if required:	NO LIMIT	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))		
15. Does temp fall within this Incremental temp. range?	NO	---
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
USEPA Office of Water, Washington D.C.)

INPUT	
	@ Acute Boundary
1. Dilution Factor at Mixing Zone Boundary	121.0
2. Ambient/Upstream/Background Conditions	
Temperature (deg C):	23.20
pH:	8.10
Alkalinity (mg CaCO3/L):	74.00
3. Effluent Characteristics	
Temperature (deg C):	25.70
pH:	6.00
Alkalinity (mg CaCO3/L):	100.00
4. Aquatic Life Use Designation	Other species (salmonid/redb
OUTPUT	
1. Ionization Constants	
Upstream/Background pKa:	6.36
Effluent pKa:	6.35
2. Ionization Fractions	
Upstream/Background Ionization Fraction:	0.98
Effluent Ionization Fraction:	0.31
3. Total Inorganic Carbon	
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	75
Effluent Total Inorganic Carbon (mg CaCO3/L):	322
4. Condtions at Mixing Zone Boundary	
Temperature (deg C):	23.22
Alkalinity (mg CaCO3/L):	74.21
Total Inorganic Carbon (mg CaCO3/L):	77.39
pKa:	6.36
5. Allowable pH change	0.50
RESULTS	
pH at Mixing Zone Boundary:	**7.73**
pH change at Mixing Zone Boundary:	0.37
Is permit limit needed?	NO

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

INPUT

1. EFFLUENT CHARACTERISTICS

Discharge (cfs):	9.44
$CBOD_5$ (mg/L):	5
NBOD (mg/L):	3
Dissolved Oxygen (mg/L):	5
Temperature (deg C):	24

2. RECEIVING WATER CHARACTERISTICS

Upstream Discharge (cfs):	81400
Upstream $CBOD_5$ (mg/L):	1.5
Upstream NBOD (mg/L):	0.2
Upstream Dissolved Oxygen (mg/L):	9
Upstream Temperature (deg C):	23
Elevation (ft NGVD):	75
Downstream Average Channel Slope (ft/ft):	0.00088
Downstream Average Channel Depth (ft):	21
Downstream Average Channel Velocity (fps):	0.98

3. REAERATION RATE (Base e) at 20 deg C (day^{-1}): 0.13

Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	0.07
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.13
Owens	0.1 - 6	1 - 2	0.08
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.99

4. BOD DECAY RATE (Base e) AT 20 deg C (day^{-1}): 0.07

(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value -->* 0.04

OUTPUT

1. INITIAL MIXED RIVER CONDITION

$CBOD_5$ (mg/L):	1.5
NBOD (mg/L):	0.2
Dissolved Oxygen (mg/L):	9.0
Temperature (deg C):	23.0

2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)

Reaeration (day^-1):	0.14
BOD Decay (day^-1):	0.08

3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU

Initial Mixed CBODU (mg/L):	2.2
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.4

4. INITIAL DISSOLVED OXYGEN DEFICIT

Saturation Dissolved Oxygen (mg/L):	8.555
Initial Deficit (mg/L):	-0.44

5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	11.48
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	184.06
7. CRITICAL DO DEFICIT (mg/L):	0.55
8. CRITICAL DO CONCENTRATION (mg/L):	**8.00**

APPENDIX B

STATE POINT ANALYSIS

STATE POINT ANALYSES

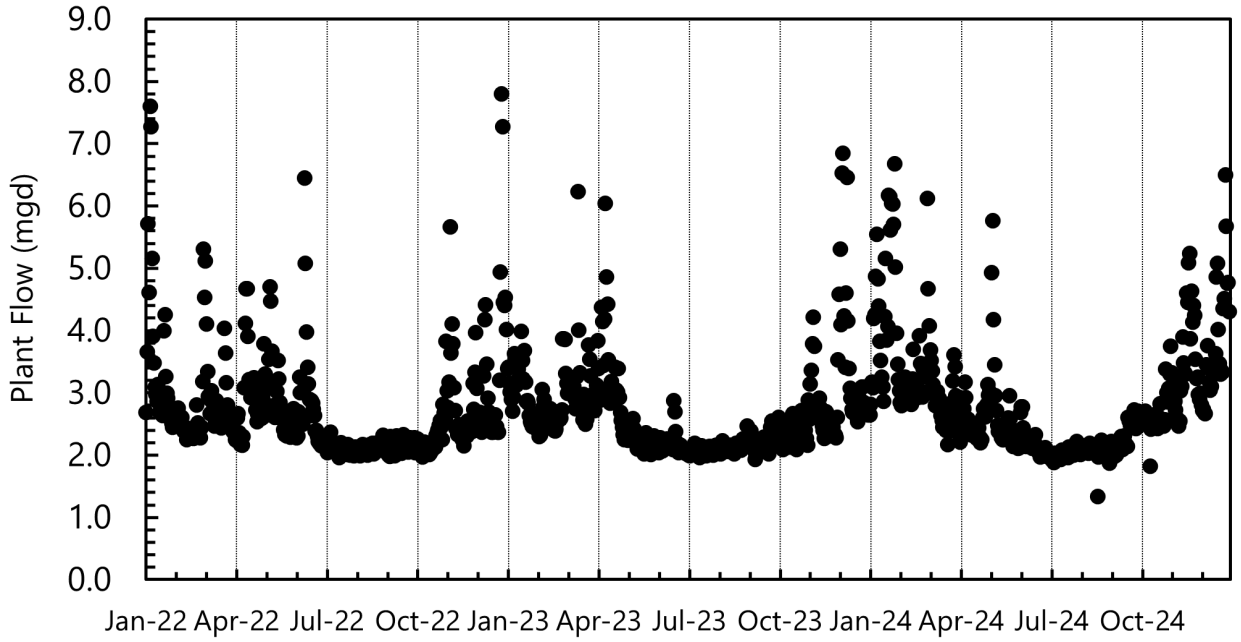


Figure B.1 Chronological Daily Influent Flow, January 2022 to December 2024

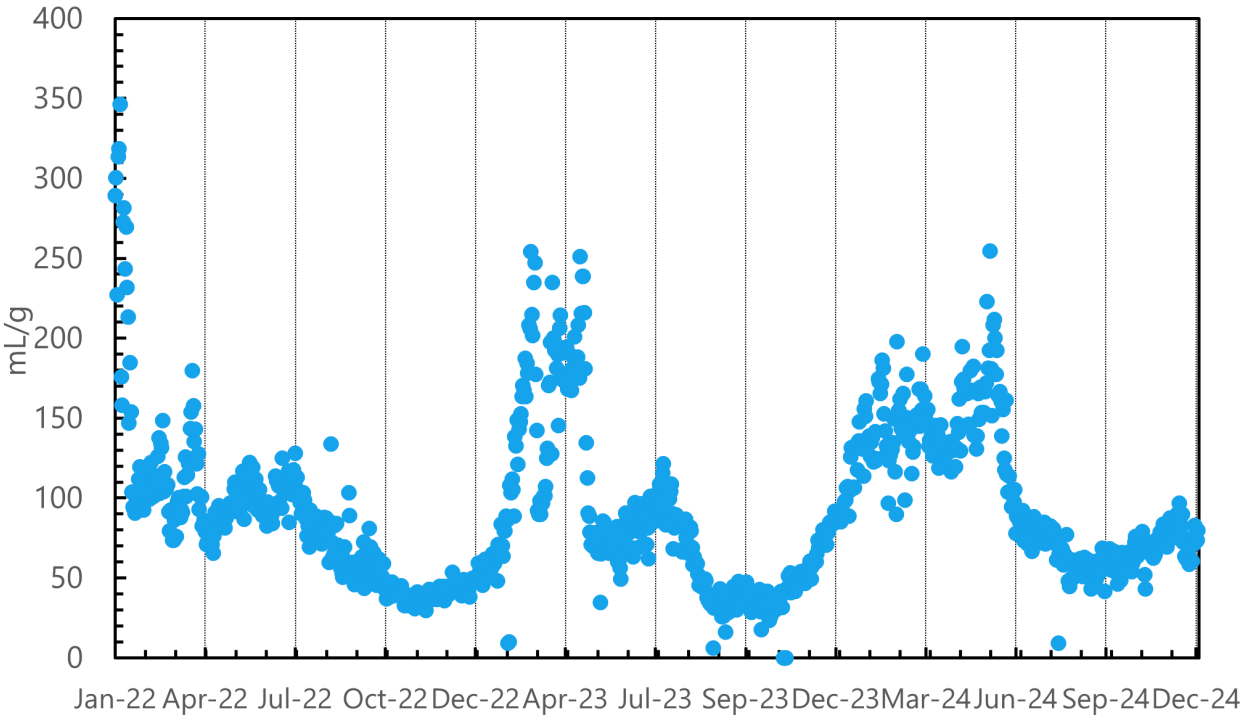


Figure B.2 Chronological SVI, January 2022 to December 2024

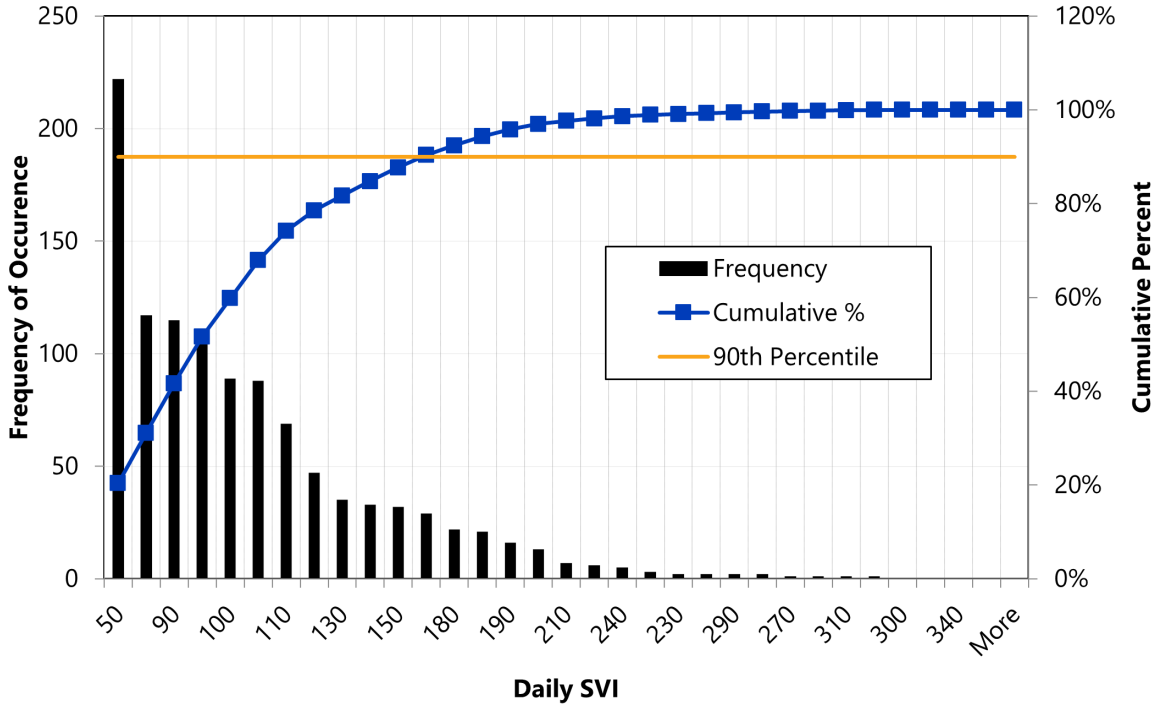


Figure B.3 Histogram of SVI Values (Frequency of occurrence and cumulative percent) from January 2022 to December 2024

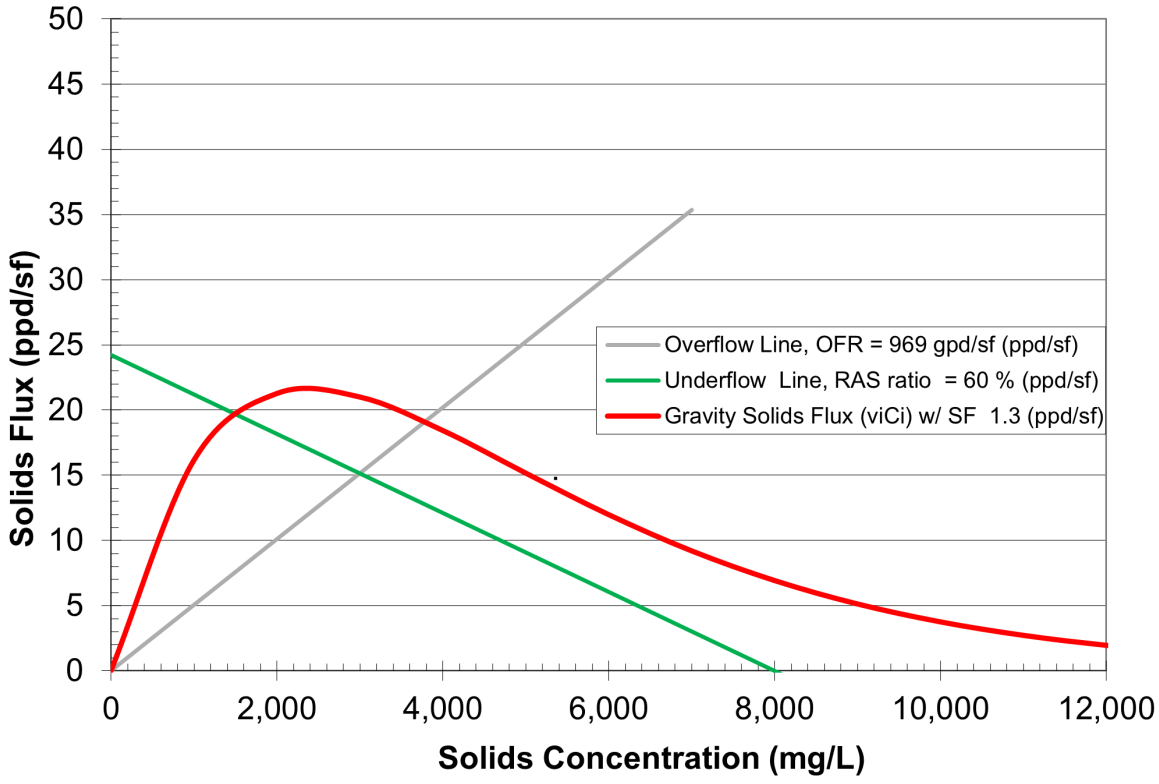


Figure B.4 State Point Analysis at Maximum Day Conditions

Notes: Four Secondary clarifiers, Flow = 10.7 mgd, MLSS = 3,000 mg/L, SVI = 160, Safety Factor = 1.3

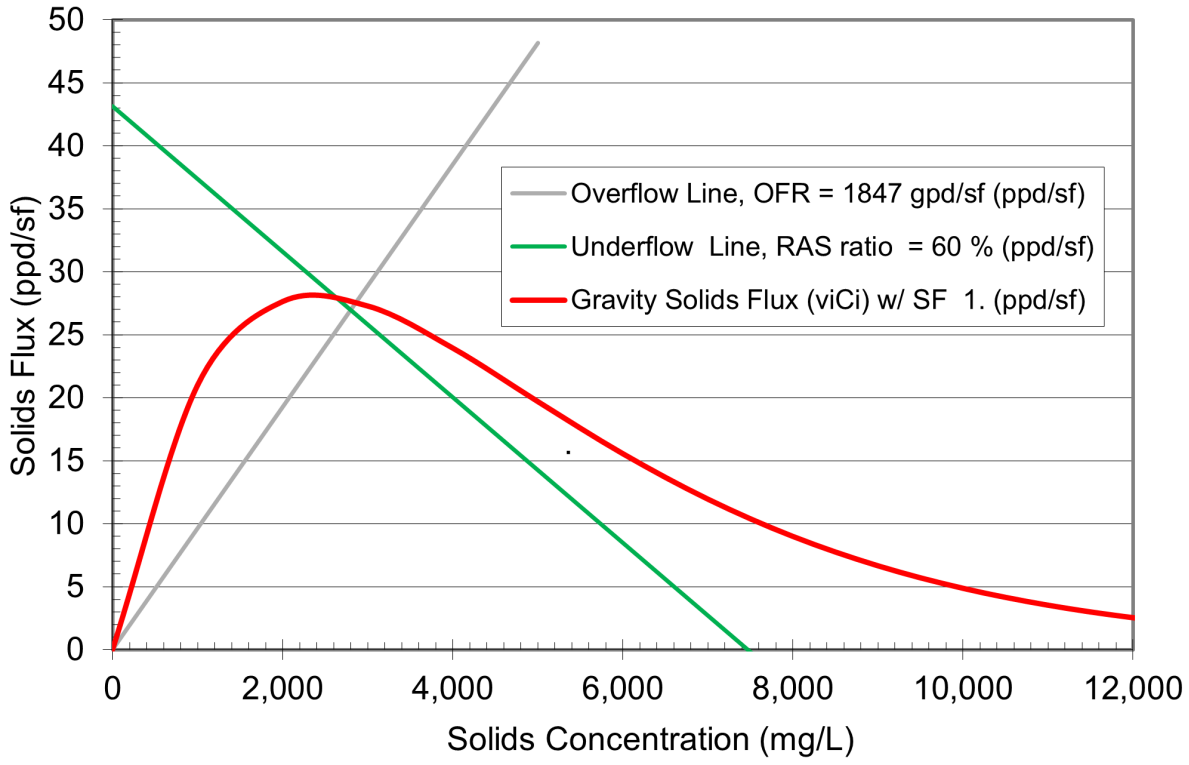


Figure B.5 State Point Analysis at Peak Hour Conditions

Notes: Four Secondary clarifiers, Flow = 20.4 mgd, MLSS = 2,800 mg/L, SVI = 160, Safety Factor = 1.0

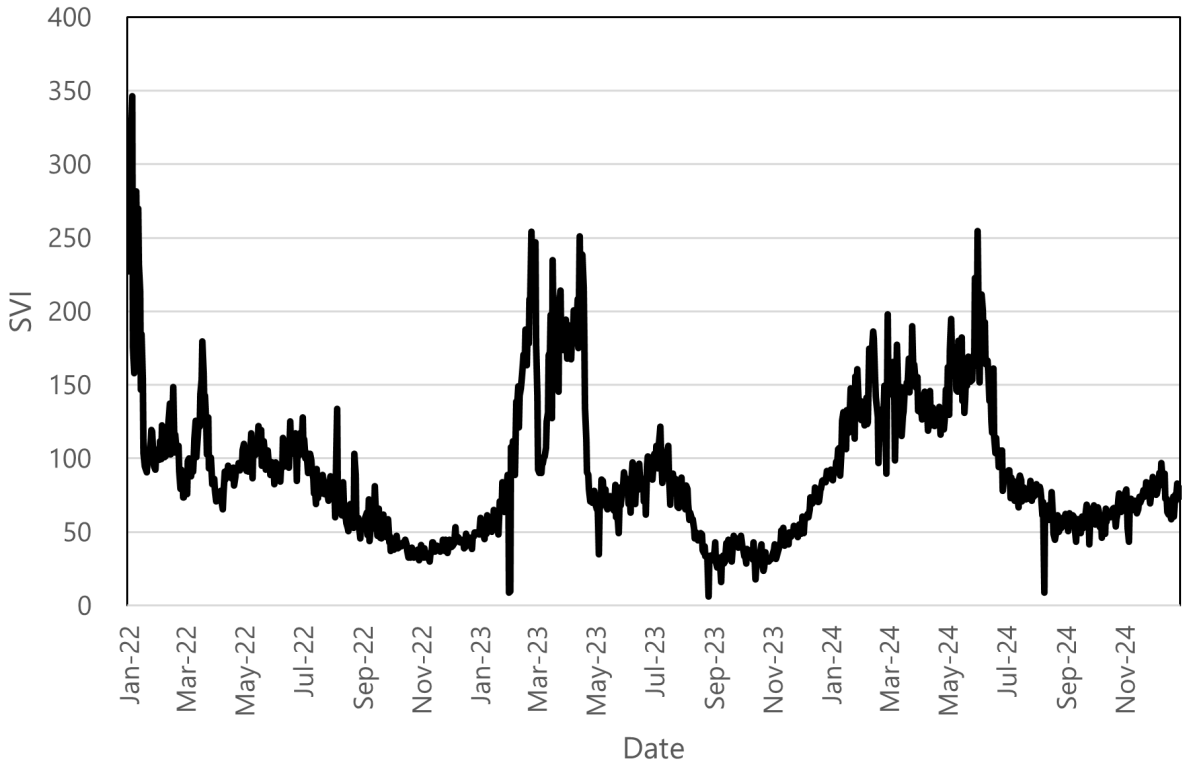


Figure B.6 Chronological Plot of Daily SVIs at the WWTF from January 2022 through December 2024

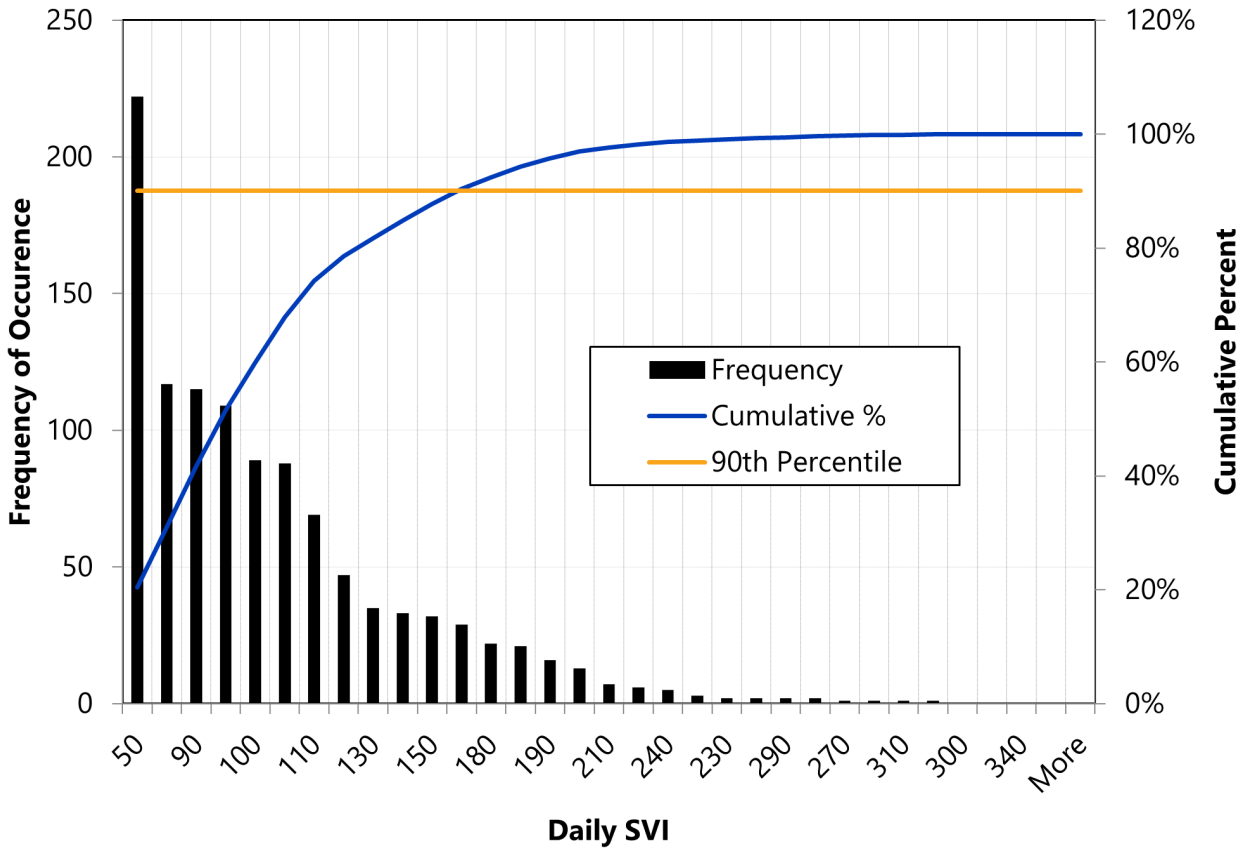


Figure B.7 Frequency of Occurrence Plot of Daily SVIs at the WWTF from January 2022 through December 2024

APPENDIX C

BIOWIN DATA

BIOWIN DATA

Geometry

Table C.1 Biowin Process Geometry

Tank/Zone	No.	Length	Width	Depth	Diameter	Unit Area	Total Area	Unit Volume	Total Volume
Primary Clarifiers	2			10.00	60.00	2,827	5,655	0.211	0.423
Selector Zones									
Zone 1	3	10.00	7.00	21.00		70	210	0.011	0.033
Zone 2	3	10.00	7.00	21.00		70	210	0.011	0.033
Zone 3	3	20.00	7.00	21.00		140	420	0.022	0.066
Subtotal		40.00				280	840	0.044	0.132
Anoxic Zones									
Zone 1	3	21.50	40.00	21.00		860	2,580	0.135	0.405
Zone 2	0					0	0	0.000	0.000
Subtotal		21.50				860	2,580	0.135	0.405
Total							3,420		0.537
Aeration Zones									
Zone 2 Anoxic	3	21.50	40.00	21.00		860	2,580	0.135	0.405
Zone 1	3	23.33	40.00	21.00		933	2,800	0.147	0.440
Zone 2	3	23.33	40.00	21.00		933	2,800	0.147	0.440
Zone 3	3	23.33	40.00	21.00		933	2,800	0.147	0.440
Subtotal		91.49				3,660	10,979	0.575	1.725
Total BNR						4,800	14,399	0.754	2.262
Secondary Clarifiers									
SC No. 1	1			17.00	75.00	4,418	4,418	0.562	0.562
SC No. 2	1			17.00	75.00	4,418	4,418	0.562	0.562
SC No. 3	1			14.00	75.00	4,418	4,418	0.463	0.463
SC No. 4	1			17.00	75.00	4,418	4,418	0.562	0.562
Subtotal							17,671		2.148

Notes:
BNR - biological nutrient removal; SC - secondary clarifier.

Table C.2 Tank Geometry in Process Simulation Model

Element name	Volume (MG)	Area (sf)	Depth (feet)	Aeration
PC	0.423	5,655	10.00	---
Selector 1	0.022	140	21.00	Mixed
Selector 2	0.022	140	21.00	Mixed
Selector 3	0.044	280	21.00	Mixed
Anoxic 1	0.41	2,610	21.00	Mixed
Anoxic 2	0.27	1,679	21.00	Mixed
Oxic 1	0.293	1,865	21.00	Aerated
Oxic 2	0.293	1,865	21.00	Aerated
Oxic 3	0.293	1,865	21.00	Aerated
SST	0.859	8,834	13.00	---
GST	5.283	540	13.12	---
MAD1	0.355	1,609	29.50	Mixed
MAD2	0.355	1,609	29.50	Mixed
DSHT	0.084	802	14.00	----

Notes:
DSHT - digested sludge holding tank; GST - gravity sludge thickener; MAD - mesophilic anaerobic digester; PC - primary clarifier; sf - square feet; SST - secondary settling tank.

APPENDIX D

WASHINGTON DEPARTMENT OF ECOLOGY AND USEPA DESIGN AND RELIABLITY CRITERIA

WASHINGTON DEPARTMENT OF ECOLOGY AND USEPA DESIGN AND RELIABLITY CRITERIA

Table D.1 Design Condition Summary(1)

Unit Processes	Flow (F)	Organic or Solids Loading (L)
All plant pumping, conveyance channels, pipes, and flow structures	PIDF	N/A
Primary and secondary clarifiers	PHDF + recirculation flow for overflow rate and weir loading rate.	PHDL (TSS loading rate to clarifiers)(2)
Biological reactor	MWDF	MWDL (BOD_5 loading to reactor(s))(2)
	MDDF	MDDL (BOD_5 loading to reactors)(2)
Aeration equipment for substrate removal	N/A	PHDL (BOD_5 and for nitrifying systems, TKN loading rate to biological reactor(s))(2)
Plant liquid stream pumping equipment	PIDF	N/A
Filters used for secondary effluent polishing	Pass all flows requiring tertiary treatment	N/A
Primary and secondary sludge wasting equipment	N/A	MDDL (BOD_5 and TSS loading to primary clarifiers and/or biological reactor(s))(2)
Sludge digestion and dewatering equipment	N/A	MDDL (BOD_5 loading to reactor(s))(2)
Disinfection (non-reuse and non-reliability Class I plants)	MDDF (for disinfection requirements, PHDF (for hydraulic considerations)	N/A
Disinfection (reuse and reliability Class I plants)	All flows	N/A

Notes:
(1) Source: Department of Ecology, State of Washington. August 2008 (Revised May 2023). Criteria for Sewage Works Design. Publication # 98-37 WQ. Olympia, Washington.
(2) Organic or solids loading parameters are to be computed with the same time intervals as hydraulic loadings.
(3) Continuous flow routing analysis to ensure the discharge from the equalization basin does not exceed the hydraulic design limit for the downstream unit processes.

BOD_5 - 5-day biological oxygen demand; MDDF - maximum day design flow; MDDL - maximum day design load; MWDF - maximum week design flow; MWDL - maximum week design load; N/A - not applicable; PHDF - peak hour design flow; PHDL - peak hour design load; PIDF - peak instantaneous design flow; TKN - total Kjeldahl nitrogen; TSS - total suspended solids.

Table D.2 General Requirements for Each Reliability Classification(1)

Reliability Class	General Requirements
I	For components included in the design of Reliability Class I works, the following backup requirements apply: ▪ **Mechanically Cleaned Bar Screens**. 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. ▪ **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. ▪ **Comminution Facility**. If comminution of the total wastewater flow is provided, an overflow bypass with a manually-installed or mechanically-cleaned bar screen shall be provided. The hydraulic capacity of the comminutor overflow bypass should be sufficient to pass the peak flow with all comminution units out of service. ▪ **Primary Sedimentation Basins**. The units should be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units should have a design flow capacity of at least 50% of the total design flow. ▪ **Final Sedimentation Basins and Trickling Filters**. 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 75% of the total design flow. ▪ **Activated Sludge Process Components**: » **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.) » **Aeration Blowers or Mechanical Aerators**. 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. » **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. ▪ **Disinfectant Contact Basins**. 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.
II	The Reliability Class I requirements shall apply except as modified below: ▪ D/E. **Primary and Final Sedimentation Basins and Trickling Filters**. 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.
III	The Reliability Class I requirements shall apply except as modified below: ▪ D/E. Primary and Final Sedimentation Basins. There shall be at least two sedimentation basins. » Activated Sludge Process Components. » Aeration Basin. A single basin is permissible. **Aeration Blowers/Mechanical Aerators or Rotors**. There shall be at least two blowers, mechanical aerators, or rotors available for service. It is permissible for one of the units to be uninstalled, provided that the installed unit can be easily removed and replaced. Aeration must be provided to maintain sufficient DO in the tanks to maintain the biota.

Notes:
(1) Source: From Department of Ecology, State of Washington. August 2008 (Revised May 2023). Criteria for Sewage Works Design. Publication # 98-37 WQ. Olympia, Washington.

Table D.3 Summary of Class I Reliability Criteria for Wastewater Treatment Facilities(1)

Plant Component	Class I Reliability (2)	Design Flow/Load(3)
Hydraulic Elements	Peak flow with largest unit out of service.	Peak hour
Primary Sedimentation	50% design flow with largest unit out of service.	Average day / peak hour
Aeration System	Design transfer with largest unit out; backup may be uninstalled; minimum 2 installed units.	Maximum day / maximum week
Biological Treatment Systems	Minimum 2 equal volumes; no backup required.	Annual average / maximum month
Secondary Clarifiers	75% design flow with largest unit out of service.	Maximum day / peak hour
Disinfection	50% design flow with largest unit out of service.	Average day / peak hour
Filtration	75% design flow with largest unit out of service.	Average day / peak hour
Sludge Facilities		
Digestion	Minimum 2 tanks.	Maximum month
Mixing	Design capacity with one unit out.	
Dewatering	Design capacity with one unit out.	

Notes:
(1) Source: U.S. Environmental Protection Agency. 1974. Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability. Publication No. EPA-430-99-74-001, Washington, D.C.
(2) Reliability - A measurement of the ability of a component or system to perform its designated function without failure. In the referenced Technical Bulletin, reliability pertains to mechanical, electric, and fluid systems and components only and includes the maintainability of those systems and components. Reliability of biological processes, operator training, process design, or structural design is not within the scope of the referenced publication.
(3) Fluid System - A system within the treatment works which contains liquid or gaseous fluids. This includes the main wastewater treatment system, parts of the sludge handling and disposal system, and auxiliary systems.
(4) Design Flow – That flow used as the basis of design of a component and/or system.
(5) Peak Wastewater Flow - The maximum wastewater flow expected during the design period of the treatment works.
(6) Hydraulic Capacity - The maximum flow capacity of a component which does not result in flooding or overflowing.
(7) Reliability Class I – Works which discharge into navigable waters that could be permanently or unacceptably damaged by effluent which was degraded in quality for only a few hours. Examples of Class I Works might be those discharging near drinking water reservoirs, into shellfish waters, or in close proximity to areas used for water contact sports.

APPENDIX E

DESIGN INFLUENT PARAMETERS

DESIGN INFLUENT PARAMETERS

Table E.1 Existing Influent Flows

Flow Condition	Units	May 2025	2045
AADF	mgd	2.56	5.36
MMADF	mgd	___	7.5
MWADF	mgd	___	8.6
Max Day Flow	mgd	3.11	10.7
Peak Hour Flow	mgd	----	20.4
	gpm		14,200

Notes:
AADF - annual average day flow; MMADF - maximum month average day flow; MWADF - maximum week average day flow.

Table E.2 Historical Influent and Primary Effluent Concentrations (mg/L)

Parameter	Flow	BOD_5	TSS	NH3
	(mgd)	(mg/L)	(mg/L)	(mg/L)
Influent				
Average	2.73	121.49	133.82	40.33
Minimum	1.33	48.80	39.00	9.74
Maximum	7.80	313.90	380.00	59.30
Standard deviation	0.85	29.92	46.49	8.63
No. of data points (n)	1,095	722	726	725
Coefficient of variation	0.31	0.25	0.35	0.21
Primary Effluent				
Average		72.09	43.03	
Minimum		17.70	10.00	
Maximum		801.10	201.00	
Standard deviation		36.06	17.65	
No. of data points (n)		540	599	
Coefficient of variation		0.50	0.41	

Table E.3 Historical Influent and Primary Effluent Mass Loads (ppd)

Parameter	2022	2023	2024
Influent			
Flow	2.71	2.64	2.85
BOD_5	2,498.30	2,773.30	2,771.85
TSS	2,872.54	3,153.41	2,911.42
TKN	1,322.18	1,237.17	1,209.36

Parameter	2022	2023	2024
Primary Effluent			
BOD_5	2,094.96	1,551.04	1,550.93
TSS	1,380.04	920.99	828.93
TKN	-	-	-

Notes:
BOD_5 - 5-day biological oxygen demand; TSS - total suspended solids; TKN - total Kjeldahl nitrogen.

Table E.4 Historical Effluent Concentrations (mg/L)

Parameter	2022	2023	2024
Final Effluent			
BOD_5	4.05	4.01	3.20
TSS	4.05	3.47	3.20
NH3	0.29	0.32	0.31

Table E.5 BioWin Model Influent Mass Loads by Average Period

Averaging Period	Units	Flow	BOD_5	TSS	TKN	TP
AAD	ppd	5.36	5,932	5,643	2,460	134
MMAD	ppd	6.80	7,525	7,158	3,121	170
MWAD	ppd	7.60	8,410	8,001	3,488	190
MD	ppd	13.3	14,718	14,001	6,105	333

Notes:
AAD - annual average day; MMAD - maximum month average day; MWAD - maximum week average day; MD - maximum day.

Table E.6 Predicted BNR Influent Flow and Mass Loads

Averaging Period	Units	PC Effluent	PS 1	PS 2	Total	Total Sidestream	Sidestream Concentration
Flow							
AADF	mgd	5.29	0.18	0.08	5.55	0.26	
MMADF	mgd	6.71	0.23	0.08	7.01	0.30	
MWADF	mgd	7.49	0.27	0.07	7.83	0.35	
MDF	mgd	10.56	0.36	0.13	11.06	0.50	
cBOD5							
AAD	ppd	3,866	194	182	4,243	376	176
MMAD	ppd	4,714	272	221	5,207	493	194
MWAD	ppd	5,369	346	256	5,971	602	209
MD	ppd	8,321	634	466	9,421	1,100	266
TSS							
AAD	ppd	2,596	765	682	4,043	1,448	676
MMAD	ppd	3,007	859	992	4,858	1,851	730
MWAD	ppd	3,520	1,239	940	5,699	2,179	756
MD	ppd	6,083	2,102	1,490	9,674	3,592	868

Averaging Period	Units	PC Effluent	PS 1	PS 2	Total	Total Sidestream	Sidestream Concentration
TKN							
AAD	ppd	2,370	173	56	2,600	229	107
MMAD	ppd	3,002	213	78	3,293	291	115
MWAD	ppd	3,351	253	78	3,682	331	115
MD	ppd	4,750	395	123	5,268	518	125

Table E.7 Plant Sludge Production Predicted by the BioWin Model

Averaging Period	Units	Primary Sludge	Thickened PS	Waste Activated Sludge	Thickened WAS	Total TPS + TWAS	Digested Sludge	Dewatered Sludge Cake	Dried Sludge
AAD	ppd	3,555	3,377	3,388	2,880	6,256	2,946	2,504	2,379
MMAD	ppd	4,009	3,808	4,519	3,842	7,650	3,655	3,290	2,961
MWAD	ppd	4,160	3,952	5,273	4,482	8,434	4,303	3,658	3,475
MD	ppd	3,920	3,724	10,093	8,579	12,304	7,157	6,083	5,779

APPENDIX F

BIOWIN MODEL INFLUENT WASTEWATER FRACTIONS

BIOWIN MODEL INFLUENT WASTEWATER FRACTIONS

Table F.1 Design Influent Wastewater Fractions

Wastewater Fraction	Units	Default	May 2025	2045 MMAD
Readily biodegradable (including Acetate)	g COD/g of total COD	0.16	0.1346	0.10
Volatile fatty acids	g VFA COD/g rbCOD	0.15	0.1429	0.13
Acetate	g COD/g of readily biodegradable COD	1.00	1.00	1.00
Non-colloidal slowly biodegradable	g COD/g of slowly degradable COD	0.75	0.7162	0.75
Unbiodegradable soluble	g COD/g of total COD	0.05	0.0577	0.14
Unbiodegradable particulate	g COD/g of total COD	0.13	0.0546	0.11
Cellulose fraction of unbiodegradable particulate	g COD/g COD	0.5	0.5	0.50
Ammonia	g NH_3-N TKN	0.66	0.6667	0.92
Particulate organic nitrogen	g N Organic N	0.5	0.5	0.50
Soluble unbiodegradable TKN	g N TKN	0.02	0.02	0.02
N:COD ratio for unbiodegradable part. COD	g N COD	0.07	0.07	0.07
Phosphate	g PO4-P/TP	0.5	0.4889	0.81
P:COD ratio for unbiodegradable part. COD	g P COD	0.022	0.022	0.02
Reduced sulfur (H2S)	g S S	0.15	0.15	0.20
Ordinary heterotrophic COD fraction	g COD/g of total COD	0.02	0.02	0.02
Methylotrophic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Ammonia oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Nitrite oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Anaerobic ammonia oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Phosphorus accumulating COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Propionic acetogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Acetoclastic methanogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04

Wastewater Fraction	Units	Default	May 2025	2045 MMAD
Hydrogenotrophic methanogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Sulfur oxidizing COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Sulfur reducing propionic acetogenic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	1.00E-04
Sulfur reducing acetotrophic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	0.00
Sulfur reducing hydrogenotrophic COD fraction	g COD/g of total COD	1.00E-04	1.00E-04	0.00
Endogenous products COD fraction	g COD/g of total COD	0	0	0.00

Notes:
COD - chemical oxygen demand; g - grams; MMAD - maximum month average day; N - nitrogen; P - phosphate; S - sulfur; TKN - total Kjeldahl nitrogen; VFA - volatile fatty acids.

APPENDIX G

MODEL SIMULATION RESULTS

MODEL SIMULATION RESULTS

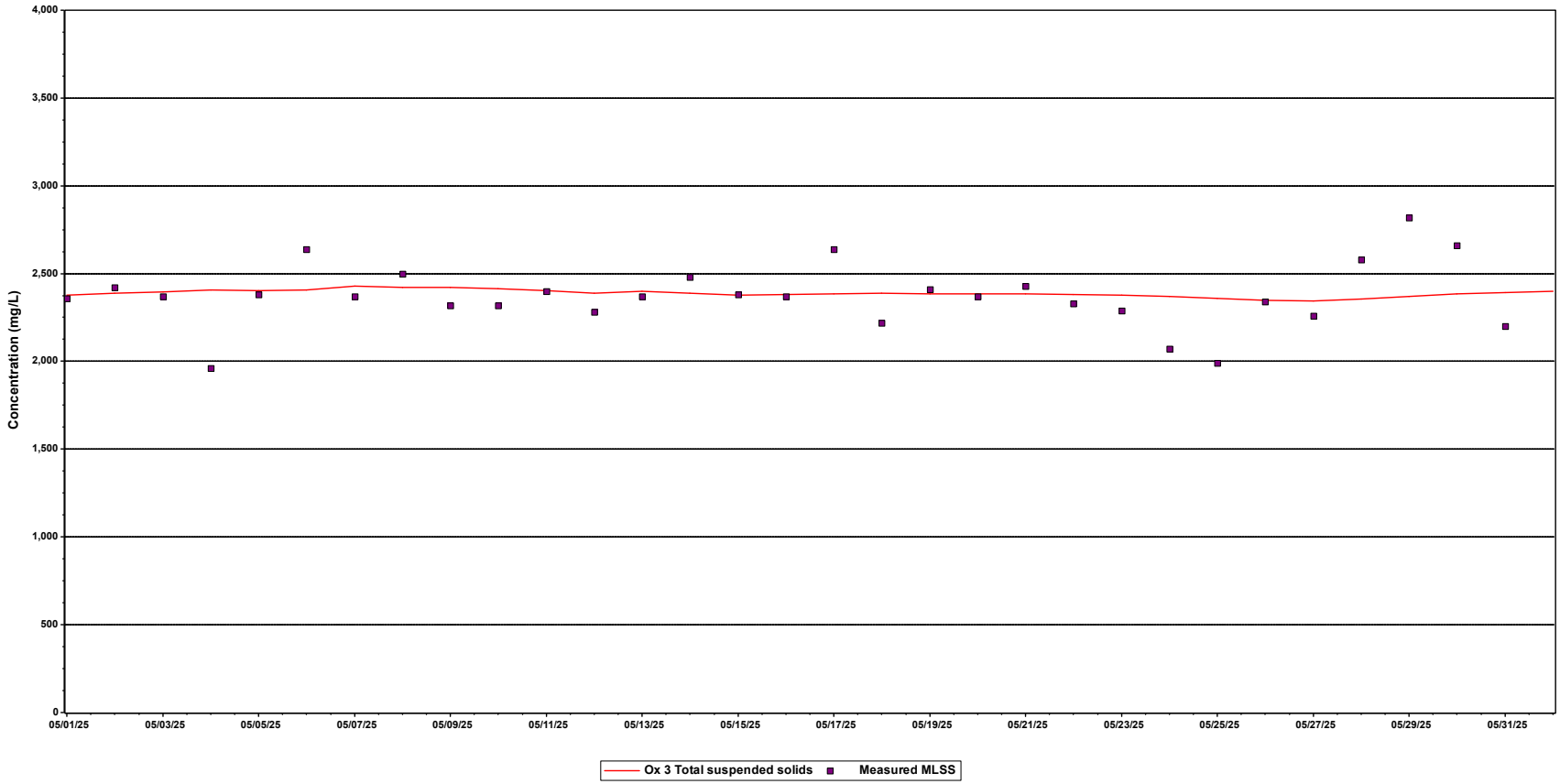


Figure G.1 Predicted Mixed Liquor Suspended Solids Versus Measured Concentrations for the Wastewater Treatment Facility for May 2025

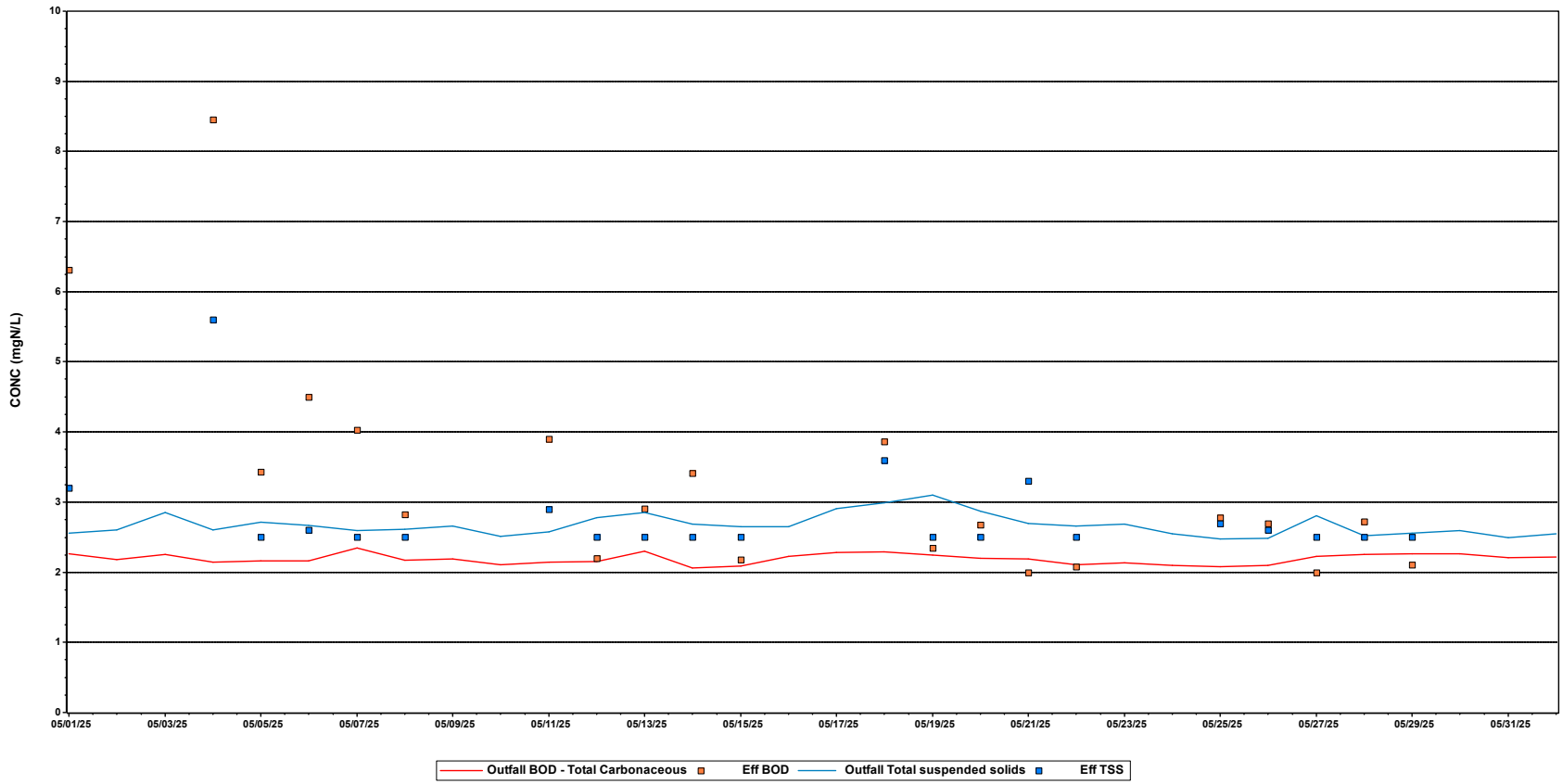


Figure G.2 Predicted versus Measured Effluent $cBOD_5$ and Total Suspended Solids Concentrations for May 2025

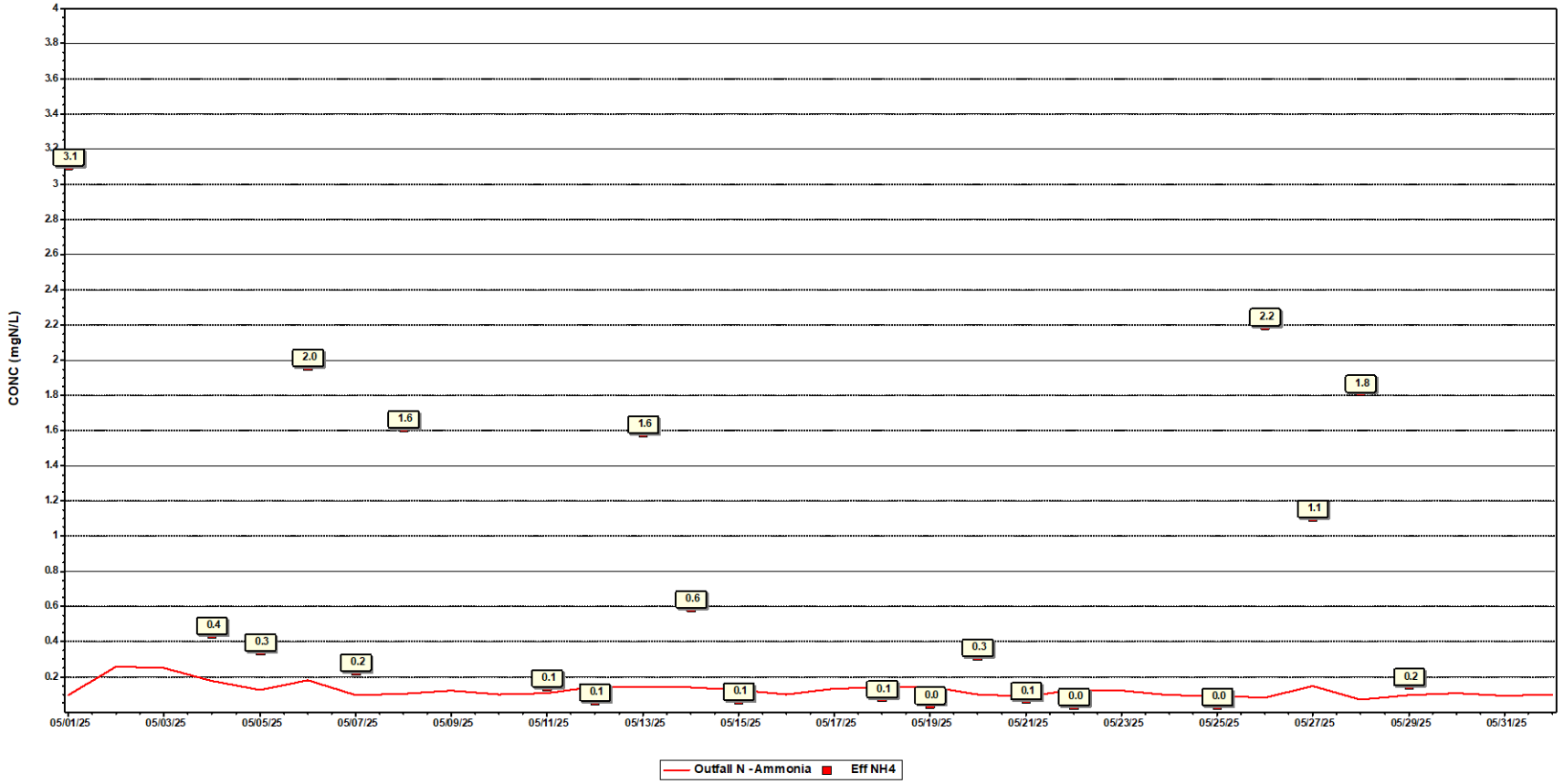


Figure G.3 Predicted versus Measured Effluent Ammonium Concentrations for May 2025

APPENDIX J

REASONABLE POTENTIAL ANALYSIS PROJECT MEMORANDUM

PROJECT MEMORANDUM

CITY OF CAMAS

General Sewer Plan Update

Project No.: 203710
Date: January 7, 2026
Prepared By: Y. Yerbich-Louman
Reviewed By: Matt Huang
Subject: Reasonable Potential Analysis

The Washington State Department of Ecology (DOE) drafted a proposed National Pollutant Discharge Elimination System (NPDES) Permit WA0020249 for the City of Camas wastewater treatment plant (WWTP) with an effective date of August 1, 2025. As a part of these efforts, DOE conducted a reasonable potential analysis (RPA) for the predicted WWTP discharge in 2045 using a maximum daily discharge value of 10.04 million gallons per day (mgd).

The maximum daily discharge in planning year 2045 is projected to be 10.70 mgd. The DOE-developed *Spreadsheets for Water Quality-Based NPDES Permit Calculations* was used to generate an updated RPA with the projected maximum daily discharge and no other changes compared to the original RPA prepared for the draft permit. The updated RPA was conducted to identify any new reasonable potentials as a result of the updated maximum daily discharge value that would require infrastructure or process modifications to be addressed in capital improvement planning.

The updated RPA indicated that no new reasonable potentials were identified. The updated RPA results are provided in the following pages.

Dilution Factor Calculations and Receiving Water Critical Conditions

Step 1: Enter Waterbody Type

Water Body Type	Freshwater

Facility Name	Camas WWTP
Receiving Water	Columbia River

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	5.36	7.5	10.7
Facility Flow, cfs (calculated)	8.29	11.60	16.55

	Condition	Receiving Water Flow, cfs	Allowable % of river flow	Max Dilution Factor Allowed
Aquatic Life - Acute	7Q10	81400	0.0042	**21.7**
Aquatic Life - Chronic	7Q10	81400	0.0229	**113.6**
HH-Non-Carcinogen	30Q5	113960	0.02508	**173.7**
HH-Carcinogen	Harmonic Mean	244200	0.0117	**173.6**
Whole river at 7Q10	7Q10	81400		

Step 3: Enter Critical Data

	Effluent	Receiving Water
Temp, °C	25.7	23.2
pH, s.u.	7.3	7.7
Alkalinity, mg/L as CaCO3	100	66.2
Hardness, mg/L CaCO3	168	74
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		

Instructions

Reasonable Potential Calculation

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:	Acute	Chronic
Aquatic Life	21.7	113.6
Human Health Carcinogenic		173.7
Human Health Non-Carcinogenic		173.6

10

Pollutant, CAS No. & NPDES Application Ref. No.			1 AMMONIA, Criteria as Total NH3	2 ANTIMONY (INORGANIC) 7440360 1M	3 ARSENIC (dissolved) 7440382 2M	4 BUTYLBENZYL PHTHALATE 85687 15B	5 CADMIUM - 7440439 4M Hardness dependent	6 CHLOROFORM 67663 11V	7 CHROMIUM(TRI) -16065831 5M Hardness dependent	8 CHROMIUM(HEX) 18540299 - Dissolved	9 COPPER - 744058 6M Hardness dependent	CYANIDE 57125 14M	DIETHYLPHTHALATE 84662 24B
Effluent Data	# of Samples (n)		1156	20	20	3	20	4	20	20	20	20	3
	Coeff of Variation (Cv)		2.02	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)		1,455		0.95	**0.27**	**0.22**	0.71	0.97	420	8.3	20	1.1
	Calculated 50th percentile Effluent Conc. (when n>10)			0.237							5.47	7.5	
Receiving Water Data	90th Percentile Conc., ug/L		183	0	0	**0**	**0.015**	0	0.416	0.086	1.43	0	
	Geo Mean, ug/L			0		**0**		0		0	0	0	0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	#REF!	-	360	-	**2.67143**	-	428.811	**15**	12.813	22	-
		Chronic	#REF!	-	190	-	**0.82523**	-	139.102	**10**	8.7758	5.2	-
	WQ Criteria for Protection of Human Health, ug/L		-	6	-	**0.013**	-	100	-	-	1300	9	200
	Metal Criteria Translator, decimal	Acute	-	-	1	-	0.943	-	0.316	-	0.996	-	-
		Chronic	-	-	1	-	0.943	-	0.86	-	0.996	-	-
	Carcinogen?		N	N	Y	N	N	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
s	$s^2=\ln(CV^2+1)$		1.275		0.555		0.555	0.555	0.555	0.555	0.555	0.555
Pn	Pn=(1-confidence level)$^{1/n}$		0.997		0.861		0.861	0.861	0.861	0.861	0.861	0.861
Multiplier			1.00		1.36		1.36	1.36	1.36	1.36	1.36	1.36
Max concentration (ug/L) at edge of…		Acute	242		0.060		0.027	0.416	26.549	1.885	1.260	
		Chronic	194		0.011		0.017	0.422	5.130	1.517	0.240	
Reasonable Potential? Limit Required?			**#REF!**		**NO**		**NO**	**NO**	**YES**	**NO**	**NO**	

Aquatic Life Limit Calculation										
# of Compliance Samples Expected per month							4			
LTA Coeff. Var. (CV), decimal							0.6			
Permit Limit Coeff. Var. (CV), decimal							0.6			
Waste Load Allocations, ug/L		Acute					323.030515			
		Chronic					1126.43826			
Long Term Averages, ug/L		Acute					103.719676			
		Chronic					594.12121			
Limiting LTA, ug/L							103.719676			
Metal Translator or 1?							1.00			
Average Monthly Limit (AML), ug/L							**161.0**			
Maximum Daily Limit (MDL), ug/L							**323.0**			

Human Health Reasonable Potential								
s	$s^2=\ln(CV^2+1)$	0.554513029	0.55451303	0.55451		0.5545	0.5545	0.5545
Pn	Pn=(1-confidence level)1/n	0.861	0.368	0.473		0.861	0.861	0.368
Multiplier		0.548111032	1.20486058	1.03846		0.5481	0.5481	1.2049
Dilution Factor		173.6066127	173.606613	173.666		173.61	173.61	173.61
Max Conc. at edge of Chronic Zone, ug/L		0.001365155	0.00187385	4.2E-03		0.0315	0.0432	0.0076
Reasonable Potential? Limit Required?		**NO**	**NO**	**NO**		**NO**	**NO**	**NO**

Instructions

Reasonable Potential Calculation - Page 2

Facility	Camas WWTP
Water Body Type	Freshwater
Rec. Water Hardness	74 mg/L

Dilution Factors:
Aquatic Life
Human Health Carcinogenic
Human Health Non-Carcinoge

Pollutant, CAS No. & NPDES Application Ref. No.			11 LEAD - 7439921 7M Dependent on hardness	12 MERCURY 7439976 8M	13 NAPHTHALENE 91203 39B	14 NICKEL - 7440020 9M - Dependent on hardness	15 PHENOL 108952 10A	16 SELENIUM 7782492 10M	17 SILVER - 7740224 11M dependent on hardness.	18 ZINC- 7440666 13M hardness dependent
Effluent Data	# of Samples (n)		20	20	3	20	3	20	20	20
	Coeff of Variation (Cv)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Effluent Concentration, ug/L (Max. or 95th Percentile)		0.15	0.0009	2.07	2.02	5.5	1	0.02	26.4
	Calculated 50th percentile Effluent Conc. (when n>10)			0.0007		2		1		20.9
Receiving Water Data	90th Percentile Conc., ug/L		0.064	0.0009	0	0.604		0.274	0.025	1.25
	Geo Mean, ug/L			0	0	0	0	0		0
Water Quality Criteria	Aquatic Life Criteria, ug/L	Acute	46.461	2.1	-	1097.1	-	20	2.05541	88.676
		Chronic	1.8105	0.012	-	121.84	-	5	-	80.975
	WQ Criteria for Protection of Human Health, ug/L		-	0.14	-	80	9000	60	-	1000
	Metal Criteria Translator, decimal	Acute	0.466	0.85	-	0.998	-	-	0.85	0.996
		Chronic	0.466	-	-	0.997	-	-	-	0.996
	Carcinogen?		N	N	N	N	N	N	N	N

Aquatic Life Reasonable Potential										
Effluent percentile value			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
Pn	Pn=(1-confidence level)$^{1/n}$		0.861	0.861		0.861		0.861	0.861	0.861
Multiplier			1.36	1.36		1.36		1.36	1.36	1.36
Max concentration (ug/L) at edge of…		Acute	0.065	0.001		0.703		0.324	0.025	2.849
		Chronic	0.064	0.001		0.623		0.284	0.025	1.555
Reasonable Potential? Limit Required?			**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								
s	$s^2=\ln(CV^2+1)$		0.5545		0.5545	0.55451	0.55451	0.5545
Pn	Pn=(1-confidence level)1/n		0.861		0.861	0.368	0.861	0.861
Multiplier			0.5481		0.5481	1.20486	0.54811	0.5481
Dilution Factor			173.61		173.61	173.607	173.607	173.61
Max Conc. at edge of Chronic Zone, ug/L			4E-06		0.0115	0.03817	5.8E-03	0.1204
Reasonable Potential? Limit Required?			**NO**		**NO**	**NO**	**NO**	**NO**

Calculation of Fecal Coliform at Chronic Mixing Zone

INPUT	
Chronic Dilution Factor	113.6
Receiving Water Fecal Coliform, #/100 ml	
Effluent Fecal Coliform - worst case, #/100 ml	400
Surface Water Criteria, #/100 ml	*14*
OUTPUT	
Fecal Coliform at Mixing Zone Boundary, #/100 ml	**4**
Difference between mixed and ambient, #/100 ml	4

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	113.6
Receiving Water DO Concentration, mg/L	8.1
Effluent DO Concentration, mg/L	5.1
Effluent Immediate DO Demand (IDOD), mg/L	2
Surface Water Criteria, mg/L	*8*
OUTPUT	
DO at Mixing Zone Boundary, mg/L	**8.06**
DO decrease caused by effluent at chronic boundary, mg/L	**0.04**

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

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	113.6	113.6
2. 7DADMax Ambient Temperature (T) (Upstream Background 90th percentile)	21.5 °C	12.6 °C
3. 7DADMax Effluent Temperature (95th percentile)	22.0 °C	16.0 °C
4. Aquatic Life Temperature WQ Criterion in Fresh Water	22.0 °C	
OUTPUT		
5. Temperature at Chronic Mixing Zone Boundary:	21.5 °C	12.6 °C
6. Incremental Temperature Increase or decrease:	0.0 °C	0.0 °C
7. Maximum Allowable Incremental Temperature Increase:	1.0 °C	0.3 °C
8. Maximum Allowable Temperature at Mixing Zone Boundary:	22.0 °C	12.9 °C
A. If ambient temp is warmer than WQ criterion		
9. Does temp fall within this warmer temp range?	NO	YES
10. Temperature Limit if Required:	---	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?	NO	---
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?	YES	---
14. Temp increase allowed at mixing zone boundary, if required:	NO LIMIT	---
D. If ambient temp is cooler than (WQ criterion - 28/(T_{amb}+7))		
15. Does temp fall within this Incremental temp. range?	NO	---
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
USEPA Office of Water, Washington D.C.)

INPUT	
	@ Acute Boundary
1. Dilution Factor at Mixing Zone Boundary	121.0
2. Ambient/Upstream/Background Conditions	
Temperature (deg C):	23.20
pH:	8.10
Alkalinity (mg CaCO3/L):	74.00
3. Effluent Characteristics	
Temperature (deg C):	25.70
pH:	6.00
Alkalinity (mg CaCO3/L):	100.00
4. Aquatic Life Use Designation	Other species (salmonid/redb
OUTPUT	
1. Ionization Constants	
Upstream/Background pKa:	6.36
Effluent pKa:	6.35
2. Ionization Fractions	
Upstream/Background Ionization Fraction:	0.98
Effluent Ionization Fraction:	0.31
3. Total Inorganic Carbon	
Upstream/Background Total Inorganic Carbon (mg CaCO3/L):	75
Effluent Total Inorganic Carbon (mg CaCO3/L):	322
4. Condtions at Mixing Zone Boundary	
Temperature (deg C):	23.22
Alkalinity (mg CaCO3/L):	74.21
Total Inorganic Carbon (mg CaCO3/L):	77.39
pKa:	6.36
5. Allowable pH change	0.50
RESULTS	
pH at Mixing Zone Boundary:	**7.73**
pH change at Mixing Zone Boundary:	0.37
Is permit limit needed?	NO

Streeter-Phelps Analysis of Critical Dissolved Oxygen Sag

INPUT

1. EFFLUENT CHARACTERISTICS

Discharge (cfs):	9.44
$CBOD_5$ (mg/L):	5
NBOD (mg/L):	3
Dissolved Oxygen (mg/L):	5
Temperature (deg C):	24

2. RECEIVING WATER CHARACTERISTICS

Upstream Discharge (cfs):	81400
Upstream $CBOD_5$ (mg/L):	1.5
Upstream NBOD (mg/L):	0.2
Upstream Dissolved Oxygen (mg/L):	9
Upstream Temperature (deg C):	23
Elevation (ft NGVD):	75
Downstream Average Channel Slope (ft/ft):	0.00088
Downstream Average Channel Depth (ft):	21
Downstream Average Channel Velocity (fps):	0.98

3. REAERATION RATE (Base e) at 20 deg C (day^{-1}): 0.13

Reference	Applic. Vel (fps)	Applic. Dep (ft)	Suggested Values
Churchill	1.5 - 6	2 - 50	0.07
O'Connor and Dobbins	0.1 - 1.5	2 - 50	0.13
Owens	0.1 - 6	1 - 2	0.08
Tsivoglou-Wallace	0.1 - 6	0.1 - 2	1.99

4. BOD DECAY RATE (Base e) AT 20 deg C (day^{-1}): 0.07

(or use *Wright and McDonnell eqn, 1979, for small rivers.) Enter this value -->* 0.04

OUTPUT

1. INITIAL MIXED RIVER CONDITION

$CBOD_5$ (mg/L):	1.5
NBOD (mg/L):	0.2
Dissolved Oxygen (mg/L):	9.0
Temperature (deg C):	23.0

2. TEMPERATURE ADJUSTED RATE CONSTANTS (Base e)

Reaeration (day^-1):	0.14
BOD Decay (day^-1):	0.08

3. CALCULATED INITIAL ULTIMATE CBODU AND TOTAL BODU

Initial Mixed CBODU (mg/L):	2.2
Initial Mixed Total BODU (CBODU + NBOD, mg/L):	2.4

4. INITIAL DISSOLVED OXYGEN DEFICIT

Saturation Dissolved Oxygen (mg/L):	8.555
Initial Deficit (mg/L):	-0.44

5. TRAVEL TIME TO CRITICAL DO CONCENTRATION (days):	11.48
6. DISTANCE TO CRITICAL DO CONCENTRATION (miles):	184.06
7. CRITICAL DO DEFICIT (mg/L):	0.55
8. CRITICAL DO CONCENTRATION (mg/L):	**8.00**

APPENDIX K

CONDITION ASSESSMENT OF CAMAS WASTEWATER TREATMENT FACILITY PROJECT MEMORANDUM

PROJECT MEMORANDUM

CITY OF CAMAS

General Sewer Plan Update

Project No.:	203710
Date:	7/17/2025
Prepared By:	Sudhan Paranjape, Sanjit Khanal, Dennis Clinefelter (Carollo Engineers), Ron Reardon (Reardon Engineering LLC)
Reviewed By:	Kate Bandettini, Matt Huang
Subject:	Condition Assessment of Camas Wastewater Treatment Plant

This document is released for the purpose of information exchange review and planning only under the authority of Matthew M. Huang, July 21, 2025, Washington PE# 54002.

1.0 PROCESS ASSESSMENT

1.1 Summary

A plant condition assessment of the Camas Wastewater Treatment Plant (WWTP) was conducted on June 11 and 12.

On June 11, Sudhan Paranjape, Kate Bandettini, and Ron Reardon toured the entire plant with Jacob Taylor, the current Plant Operations Supervisor, to learn more about the facility, including current operating protocols and the condition of the plant's mechanical equipment and processes. On June 12, Sanjit Khanal (electrical engineer) and Dennis Clinefelter (instrumentation and controls specialist) also joined. Sanjit and Dennis inspected the electrical and instrumentation and controls (I&C) equipment while Sudhan, Kate, and Ron spent the day doing more detailed assessments of selected areas of the plant. During the second day they concentrated on areas on the plant site that could be used or modified to achieve the projected capacity requirements for the current planning period. The visit was successful as far as gaining an understanding of the plant capabilities and potential modifications that could be made to expand plant treatment capacity in the future.

1.2 Notes on Condition Assessment

1. All influent raw wastewater is pumped to the plant from either the Main Pump Station (PS) or the Oak Park PS. The Main PS has variable frequency drives, and the pumping rate ramps up and down with the flow. The Oak Park PS has constant speed pumps that operate off wetwell level. This results in surges in the flow received at the WWTP.
2. In 2023 the average daily flow was 2.7 mgd while the peak flow was roughly three times the average flow. The detailed statistical analysis that has been completed on the plant's historical data is available on the project folder on ProjectWise.

3. The septic tanks connected to the City of Camas's (City) wastewater collection system are pumped out about once every five to eight years and the septage hauled to the WWTP. This includes both the septic tank effluent pumping (STEP, operates with pumps) and septic tank effluent filter (STEF, which operates by gravity) installations. Plant staff estimated Camas has about 6,000 STEP and STEF tanks. Septic tank pumping is now done by contract and only during the summer months. During the summer, the plant receives about 10 to 11 tanker truckloads per day but only on weekdays. This imposes an additional dynamic load on the activated sludge process. The influent total suspended solids (TSS) concentrations are less than 100 milligrams per liter (mg/L) without STEP pumping and in the range of 150 to 300 mg/L with STEP pumping.
4. Parts of the plant flooded in the 1997 Columbia River flood. During the 1997 flood, the river crested at an elevation of 22.5 feet on January 3 at the Port of Vancouver. See https://clark.wa.gov/public-works/columbia-river-and-flooding. The grade elevation is about 30 feet in much of the plant site. The top of wall (TOW) elevation for the aeration tanks is 37.00 feet. The plant has no flood protection.
5. The City of Vancouver, Washington and Church & Dwight (C&W), a local industry located in Vancouver, have approached the City of Camas about the potential for Church & Dwight to truck their wastewater to the Camas WWTP instead of discharging it to the Vancouver WWTP as it does now. The driver behind this is to make more treatment capacity at the Vancouver plant available for domestic wastewater and would decrease their industrial client load by about 3 percent. The discharge was said to come from the manufacture of chewable vitamins for children (Li'l Critters); https://www.lilcritters.com/).

   The C&W wastewater was said to have a five-day carbonaceous biochemical oxygen demand (cBOD5) concentration of about 15,000 mg/L and a volume of about 30,000 gallons per day (gpd). The mass load associated with the Church & Dwight wastewater (about 3,800 pounds per day) would be a substantial increase to the CWWTP's current loading, but the additional carbon could be beneficial for both improved liquid treatment (enhanced denitrification) and biosolids treatment (increased digester gas production). A chemical analysis of the waste should be done to determine the chemical oxygen demand (COD), cBOD5, total Kjeldahl nitrogen (TKN), total phosphorus (TP), pH, alkalinity and cations, and total dissolved solids (TDS).
6. The paper mill in Camas (Georgia Pacific) treats its own wastewater although it may send its sanitary wastes to the Camas WWTP.
7. The plant headworks structure has two Kusters perforated plate screens with 3/8-inch (approximately 9 millimeter [mm]) openings as reported by plant staff. The 2012 O&M manual states the opening size is 6 mm. One of the influent screens needs a bearing replacement, and the plant is planning on performing this repair in-house. One of the screen nameplates shows the screen installation date of 2007, while the other screen installation date is 2010. Each screen has a washer/compactor to reduce volume and weight of screenings before dumping into a dumpster beneath at grade level.
8. The plant has four automatic samplers:
   a. Influent (flow proportional).
   b. Effluent (flow proportional).
   c. Primary effluent (timed composite; grab samples once per hour).
   d. Waste sludge (timed composite; grab samples once per hour).

9. The plant struggled in the past with finding a satisfactory seed source for their cBOD5 tests. Now they make their own glucose and glutamic acid (GGA), 500 milliliters (mL) per week, seed from the primary effluent composite sample.
10. The plant is currently operating with one primary clarifier, two aeration tanks and one final clarifier. During the winter wet season, the plant will put both primary clarifiers and one more final clarifier in service. Final Clarifier #1 is out of service, so the plant relies on Final Clarifiers #2 and #3 during the winter month. Final Clarifier #1 has a flat bottom, and therefore, sludge is not appropriately scrapped to the center sump. In the future, if this clarifier needs to be used, it may require either adding a slope to the bottom for proper sludge collection or demolish and build a new slopped bottom clarifier in its place.
11. The primary sludge pumps operate 24 hours a day at an estimated flow of 250 gallons per minute (gpm). During the assessment, Primary Sludge Pump #3 was experiencing a motor issue and making excessive noise. The primary sludge is thin, and they do not typically carry a blanket. The sludge is degritted using hydrocyclones, which are near their useful life. Degritted sludge flows to the gravity thickener. The hydrocyclones will be replaced with new equipment as part of an ongoing plant improvements project (HDR Task Order #4).
12. The influent splitter box has an unbalanced flow split. A computational fluid dynamics (CFD) study is recommended to understand the mixing of the recycle streams and influent in this chamber.
13. Overall, there is not a lot of elevation drop through the primary liquid treatment train, raising overflow concerns. During high rain events in the winter, launder troughs in the primaries have reportedly backed up to the weirs in the influent splitter box.
14. The plant adds about 375 gpd of magnesium hydroxide ($Mg(OH)_2$) to the aeration tank influent splitter box to supplement the alkalinity in the influent wastewater. The pH of the activated sludge process is monitored at the aeration tank effluent. This introduces a lag in making changes in the Mg(OH)2 feed to respond to changes in the pH. To counter this, the plant has set a low pH alarm of 6.7. This gives the operating staff sufficient time to increase Mg(OH)2 addition to avoid effluent pH violations. This is important if the pH drops at night.
15. The activated sludge process currently reduces the influent ammonia ($NH4^+$) from about 45 mg/L down to less than 0.1 mg/L. Both WaferTech and Analog Devices discharge wastewater to the Camas wastewater system that contain appreciable amounts of ammonia. Plant staff report they receive about 2,800-gallon loads every other day from WaferTech.
16. The plant has problems with struvite (NH_4MgPO_4) scaling in the digesters and the sludge processes downstream of the digesters. This scaling could be exacerbated by using $Mg(OH)_2$ and by enhanced biological phosphorus removal (EBPR) if it is occurring in the activated sludge process. Struvite buildup occurs in the condenser and the solids drying system (operators must take the doors off and clean once per week) and blockages in the centrate piping to plant drain Pump Station #1.
17. The plant cannot operate with just one aeration basin. The reason for this was not immediately clear.
18. The activated sludge process is controlled primarily by use of the aerobic mean cell residence time (aMCRT). This is approximated by the detention time of volatile suspended solids (VSS) in the aerated portion of the activated sludge process. The mixed liquor volatile suspended solids (MLVSS) concentration is measured once per week. The target aMCRT is 10 days in winter and 11 days in summer. The plant uses an Excel spreadsheet to calculate and track the aMCRT.

19. The plant occasionally experiences minor bulking and scum formation. The bulking occurs periodically and may be related to seasonal changes or STEP pumping. The bulking is controlled by dosing sodium hypochlorite to the return activated sludge (RAS). Chlorination for about a week is typically sufficient to control the problem. When chlorinating the RAS, they add about 55 gpd of 12 percent hypochlorite.
20. The RAS pumps have variable frequency drives (VFD) and are paced from the influent flow measurement. The rate is typically 50 percent of influent flow when operating one clarifier and 30 percent (per clarifier?) when operating two clarifiers.
21. The aeration tanks have membrane disc diffusers and luminescent dissolved oxygen (LDO)-type dissolved oxygen (DO) probes. The plant wants to look at adding ammonia-based aeration control (ABAC).
22. Clarifier No. 1 is no longer used. Clarifier No. 2 is used in the winter, but it does not have sludge wasting capabilities. Final Clarifier No. 3 operates year-round and is the only location from which sludge is wasted.
23. The WAS pumps operate on a 180-minute cycle (eight cycles per day). The wasting rate is varied by changing the pump runtime. The WAS pump is currently on for 44 minutes and off for 136 minutes.
24. The effluent filters are Veolia/Hydrotech inside-out disc filters. The filters work well, and the plant staff is happy with them. They were originally installed to combat high TSS in the clarifier effluent that was caused by bulking.
25. The plant has only one waste activated sludge (WAS) thickener and needs a redundant unit as operation of the sludge process is dependent on it. The WAS concentration ranges from 4,000 to 6,000 mg/L. The rotary drum thickener (RDT) increases this to about 7 percent (70,000 mg/L).
26. Thickener feed pump in the downstairs of the equipment building appeared to have seal issues and had accumulation of dropping underneath the pump head.
27. Staff reported that an internal mixed liquor suspended solids (MLSS) recycle pump had unintentionally tripped recently. The pump's structure is severely corroded, and the operators do not have accessibility for easily repairing these pumps.
28. The dewatering centrifuge increases the digested sludge concentration to about 22 percent to 25 percent total solids. The centrifuge runs about every other day.
29. The plant has an Andritz belt-type sludge drier. It operates from eight to ten hours every day. The dried sludge solids have a concentration of about 95 percent to 98 percent total solids.
30. The plant will soon be undergoing an upgrade project, designed by HDR (Task Order No. 4). Bids were recently received for this project. The bid prices were between about $9.1 million and $10.4 million. It was unknown if an award had been made at the time of the condition assessment. This project includes the following:
    a. Replacement of the grit classifiers.
    b. Install a second dewatering centrifuge. The City has already purchased the centrifuge.
    c. Increase in the septage receiving capacity.
    d. Replacement of two of the multi-stage centrifugal blowers (Hoffman) with high-speed turbo blowers (Neuros) and associated controls modification to have two turbo blowers operate in tandem with two centrifugal blowers.

e. Replacement of the internal mechanisms in the primary clarifiers with all 316 stainless steel (SS).
f. Replacing the ultraviolet (UV) disinfection system with new UV equipment and controls.
g. Moving the electrical generator out of the Equipment Building.

31. The plant recently had the channels in the headworks structure rehabilitated (recoated) due to extensive damage to the concrete from hydrogen sulfide (H2S). The splitter box upstream of the Aeration Basins is suffering from the same deterioration from sulfide (H2S) as the influent channel.
32. The plant uses biofilter beds for odor control, but it is reported that they do not function well. The plant also has a chemical scrubber system for some of the plant's foul air.
33. The plant's new National Pollutant Discharge Elimination System (NPDES) permit has a requirement for monitoring the effluent temperature. Washington State Department of Ecology (WDOE) requires temperature sensors be accurate to 0.2 degrees Celsius. The temperature measurement in pH probes is only accurate to 0.5 degrees Celsius.
34. The plant uses a computerized maintenance management system (CMMS) called FIIX.
35. The plant staffing is currently staffed as follows:
    a. One lead operator.
    b. Two mechanics.
    c. One lab tech.
    d. One biosolids operator.
    e. One ?.
36. The plant currently has two open operator positions. An operations supervisor is anticipated to start in August 2025.
37. The plant is staffed from 5:00 a.m. to 3:30 p.m. and 7:00 a.m. to 3:30 p.m. on weekdays, plus one operator works 7:00 a.m. to 3:30 p.m. on weekends.
38. The plant operation and maintenance (O&M) manuals are not kept updated.

1.3 Future Alternatives

Several concepts were considered during the condition assessment that could be used to facilitate expansion of plant capacity. They include the following:

1. Three overall conceptual alternatives are available for increasing treatment capacity as follows:
    a. Expand capacity using traditional methods - likely the preferred alternative if sufficient land is available and the costs are competitive.
    b. Expand capacity using innovative methods - technologies like step-feed biological nutrient removal (BNR), membrane bioreactor (MBR), integrated fixed-film activated sludge (IFAS), and aerobic granular sludge (AGS) can provide more treatment capacity in a smaller footprint.
    c. Construct a new treatment facility - this is an unlikely alternative but might be an option if there is insufficient area available on the existing site, or the costs for expansion would be higher than a new facility.
2. The process could be modified to include step-feed for peak flows. This would increase the capacity of the final clarifiers by allowing the plant to operate at a higher MLSS concentration during dry weather thus increasing the overall treatment capacity.

3. Clarifier No. 1 no longer functions adequately and is never used. It could be demolished and a new final clarifier constructed at the same location.
4. Space is available between the existing plant process tanks and the access road along the river. This area could be sufficient for one or two more aeration tanks, and a third primary clarifier.
5. The existing centrate/septage/WAS storage tank could be replaced with a fourth secondary clarifier, and the storage volume provided elsewhere on the site.
6. The primary clarifiers could be abandoned or converted to anaerobic and anoxic tanks. This would improve influent carbon management and provide nutrient removal in the activated sludge process, while reducing or potentially eliminating the MgOH feed. Demolishing primary clarifiers and building new anaerobic tanks in their place can make sufficient head available to either modify or replace the aeration tank influent splitter box to provide a more accurate flow split to the aeration basins.
7. The land to the west of the existing plant is reported to be owned by the City; however, the ground elevation is significantly lower than the existing plant site and is in the flood plain. Because of the lower elevation, the land to the west of the existing plant would require significant fill, or a dike or another method of flood protection.
8. The electrical equipment in the digester building could be removed and relocated on the site, and another thickener could be added in this area. There are hazardous occupancy concerns about the electrical equipment located directly next to the digester wall in the digester building.
9. The City would like to make modifications to the sludge cake conveyor system from the dewatering centrifuge to allow diversion of the cake to a truck unloading station to dispose of dewatered cake, should the dryer be out of service, as a contingency plan.
10. It is understood that the City of Vancouver is investigating alternatives to phase out the aging sludge incinerator at its Westside Wastewater Treatment Facility (WTF). City of Vancouver staff have shown interest in visiting the Camus belt dryer. Since the belt dryer is also nearing its useful life, Camas could partner with Vancouver to build a regional biosolids handling plant using thermal drying technology. If per- and polyfluoroalkyl substances (PFAS) turn out to be a concern in the future to limit the beneficial use of the dried pellets, thermal drying can be appended with pyrolysis treatment for PFAS treatment.

2.0 ELECTRICAL ASSESSMENT

2.1 Introduction

The City mentioned that the WWTP was first constructed in 1972, but the current general layout is from upgrades done in 1992 and 2002. A large portion of the electrical distribution equipment is from the 2002 plant upgrades retrofitted in subsequent plant upgrades. The WWTP is fed from two utility transformers: a 500-kilovolt amp (kVA) "UT1" located on the southwest side of UV Building, and a 1,000-kVA "UT2" located on the north side of Equipment/Blower Building.

2.2 Condition Assessment

The City was asked about the major electrical issues seen at the WWTP and noted that there are no major issues with electrical system, other than occasional power blips from the electrical utility feed. The City

noted that the existing two 250-kilowatt (kW) generators have been able to back up the WWTP during such electrical utility outages.

It was noted during the site visit that the water utility does not have a dedicated electrician or instrumentation technician in their team. The City also noted that they do not have any on-call contracts with an independent electrician or system integrator. Carollo recommends having an in-house electrician and controls technician or maintaining on-call contracts with independent electricians (electrical contractors) and systems integrators. It is likely that since there has not been a major electrical or controls failure at the WWTP this has not been an issue, but if that were to happen, the electrician and system integrator could help solve the problem sooner with their dedicated expertise in those particular fields.

Furthermore, it was noted during the site visit that none of the electrical distribution equipment had an arc flash labels on them. The City noted that they do not maintain an electrical system study for the plant. The Occupational Safety and Health Administration (OSHA) recommends an electrical system study after five years or after a major plant upgrade for the safety of electricians who work on this distribution equipment. Carollo recommends having an electrical system study done immediately and arc flash labels applied to all electrical distribution equipment.

The City noted during the condition assessment site visit that the last major flood that put most of the WWTP underwater was in 1997. Carollo recommends doing a flood risk analysis of all major electrical distribution equipment and control panels to assess the risks.

2.2.1 Utility Transformer "UT1", 500kVA

The first utility transformer "UT1" 500-kVA, located on the southwest side of the UV Building, has two separate feeders, one feed going to MDS-UV located in the UV Building electrical room, and the second feed going to MCC-A located in the Old Controls Building, as shown on Figure 1 and Figure 2.

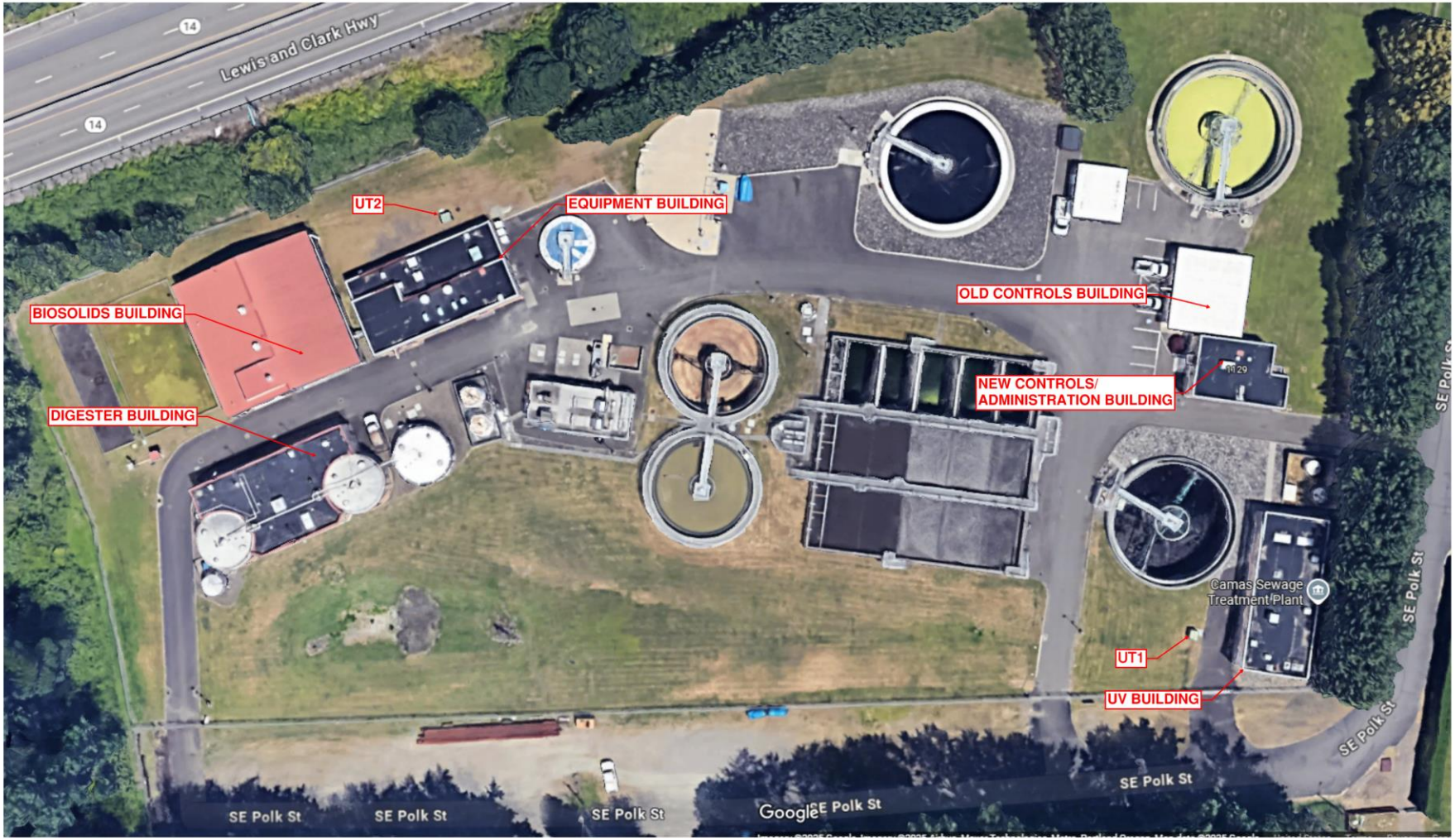


Figure 1 Site Layout

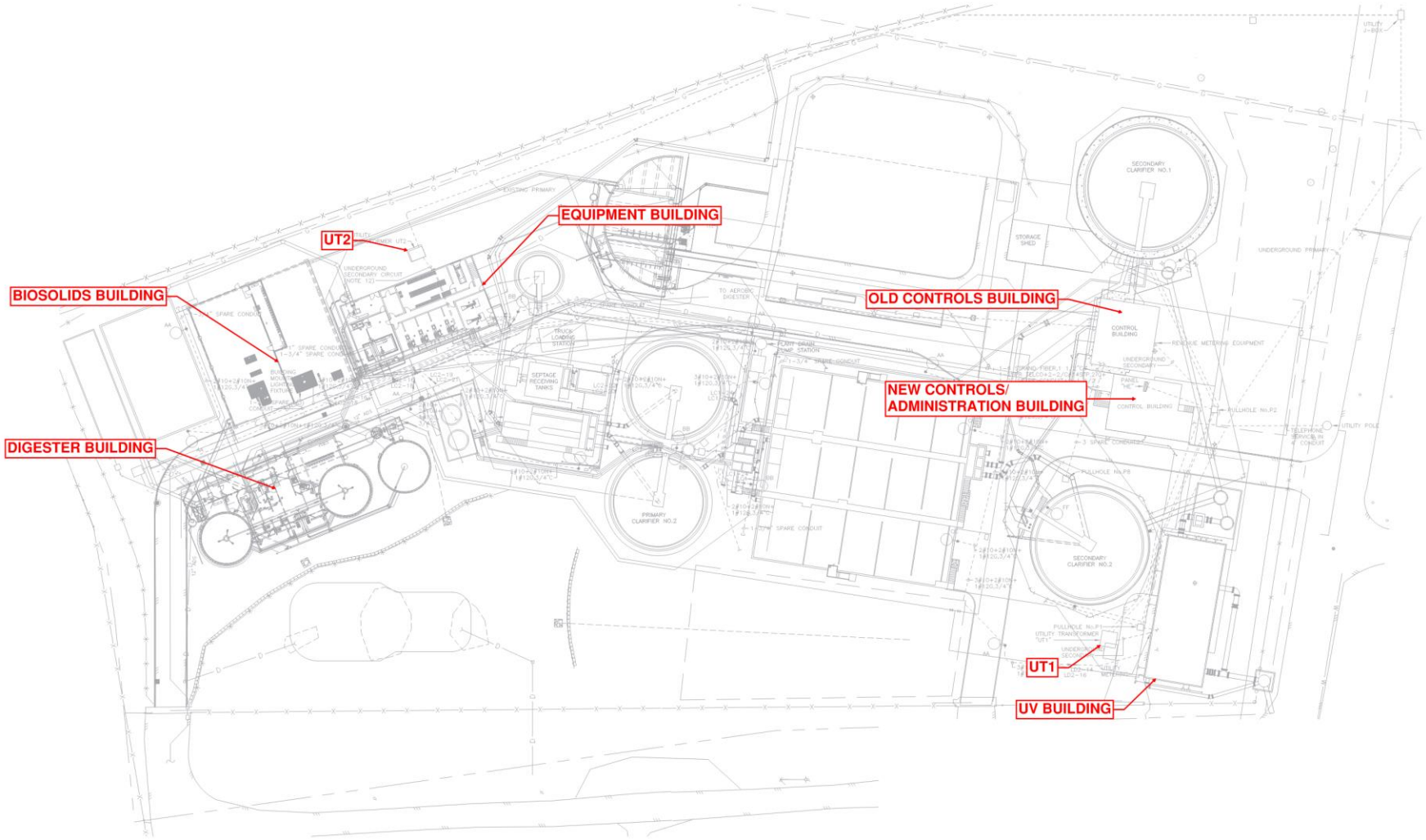


Figure 2 Simplified Site Plan

3.0 INSTRUMENTATION AND CONTROLS ASSESSMENT

The previous report called out needed upgrades for programmable logic controllers (PLC) and the supervisory control and data acquisition (SCADA) system. There has been some limited progress with the PLC upgrades. However, the risk remains, as evidenced in a cabinet fire during the 2023-2023 timeframe to PLC D1, to all PLC hardware that has not been upgraded. This applies to both the general plant PLCs as well as vendor-provided equipment with PLCs. For example, the Biosolids Dryer PLCs use the Rockwell Automation 1756-L6x series processor, which has been discontinued since 2017. Additionally, the continued usage of ControlNet upgrade options exist for just the processor. However, the version of the chassis for the PLC must be investigated to determine which path for upgrades is available.

The WWTP's existing Wonderware SCADA application is still installed on just a single computer. Only one operator can use the system at a time. While observing the historian with the operator, an operator in the field needed to interact with the SCADA system and took over control, without any notification to the operator in the control room. The move to a server-based system with redundancy should be prioritized to ensure multi-user operations of the plant.

The following upgrades are still recommended:

1. Replace the existing SCADA server with matching redundant SCADA servers.
2. Upgrade the SCADA human-machine interface (HMI) application to a redundant configuration.
3. Add a SCADA reporting application.
4. Rebuild HMI graphics to take advantage of increased system functionality, correct existing errors with data collection and display, and provide robust communications with the upgraded PLC hardware.
5. Integrate the existing Hach Water Information Management System (WIMS) data with the SCADA historian and reporting applications.

Additional upgrades for SCADA server:

1. Add an alarm historian to allow monitoring of specific alarms to understand if alarms are being repeated and should be addressed, or a one-time alarm that requires immediate action.
2. Add individual user logins to identify who did what and when to facilitate training when the incorrect action had been taken. Additionally, this improves site security as only individuals allowed to log in can make changes to system operations.
3. Follow International Society of Automation (ISA) 101.01 Human Machine Interfaces for Process Automation Systems recommendations for graphics used on SCADA screens.

During the walk around the site, several housekeeping items were identified that will affect equipment lifespans:

1. Network equipment enclosures are located in a couple of rooms. Comparing the switches located within enclosures to those not within enclosures shows a dramatic increase in dirt and dust on the switches. Dirt and dust accumulating within the network equipment will cause overheating conditions and failure of the equipment.
2. Loose network cables could be trip hazards.

3. The pH and flowmeter above the influent are in a highly corrosive environment with no protection for cables or transmitters.
4. Sunshields are highly recommended for all outdoor instrument transmitters not facing north. On one flowmeter, the sunshield was broken off and sitting on the pipe nearby.

The magnesium oxide tank utilizes an ultrasonic level probe that has generated false positive alarms due to condensation buildup on probe head. It is recommended to replace the ultrasonic in locations where there is condensation due to the incorrect readings that occur.

The centrifuge was unable to start in Automatic. Instead, it was started by using a switch installed inline as a workaround, and then after the centrifuge was started, flipping the system back to Auto.

Equipment tagging outside of the biosolids dryer was nonexistent. A site-wide tagging of equipment/instruments/valves is recommended to reduce human errors when an operator is manually operating equipment.

There is a lack of maintenance/storage facility, resulting in insufficient clearance in front of electrical panels. An accumulation of materials exists within the generator room. The generator is moving outdoors, but until such time the room should not be used for storage, nor should flammable materials be stored within the generator rooms.

APPENDIX L

CIP PROJECT SHEET

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-01
Project Title: NW 6th Place West Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This system has a deficiency from MH 10-1-8 and 10-1-6 which must be improved. Model surcharging and manhole flooding at manholes 10-1-8 and 10-1-6 revealed the need for upsizing. To alleviate surcharging, 422 LF of pipe between manholes 10-6-1 and 10-1-11 should be upsized from 8- to 12-inch, 809 LF of pipes from manhole 10-1-11 to 10-1-7 should be upsized from 8-inch to 15-inch, 472 LF of pipes between 10-1-7 to Lower/South Prune Hills wet well should be upsized from 12-inch to 18-inch. This project is a gravity pipeline along NW 6th Place, just upstream of Lower/South Prune Hills Lift Station. This project is primarily driven by existing capacity deficiency during peak wet weather however some infill development provides additional flow at buildout. Therefore, cost has been distributed 25% to future gorwth and 75% existing and matches the split for the South Prune Hill LS capacity project.

Reasoning Capacity Upgrade Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12-inch diameter	422	LF	$ 300	$ 126,500	$ 38,000	$ 91,500		$256,000
15-inch diameter	809	LF	$ 378	$ 306,000	$ 92,000	$ 222,000		$620,000
18-inch diameter	472	LF	$ 442	$ 208,500	$ 62,500	$ 151,000		$422,000
Total Anticipated Project								$ 1,298,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

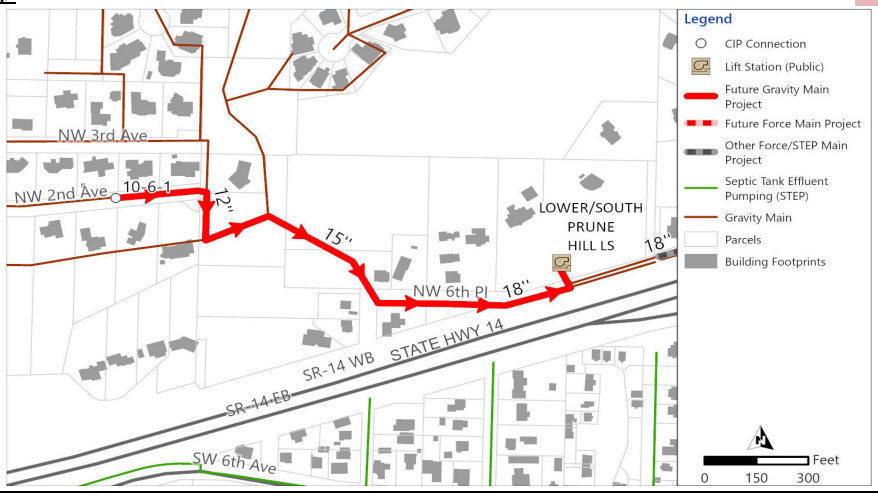
Project Type	Percent	Cost
Growth:	25%	$ 324,500
Upgrade:	75%	$ 973,500
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 1,298,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2034	$ 1,298,000
Total		$ 1,298,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-02
Project Title: NW 6th Place East Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This system has a deficiency from MH 10-1-3 and 10-1-1 which must be improved. Model surcharging and manhole flooding at manholes 10-1-3 and 10-1-1 revealed the need for upsizing. To alleviate surcharging, 682 LF of pipe between manhole 10-1-3 to manhole West Camas wet well should be upsized from 8-inch to 21-inch. This project is a gravity pipeline along NW 6th Place between Lower/South Prune Hills PS and West Camas PS, at an approximate depth of 5 to 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
21-inch diameter	682	LF	$ 504	$ 343,500	$ 103,000	$ 248,500		$695,000

Total Anticipated Project Cost	$ 695,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 695,000
General:	0%	$ -
R&R:	0%	$ -

Total Anticipated Project Cost	100%	$ 695,000

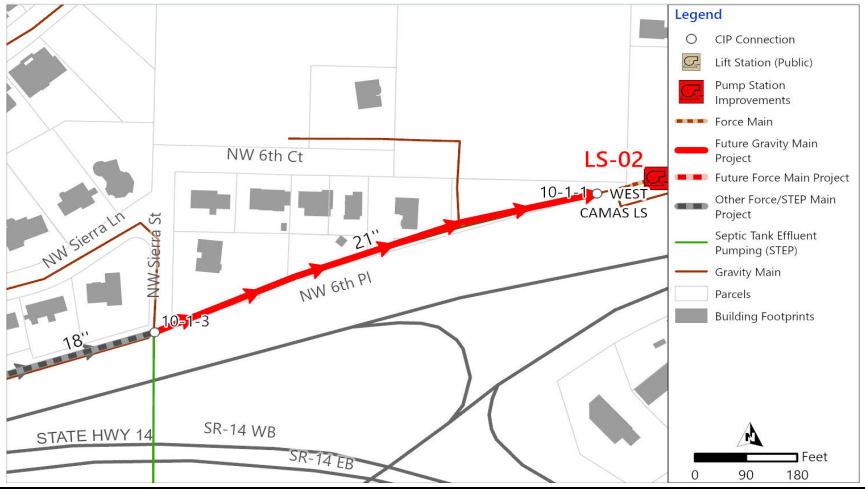
Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 695,000

Total	$ 695,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-03
Project Title: NW 6th Place Avenue West Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: There is a deficiency present and the existing gravity main must be upsized to accommodate growth and stop flooding. Model surcharging and manhole flooding at manholes 1-1-10, 1-1-6, and 1-1-4 revealed the need for upsizing. To alleviate surcharging, 1,943 LF of pipe between manholes 1-1-10 and 2-1-11 should be upsized from 12- to 24-inch, and 592 LF of pipe between manholes 2-1-11 and 2-1-9 should be upsized from 12- to 21-inch. This project is a gravity pipeline along NW 6th Avenue, downstream of the West Camas PS and through Forest Home Park, at an approximate depth of five feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
24-inch diameter	1,943	LF	$ 576	$ 1,119,000	$ 335,500	$ 810,500		$2,265,000
21-inch diameter	592	LF	$ 504	$ 298,500	$ 89,500	$ 216,000		$604,000

Total Anticipated Project	$ 2,869,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

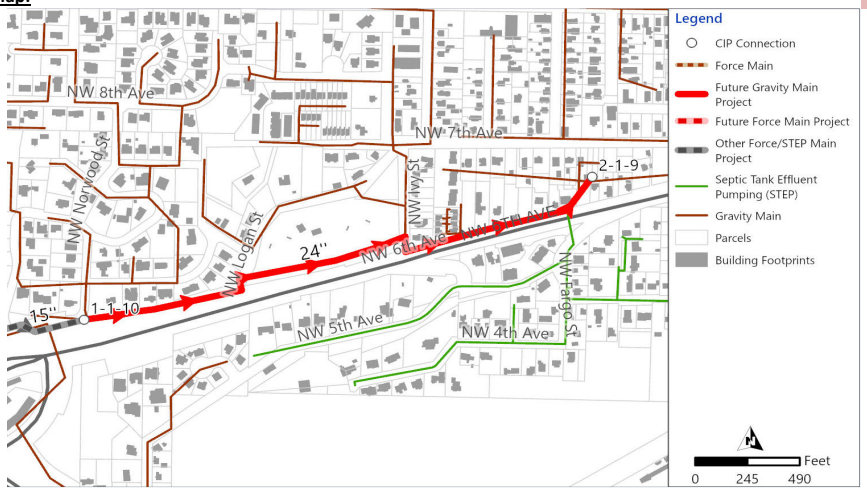
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,869,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 2,869,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2031	$ 2,869,000
Total		$ 2,869,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-04
Project Title: NW 6th Place Avenue East Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Once upstream deficiency areas were improved in NW 6th Place Avenue West Upsize, model surcharging occurred between manholes 2-1-2B and 2-1-2 along NW 6th Avenue. To alleviate surcharging, the proposed pipeline profile between manholes 5-1-5 and 5-1-1 was modified to provide a steeper slope and improve hydraulic conveyance through the relatively flat portion of the existing alignment. The shallow manhole at 5-1-6 should also be evaluated during future project planning and design to determine whether an adjustment to the pipeline profile or manhole invert could provide additional hydraulic benefit. The recommended improvements include upsizing 446 LF of pipe between manhole 3-1-1 and 5-8-1 from 18- to 27-inch, 260 LF of pipe between manhole 5-8-1 and 5-1-12 from 21- to 30-inch, 402 LF of pipe between manhole 2-1-1 and 5-1-12 from 12- to 30-inch, 545 LF between manhole 5-1-12 and manhole 5-1-11 from 21- to 36-inch, 947 LF between manhole 5-1-10 and manhole 5-1-7 from 24- to 36-inch, 1,126 LF of pipe between manhole 5-1-7 and manhole 5-1-2 from 21- to 36-inch, and 34 LF between manhole 5-1-2 and manhole 5-1-1 from 24- to 36-inch. This project is a gravity pipeline along NW 6th Avenue to SE 3rd Avenue upstream of Main Lift Station, at an approximate depth of five feet. Portions of the proposed improvements are located beneath an existing building, and a portion of the proposed alignment crosses an existing railroad. The proposed improvements may also be affected by an existing bridge along the alignment. An alternative alignment analysis was not performed as part of this GSP because future redevelopment and land use changes may affect the presence of the existing building and the feasibility of potential alternative alignments. Additional evaluation should be completed during the future project planning and design phase to determine the feasibility of constructing the proposed pipeline through or adjacent to the existing building, railroad, and bridge. Depending on the condition and structural constraints of the existing bridge, replacement or modification of the bridge may be required to accommodate the proposed improvements. This project is driven by existing capacity deficiency and exacerbated by future growth in the North Shore Area. The cost has been split 50% existing upgrade and 50% future growth similar to Main LS.

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element		Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
27-inch diameter		446	LF	$ 736	$ 328,500	$ 98,500	$ 238,000		$665,000
30-inch diameter		260	LF	$ 896	$ 233,000	$ 70,000	$ 169,000		$472,000
30-inch diameter		402	LF	$ 896	$ 360,000	$ 108,000	$ 261,000		$729,000
36-inch diameter		545	LF	$ 1,204	$ 656,000	$ 197,000	$ 475,000		$1,328,000
36-inch diameter		947	LF	$ 1,204	$ 1,140,000	$ 342,000	$ 826,000		$2,308,000
36-inch diameter		1126	LF	$ 1,204	$ 1,355,500	$ 406,500	$ 982,000		$2,744,000
36-inch diameter		34	LF	$ 1,204	$ 40,900	$ 12,500	$ 29,600		$83,000

Total Anticipated Project Cost	$ 8,329,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	50%	$ 4,164,500
Upgrade:	50%	$ 4,164,500
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 8,329,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 8,329,000
Total		$ 8,329,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-05 **Facility Type:** Gravity Main

Project Title: NW Fargo St, NW 18th Loop, and NW 18th Ave Improvements

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: Model surcharging and manhole flooding between manholes 3-1-33 to 3-1-25 revealed the need for upsizing. To alleviate surcharging, 2,744 LF of pipe between manholes 3-1-26 to 3-1-14 should be upsized from 8- to 15-inch. This project is at a depth of approximately 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
15-inch diameter	2,744	LF	$ 378	$ 1,037,000	$ 311,000	$ 751,000		$2,099,000

Total Anticipated Project Cost	$ 2,099,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,099,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,099,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2028	$ 2,099,000
Total		$ 2,099,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-06 **Facility Type:** Gravity Main

Project Title: NE Garfield St to NE 15th Ave to NE Franklin St to along the Mill Ditch Improvements

Go to CIP Summary Table

Priority: 10-20 years **Project Status (Completed?):** N

Project Description:

Project Description: There is a deficiency present at manholes 4-2A-1, 4-2-1, 4-1-2, 4-1-1, and 3-2-2, which has revealed the need for upsizing. To alleviate surcharging, 282 LF of pipe between manholes 4-2A-2 to 4-2A-Q should be upsized from 8- to 12-inch, 115 LF of pipe between manholes 4-2A-Q and 4-2A-1 from 8- to 15-inch, 795 LF of pipe between manholes 4-2A-1 and 4-2-2 from 8- to 18-inch, 427 LF of pipe between manhole 4-2-2 and 4-2-1 from 8- to 24-inch, 256 LF of pipe between manholes 4-2-1 and 4-1-2 from 8- to 27-inch, 254 LF of pipe between manholes 4-1-2 and 4-1-1 from 21- to 30-inch, 158 LF of pipe between manholes 4-1-1 and 3-2-6 from 21- to 30-inch, and 347 LF of pipe between manholes 4-1-1 and 3-2-4 from 15- to 36-inch. This project is a gravity pipeline along Division Street between NW 18th and 11th Avenue, at an approximate depth of 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12-inch diameter	282	LF	$ 300	$ 84,600	$ 25,500	$ 60,900		$171,000
15-inch diameter	115	LF	$ 378	$ 43,500	$ 13,000	$ 31,500		$88,000
18-inch diameter	795	LF	$ 442	$ 351,500	$ 105,500	$ 255,000		$712,000
24-inch diameter	427	LF	$ 576	$ 246,000	$ 74,000	$ 178,000		$498,000
27-inch diameter	256	LF	$ 736	$ 188,500	$ 56,500	$ 137,000		$382,000
30-inch diameter	254	LF	$ 896	$ 227,500	$ 68,500	$ 165,000		$461,000
36-inch diameter	158	LF	$ 1,204	$ 190,000	$ 57,000	$ 138,000		$385,000

Total Anticipated Project Cost	$ 2,697,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,697,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,697,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2037	$ 2,697,000
Total		$ 2,697,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-07
Project Title: Lower/South Prune Hill Force Main Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The Lower/South Prune Hill Lift Station captures flows from the eastern side of the City's gravity collection system. Based on the modeled flows to the Lift Station wet well, the existing force main diameter is unable to convey flows, producing velocities that exceed the 8 feet per second criteria under both existing and 20-year conditions. To address this deficiency, upsizing 925 LF of the force main from South Prune Hill wet well to manhole 10-1-3 must occur to reduce velocity below the criteria. This project is split 25% future growth and 75% existing upgrade similar to the South Prune Hill LS.

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
18-inch diameter	925	inch-dia	$ 442	$ 409,000	$ 122,500	$ 296,500		$828,000

Total Anticipated Project Cost	$ 828,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	25%	$ 207,000
Upgrade:	75%	$ 621,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 828,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2033	$ 828,000
Total		$ 828,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-08
Project Title: West Camas Lift Station Force Main Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The West Camas Force Main faces a deficiency between West Camas Wet Well and manhole 1-1-10. To address this deficiency, approximaely 574 LF of the existing 6-inch asbestos cement force main should be removed and replaced with a 15-inch force main.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
15-inch diameter	574	inch-dia	$ 478	$ 274,500	$ 82,500	$ 199,000		$556,000

Total Anticipated Project Cost	$ 556,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 556,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 556,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2031	$ 556,000
Total		$ 556,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-09 **Facility Type:** Gravity Main

Project Title: Main Lift Station Dual Force Main Improvements

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: The Main Lift Station captures flows from the majority of the system, except the STEP Basin and Flow Meter 8-1-2. Based on the modeled flows to the Lift Station wet well, the existing force main is unable to convey flows under both existing and 20-year conditions, resulting in velocities that exceed the 8 feet per second criterion. To address this deficiency, approximately 2,348 LF of the proposed 21-inch force main should be installed between the Main Lift Station wet well and the WWTF. The replacement force main will require a river crossing as part of the installation. This project is split 50% future growth and 50% existing capacity deficiency to match the Main LS capacity project.

Reasoning Capacity Upgrades / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
21-inch diameter	448	inch-dia	$ 504	$ 226,000	$ 68,000	$ 164,000		$458,000
Total Anticipated Project								$ 458,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

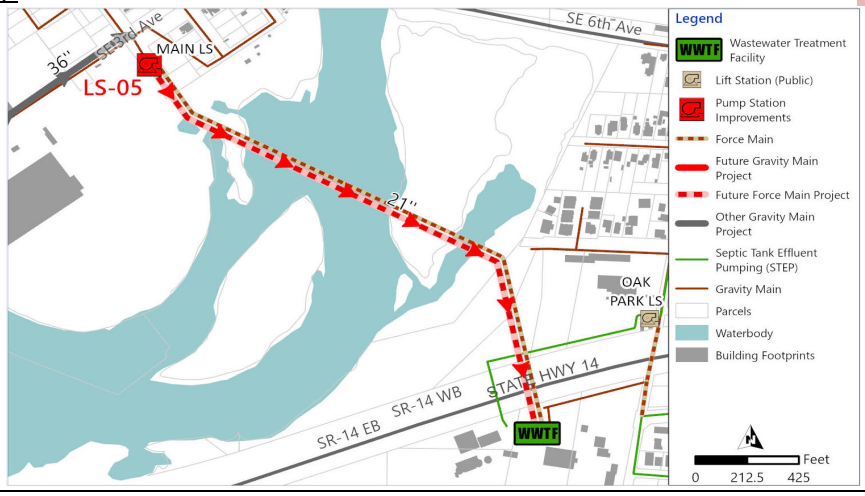
Project Type	Percent	Cost
Growth:	50%	$ 229,000
Upgrade:	50%	$ 229,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 458,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 458,000
Total		$ 458,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-10 **Facility Type:** Gravity Main

Project Title: Leadbetter Rd Lift Station Dual Force Main Improvements

Priority: 10-20 years **Project Status (Completed?):** N

Go to CIP Summary Table

Project Description:

Project Description: The Leadbetter Rd Lift Station captures all the flows from the North Shore area. Based on the modeled flows to the Lift Station wet well, the existing single 8-inch force main diameter is too small to convey these flows, producing velocities that exceed the 8 feet per second criteria under 20-year system conditions. Installing a 6,500 LF parallel 10-inch force main between Node_161 and Node_27 is needed to reduce velocity below the criteria. The proposed force main alignment follows NE Everett St. and will cross an existing bridge along the route. The bridge crossing and existing roadway conditions may present construction challenges and should be further evaluated during the project planning and design phase. The project cost estimate includes the cost associated with installing the proposed force main across the existing bridge.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
10-inch diameter	6,500	inch-dia	$ 268	$ 1,742,000	$ 522,500	$ 1,261,500		$3,526,000

Total Anticipated Project Cost	$ 3,526,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

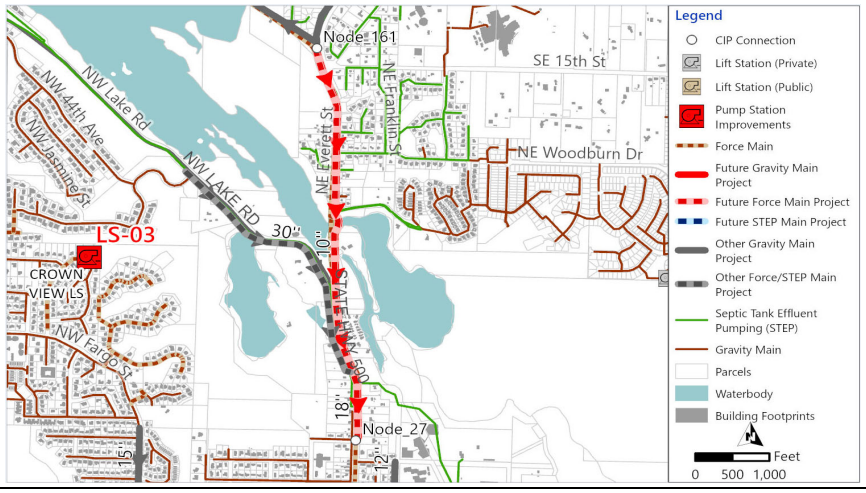
Project Type	Percent	Cost
Growth:	100%	$ 3,526,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,526,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2041	$ 3,526,000
Total		$ 3,526,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-11
Project Title: Division Street Improvements
Facility Type: Gravity Main
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Model surcharging and manhole flooding between manholes 3-1-11 to 3-1-10, and 3-1-6 revealed the need for upsizing. To alleviate surcharging, 827 LF of pipe between manholes 3-1-14 and 3-1-11 from 8- to 15-inch, 505 LF of pipe between manholes 3-1-11 and 3-1-9 from 8- to 21-inch, and 1,526 LF of pipe between manhole 3-1-9 and 3-1-2 from 8- to 18-inch. This project is at a depth of approximately 10 feet.

Reasoning Capacity Upgrades

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
15-inch diameter	827	LF	$ 378	$ 312,500	$ 94,000	$ 226,500		$633,000
21-inch diameter	505	LF	$ 504	$ 254,500	$ 76,500	$ 184,000		$515,000
18-inch diameter	1,526	LF	$ 442	$ 674,500	$ 202,500	$ 489,000		$1,366,000

Total Anticipated Project	$ 2,514,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 2,514,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 2,514,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 2,514,000
Total		$ 2,514,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-12
Project Title: SE Everett Rd to Leadbetter Rd Extension
Facility Type: Gravity Main
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Extend the existing sanitary sewer system to serve planned development within the project area. The project will provide sewer infrastructure and capacity necessary to accommodate future development and connect the proposed development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
8-inch diameter	2,031	LF	$ 236	$ 479,500	$ 144,000	$ 347,500		$971,000
12-inch diameter	692	LF	$ 300	$ 207,500	$ 62,500	$ 150,000		$420,000
18-inch diameter	6,036	LF	$ 442	$ 2,668,000	$ 800,500	$ 1,932,500		$5,401,000

Total Anticipated Project	$ 6,792,000

Notes on Cost Estimation:

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Cost Allocation:

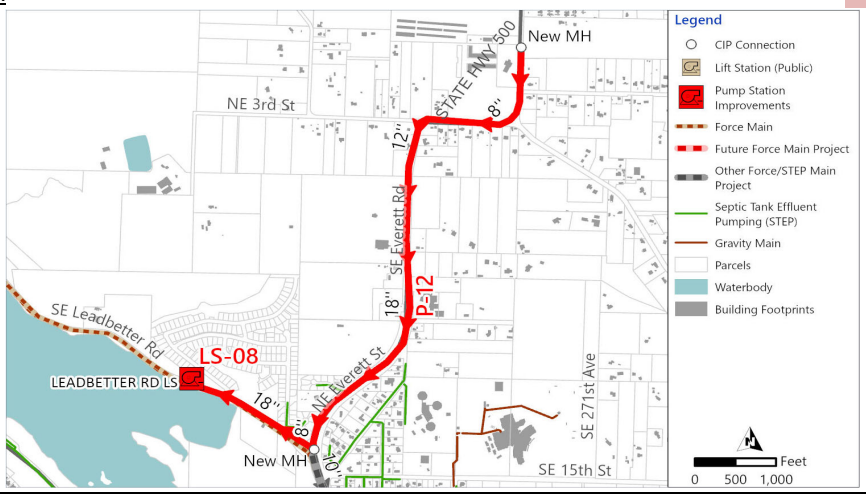
Project Type	Percent	Cost
Growth:	100%	$ 6,792,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 6,792,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2045	$ 6,792,000
Total		$ 6,792,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: P-13
Project Title: SE 283rd Ave to NE Woodburn Dr Extension
Facility Type: Gravity Main
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Extend the existing sanitary sewer system to serve planned development within the project area. The project will provide sewer infrastructure and capacity necessary to accommodate future development and connect the proposed development to the existing public sewer system. Project timing and implementation will be driven by development needs and coordinated with the developer.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12-inch diameter	6,782	LF	$ 300	$ 2,034,500	$ 610,500	$ 1,474,000		$4,119,000

Total Anticipated Project	$ 4,119,000

Notes on Cost Estimation:

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Cost Allocation:

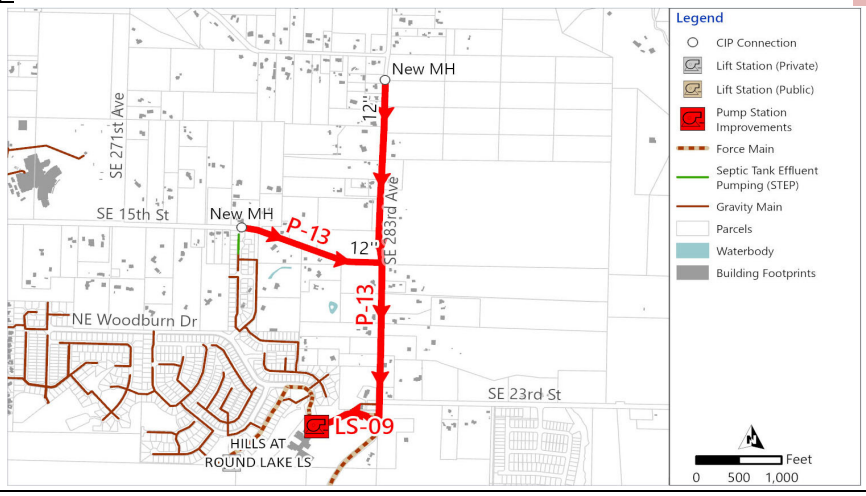
Project Type	Percent	Cost
Growth:	100%	$ 4,119,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 4,119,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2045	$ 4,119,000
Total		$ 4,119,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: S-01 **Facility Type:** STEP Main

Project Title: NW Parker St to NW Lake Rd STEP Main Improvements

Go to CIP Summary Table

Priority: 10-20 years **Project Status (Completed?):** N

Project Description:

Project Description: The NW Parker St to NW Lake Rd STEP Main captures all the flows in STEP Basin areas from NW Parker St and NW Lake Rd . Based on the modeled flows and velocity results, the existing 21- and 24-inch STEP main diameters are unable to convey these flows, producing higher hydraulic grade line under the 20-year system conditions. To address these deficiencies, a parallel STEP main will be installed. The proposed improvement consist of installing approximately 14,002 LF of 30-inch pipe from Node 9 to Node J176 and 4,061 LF of 30-inch pipe from Node 13 to Node 15. The STEP Main is reaching the end of it's useful life and the City is beginning to construct new segments to address age. The new pipe will be sized to accomodate future growth. Therefore, this project is assigned 50% future growth and 50% age and condition based replacement.

Reasoning Growth and Age/Condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
30-inch diameter	14,002	LF	$ 896	$ 12,546,000	$ 3,764,000	$ 9,088,000		$25,398,000
30-inch diameter	4,061	LF	$ 896	$ 3,638,500	$ 1,091,500	$ 2,636,000		$7,366,000
Total Anticipated Project								$ 32,764,000

Notes on Cost Estimation:

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Cost Allocation:

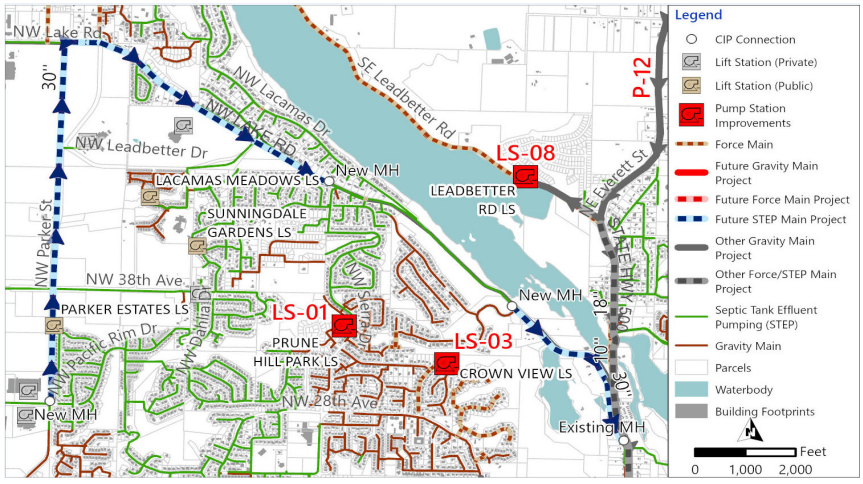
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 32,764,000
General:		
R&R:	0%	$ -
Total Anticipated Project	100%	$ 32,764,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2038	$ 32,764,000
Total		$ 32,764,000

Project Location Map:

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City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-01 **Facility Type:** Lift Station

Project Title: Lower/South Prune Hill Lift Station Improvements

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: The existing lift station is right off of NW 6th Pl. in a residential area and directly west of the entrance to NW Sierra Ln. The current station connects to a 10-inch force main.The Lower/South Prune Hills Lift Station captures flows from the Southwest portion of the system. Based on the modeled flows to the lift station wet well, the lift station receives more peak wet weather flow (PWWF) than its firm capacity during

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Lower/South Prune Hill Lift Station	3.00	MGD	$ 2,425,167	$ 2,425,167	$ 727,500	$ 1,914,333		$5,067,000
Odor Control	1.00	EA	$ 150,000	$ 150,000	$ 45,000	$ 119,000		$314,000

Total Anticipated Project	$ 5,381,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	25%	$ 1,345,250
Upgrade:	75%	$ 4,035,750
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 5,381,000

Project Timing:

Project Element	Timing	Cost
Partial Project	2033	$ 2,690,500
Partial Project	2033	$ 2,690,500
Total		$ 5,381,000

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Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-02
Project Title: West Camas Lift Station Improvements
Facility Type: Lift Station
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The existing lift station is next to a roundabout and sits along NW 6th place. The existing inrastrucutre PWWF's are constricted. The current system connects to a 6-inch force main. The West Camas Lift Station captures flows from the Southwest portion of the system and is just downstream of the Lower/South Prune Hills LS. Based on the modeled flows to the lift station wet well, the lift station receives more PWWF

Reasoning Capacity Upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
West Camas Lift Station Improvements	3.30	MGD	$ 2,490,700	$ 2,490,700	$ 747,000	$ 1,966,300		$5,204,000

Total Anticipated Project	$ 5,204,000

Notes on Cost Estimation:

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Cost Allocation:

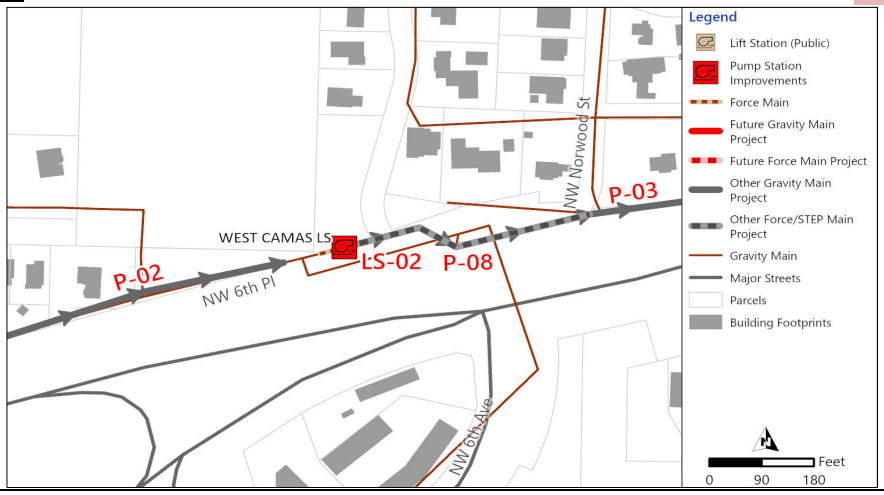
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 5,204,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 5,204,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2031	$ 5,204,000
Total		$ 5,204,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-03
Project Title: Crown View Lift Station Improvements
Facility Type: Lift Station
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Crown View Lift Station currently has 2 pumps and connects to a 6-inch force main. It is not able to serve existing system PWWF and will not be able to serve 20-year and buildout PWWF. This system is located right next to intersection of NW 32nd St and NW Kent St at the end of a cul de sac. Based on the modeled flows to the lift station wet well, the lift station receives more PWWF than its firm capacity during existing and 20-

Reasoning Capacity Upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Crown View Lift Station Improvements	1.00	MGD	$ 2,053,000	$ 2,053,000	$ 616,000	$ 1,621,000		$4,290,000

Total Anticipated Project	$ 4,290,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 4,290,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 4,290,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2034	$ 4,290,000
Total		$ 4,290,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-04 **Facility Type:** Lift Station

Project Title: Lacamas Creek Lift Station Improvements

Priority: 10-20 years **Project Status (Completed?):** N

Go to CIP Summary Table

Project Description:

Project Description: The Lacamas Creek Lift Station captures the flow from the Hills at Round Lake Lift Station and a small portion of the eastern portion of the system. Based on the modeled flows to the Lift Station wet well, the lift station receives more PWWF than its firm capacity during 20-year and build-out conditions. The station's firm capacity needs to convey more than its current firm capacity from 1.37 MGD to 2.13 MGD. Replacing its

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Lacamas Creek Lift Station Improvements	2.1	MGD	$ 584,525	$ 584,525	$ 175,500	$ 461,975		$1,222,000

Total Anticipated Project	$ 1,222,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

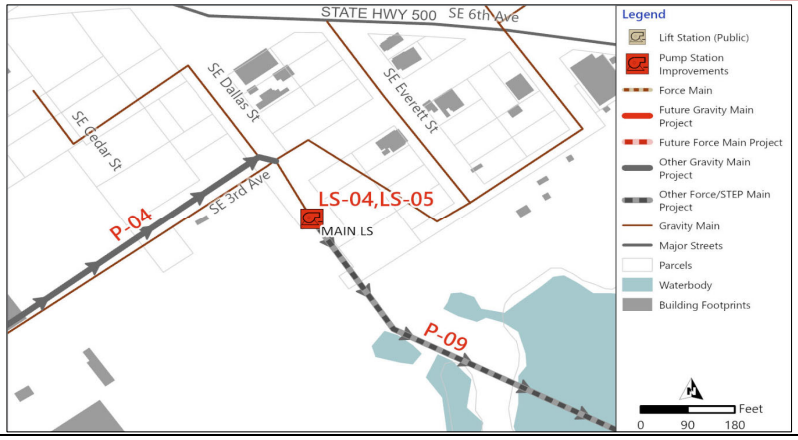
Project Type	Percent	Cost
Growth:	100%	$ 1,222,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 1,222,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2045	$ 1,222,000
Total		$ 1,222,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-05
Project Title: Main Lift Station Improvements
Facility Type: Lift Station
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The existing Main Lift Station has three pumps and is connected to an existing 18-inch force main. The station receives flows from the majority of the system, with the exception of Flow Monitoring Basin 8-1-2 and the STEP/WWTF, and is located immediately upstream of the WWTF. Existing infrastructure PWWF capacity is constrained. While the existing and 20-year PWWF are below the existing firm capacity, the station does not

Reasoning Capacity Upgrade / Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Main Lift Station Improvements	21.0	MGD	$ 4,942,444	$ 4,942,444	$ 1,482,500	$ 3,901,056		$10,326,000

Total Anticipated Project	$ 10,326,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

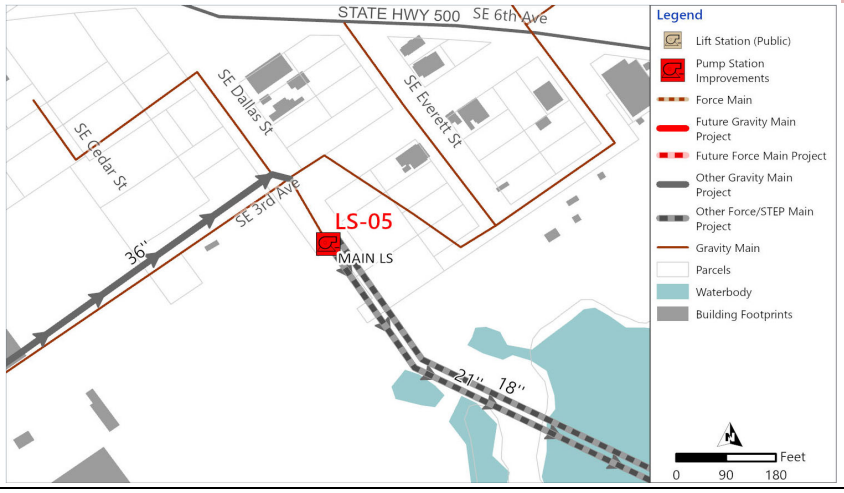
Project Type	Percent	Cost
Growth:	50%	$ 5,163,000
Upgrade:	50%	$ 5,163,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 10,326,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 10,326,000
Total		$ 10,326,000

Project Location Map:

Go to Maps Tab



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-06
Project Title: Goodwin Rd Lift Station Improvements
Facility Type: Lift Station
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The Goodwin Lift Station captures flows from the northern portion of the North Shore area of the system. Based on the modeled flows to the Lift Station wet well, the lift station receives more PWWF than its firm capacity during the 20-year conditions. The station's firm capacity needs to convey more than its current firm capacity from 0.49 MGD to 0.71 MGD. Adding an additional 3rd pump to the station are recommended in the

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Goodwin Rd Lift Station Improvements	0.49	MGD	$ 240,000	$ 240,000	$ 72,000	$ 190,000		$502,000
Total Anticipated Project								$ 502,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

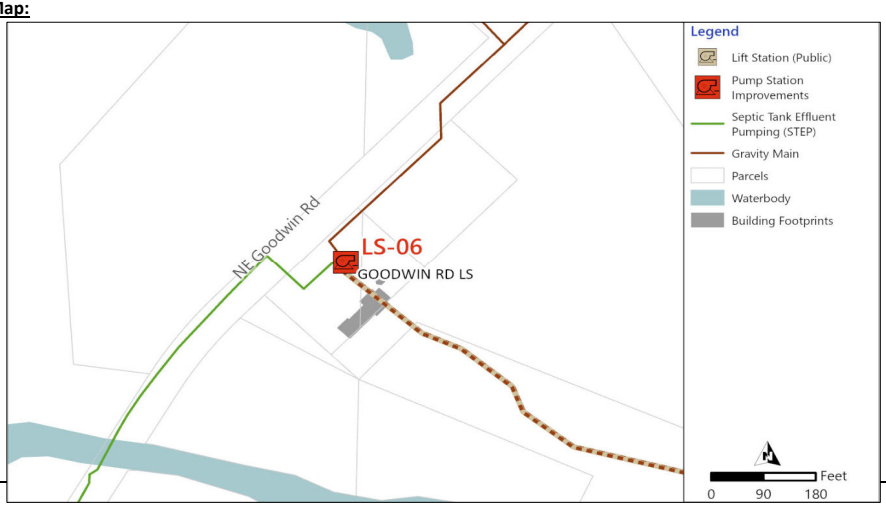
Project Type	Percent	Cost
Growth:	100%	$ 502,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 502,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2043	$ 502,000
Total		$ 502,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-07
Project Title: 232nd Ave Lift Station Improvements
Facility Type: Lift Station
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The existing lift station infrastructure is constricted. There are currently two pumps but there is room for a third pump. Demand is expected to grow and Lift Station capacity will need to be increased. The 232nd Ave Lift Station captures flows from the Goodwin Lift Station. Based on the modeled flows to the Lift Station wet well, the Lift Station receives more PWWF than its firm capacity during existing and 20-year conditions. The

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
232nd Ave Lift Station	0.53	MGD	$ 240,000	$ 240,000	$ 72,000	$ 190,000		$502,000

Total Anticipated Project	$ 502,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

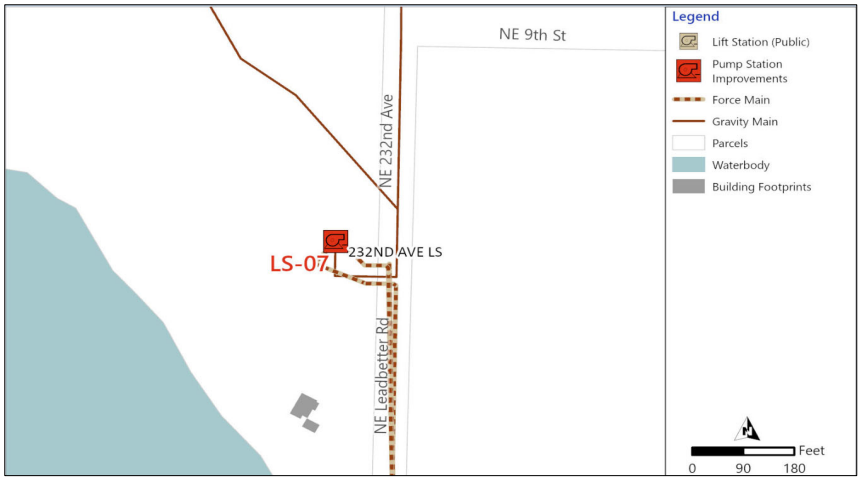
Project Type	Percent	Cost
Growth:	100%	$ 502,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 502,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2042	$ 502,000
Total		$ 502,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-08
Project Title: Leadbetter Rd Lift Station Improvements
Facility Type: Lift Station
Priority: 10-20 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The lift station does not have sufficient capacity for existing system PWWF and will remain capacity-constrained under 20-year and buildout PWWF conditions. The current station has two pumps, with space available for a third pump and a dual force main. The Leadbetter Rd Lift Station captures flows from the 232nd Ave Lift Station. Based on modeled flows to the lift station wet well, the station receives more PWWF than its firm

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Leadbetter Rd Lift Station Improvements	0.87	MGD	$ 240,000	$ 240,000	$ 72,000	$ 190,000		$502,000
Leadbetter Rd Lift Station Improvements	1.82	MGD	$ 898,350	$ 898,350	$ 269,500	$ 709,150		$1,877,000

Total Anticipated Project	$ 2,379,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

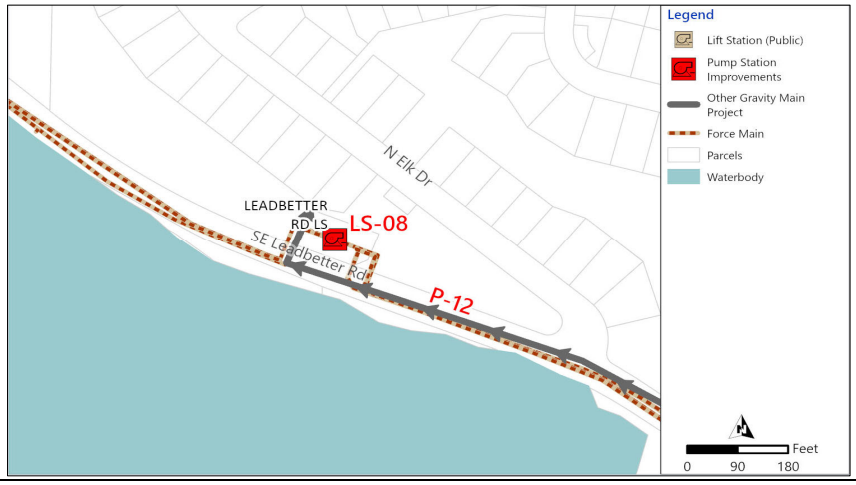
Project Type	Percent	Cost
Growth:	100%	$ 2,379,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 2,379,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2041	$ 2,379,000
Total		$ 2,379,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: LS-09 **Facility Type:** Lift Station

Project Title: Hills at Round Lake Lift Station Improvements

Priority: 10-20 years **Project Status (Completed?):** N

Go to CIP Summary Table

Project Description:

Project Description: The Hills at Round Lake Lift Station captures flows from the northeastern portion of the system. Based on the modeled flows to the Lift Station wet well, the lift station receives more PWWF than its firm capacity during 20-year and build-out conditions. The station's firm capacity needs to convey more than its current firm capacity from 0.96 MGD to 1.21 MGD. Replacing its pumps in this station are recommended in the long-term.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Hills at Round Lake Lift Station Improvements	1	MGD	$ 720,000	$ 720,000	$ 216,000	$ 568,000		$1,504,000

Total Anticipated Project	$ 1,504,000

Notes on Cost Estimation:

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Cost Allocation:

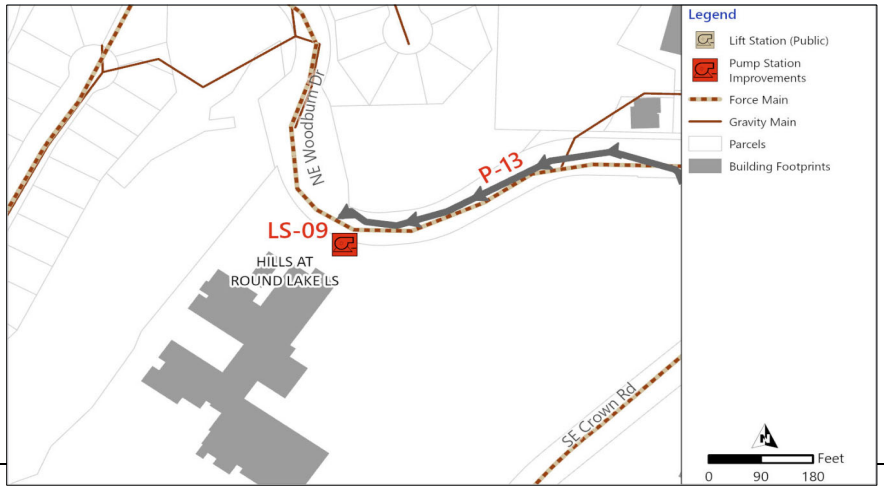
Project Type	Percent	Cost
Growth:	100%	$ 1,504,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 1,504,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2044	$ 1,504,000
Total		$ 1,504,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-01
Project Title: Basin 4-1-3 Pilot I/I Study
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This program will investigate the source and magnitude of inflow and infiltration (I&I) of storm and groundwater into the wastewater system at locations where suspected high I&I is currently or is forecast to exceed conveyance and/or Lift Station capacity. Identifying and removing non-sewage flow where that would reduce surcharging such that costly capacity improvements might be avoided.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Basin 4-1-3 Pilot I/I Study	1	ea	$ 200,000	$ 200,000	-	-		$200,000

Total Anticipated Project Cost	$ 200,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

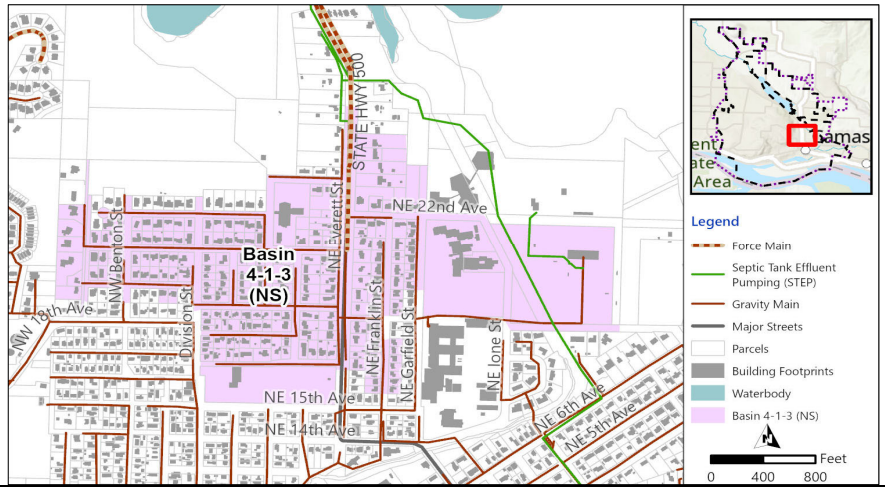
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 200,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 200,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 200,000
Total		$ 200,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-02
Project Title: Basin 5-1-2 Flow Monitoring
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This project is to install temporary flow meters in Basin 5-1-2 to capture flows from the Camas LS and Upper Prune Hill contributing areas separately. Both areas have pipe and LS capacity deficiencies and additional flow monitoring within this basin would help to understand if part of the basin is contributing a greater portion of I&I. This study should evaluate if projects within the basin have the potential to reduce I&I such that projects to increase hydraulic capacity within

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Basin 5-1-2 Flow Monitoring	1	ea	$ 250,000	-	-	-		$250,000

Total Anticipated Project Cost	$ 250,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

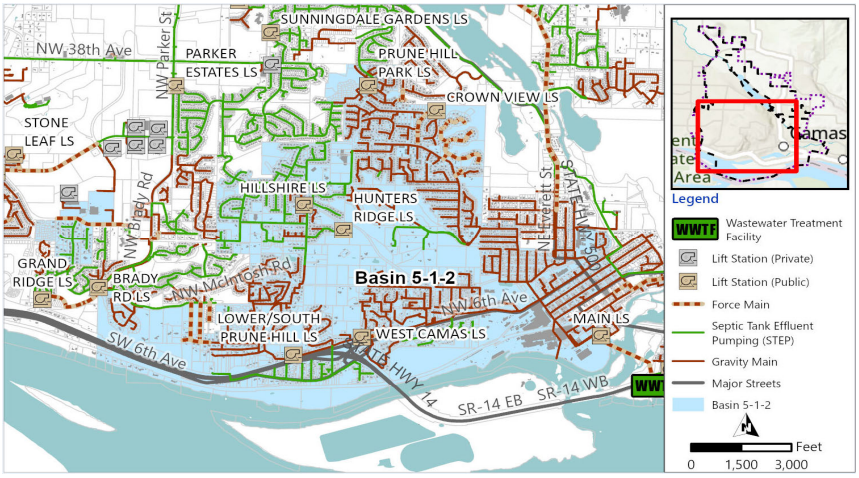
Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 250,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 250,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 250,000
Total		$ 250,000

Go to Maps Tab

Project Location Map:



City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-03
Project Title: Geographic Information System (GIS)
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: This program will implement ongoing enhancements to the Geographic Information System (GIS), including asset mapping, data collection, database maintenance, and integration with utility management systems. Maintaining accurate and up-to-date spatial information will improve infrastructure planning, field operations, emergency response, and asset management while supporting informed decision-making and efficient delivery of utility services.

Reasoning General

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Geographic Information System (GIS)	1	ea	$ 200,000	$ 200,000	-	-		$200,000

Total Anticipated Project Cost	$ 200,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 200,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 200,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 200,000
Total		$ 200,000

Go to Maps Tab

Project Location Map:
N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-04
Project Title: Hydraulic Modeling
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: The City's collection system model is heavily skeletonized, only 28 percent of the City's collection system pipes are included. A full pipe or less skeletonized model is needed for a more robust evaluation of the system. In order to expand the model, accurate and updated GIS for the collection system should be developed.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Hydraulic Modeling	1	ea	$ 75,000	$ 75,000	-	-		$75,000

Total Anticipated Project Cost	$ 75,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 75,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 75,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 75,000
Total		$ 75,000

Go to Maps Tab

Project Location Map:

N/A - Treatment Plant

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-05
Project Title: Electrical System Arc Flash Study
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: No arc flash labels were found on the plant's distribution equipment, and the owner confirmed that an Electrical System Study is not maintained. Carollo recommends completing this study as soon as possible and applying arc flash labels in accordance with Occupational Safety and Health Administration requirements to ensure worker safety.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Electrical System Arc Flash Study	1	ea	$ 50,000	$ 50,000	-	-		$50,000
Total Anticipated Project Cost								$ 50,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 50,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 50,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 50,000
Total		$ 50,000

Go to Maps Tab

Project Location Map:
N/A - Treatment Plant

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-06
Project Title: Hazardous Area Classification Study
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: To ensure regulatory compliance, and safety, Carollo recommends conducting a hazardous area classification study per NFPA 820 and upgrading any areas that do not meet code.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
2034 Hazardous Area Classification Study	-	1	$ 700,000	$ 700,000	-	-		$700,000
2044 Hazardous Area Classification Study	-	1	$ 700,000	$ 700,000	-	-		$700,000

Total Anticipated Project Cost	$ 1,400,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 1,400,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,400,000

Project Timing:

Project Element	Timing	Cost
First General Sewer Plan	2027	$ 700,000
Second General Sewer Plan	2045	$ 700,000
Total		$ 1,400,000

Go to Maps Tab

Project Location Map:

N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-07
Project Title: Flood Risk Assessment
Facility Type: General
Priority: 0-10 years
Project Status (Completed?):

Go to CIP Summary Table

Project Description:

Project Description: This project is a comprehensive flood risk analysis for all major electrical and control systems to assess vulnerabilities and strengthen flood resilience at the WWTF.

Reasoning Study

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
2034 Flood Risk Assessment	-	1	$ 700,000	$ 700,000	-	-		$700,000
2044 Flood Risk Assessment	-	1	$ 700,000	$ 700,000	-	-		$700,000

Total Anticipated Project Cost	$ 1,400,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 1,400,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,400,000

Project Timing:

Project Element	Timing	Cost
First General Sewer Plan	2027	$ 700,000
Second General Sewer Plan	2045	$ 700,000
Total		$ 1,400,000

Go to Maps Tab

Project Location Map:

N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: G-08
Project Title: General Sewer Plan
Facility Type: General
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Occurs two times over the 20-year planning horizon, with each occurrence assumed to take place approximately 10 years apart. For the purposes of this GSP, the occurrences are assumed to occur in 2035 and 2045.

Reasoning General

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
2035 General Sewer Plan	-	1	$ 700,000	$ 700,000	-	-		$700,000
2045 General Sewer Plan	-	1	$ 700,000	$ 700,000	-	-		$700,000

Total Anticipated Project Cost	$ 1,400,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	100%	$ 1,400,000
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,400,000

Project Timing:

Project Element	Timing	Cost
First General Sewer Plan	2035	$ 700,000
Second General Sewer Plan	2045	$ 700,000
Total		$ 1,400,000

Go to Maps Tab

Project Location Map:
N/A - Systemwide

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-01
Project Title: Parshall Flume Replacement
Facility Type: Treatment Plant
Priority: 0-10 years
Project Status (Completed?): N

Go to CIP Summary Table

Project Description:

Project Description: Replace existing Parshall Flume with new Parshall Flume (higher capacity) and structural modification to prevent spraying of the influent wastewater during peak flow events. Cost is split between growth and upgrade because the parshall flume needs to be modified to address existing process issues and it needs to be a larger size to accomodate growth-driven future peak wet weather.

Reasoning Existing and future growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Top Slab Demolition	2.1	CY	$ 560.00	$ 1,200.00	$ 400.00	$ 1,000		$2,600
Wall Demolition	9.4	CY	$ 560.00	$ 5,300.00	$ 1,600.00	$ 4,100		$11,000
Foundation Slab	1.7	CY	$ 560.00	$ 1,000.00	$ 300.00	$ 800		$2,100
Influent Channel Wall	2.5	CY	$ 3,000.00	$ 7,500.00	$ 2,300.00	$ 6,200		$16,000
Influent Channel Walls	6.5	CY	$ 1,800.00	$ 11,500.00	$ 3,500.00	$ 9,000		$24,000
Influent Channel	9.5	CY	$ 3,000.00	$ 28,500.00	$ 8,600.00	$ 22,900		$60,000
Excavation and Backfill	95.0	CY	$ 225.00	$ 21,500.00	$ 6,500.00	$ 17,000		$45,000
Guardrail Demolition	8.0	LF	$ 110.00	$ 900.00	$ 300.00	$ 800		$2,000
New Guardrail	8.0	LF	$ 225.00	$ 1,800.00	$ 500.00	$ 1,400		$3,700
Parshall Flume Shoring Elevated Slab	1.0	LS	$ 22,500.00	$ 22,500.00	$ 6,800.00	$ 17,700		$47,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 30,500.00	$ 9,200.00	$ 24,300		$64,000
Total Anticipated Project								$ 277,400

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	50%	$ 138,700
Upgrade:	50%	$ 138,700
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project	100%	$ 277,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 277,400
Total		$ 277,400

Project Location Map:
N/A

Go to Maps Tab

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-02
Project Title: Primary Clarifier Bypass

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Add a Bypass around Existing Primary Clarifiers. Add a weir, dropbox, and piping as needed to construct a bypass around the primary clarifiers. This bypass will direct all flows greater than the maximum day flows around the primary clarifiers. The driver for this project is growth, predominantly occuring from development in the North Shore area.

Reasoning Future PWWF driven

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Install a new 30-inch bypass around the Primary Clarifiers No. 1 and 2	220.0	LF	$ 897	$ 200,000	$ 60,000	$ 158,000		$418,000
Structural modifications and installation of weir gates at Plant Headworks Effluent	1.0	LS	$ 112,500	$ 112,500	$ 34,000	$ 88,500		$235,000
Additional Site Work	25.0	%	N/A	$ 78,100	$ 23,500	$ 61,400		$163,000
Total Anticipated Project Cost								$ 816,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 816,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 816,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 816,000
Total		$ 816,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-03
Project Title: Aeration Basin Flow Splitter Box

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Construct new Aeration Basin Influent Flow Splitter Box.This is a new structure to provide adequate mixing and even split of flow to the aeration basins. It should also be designed to address the issue of very little head available between the primary clarifier and aeration basins. The improvements include an 18-inch foundation slab, 12-inch-thick walls, new guardrails and aluminum grating, and associated excavation and backfill. New 60-inch by 30-inch and 24-inch by 24-inch stainless steel slide gates will be provided to control flows through the splitter box. The project also includes demolition of the existing Aeration Basin Flow Splitter Box, temporary pumping and piping during construction, installation of piping to and from the new splitter box, and additional site work as needed to complete the improvements. This project is timed to align with TP-02.

Reasoning Addresses existing peak event capacity issues and issues with mixing

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
18" Floundation Slab	32.0	CY	$ 975	$ 31,000	$ 9,300	$ 24,700		$ 65,000
12" Thick Wall	61.0	CY	$ 1,800	$ 110,000	$ 33,000	$ 87,000		$ 230,000
New Guardrail	116.0	LF	$ 225	$ 26,000	$ 7,800	$ 20,200		$ 54,000
Aluminum Grating	777.0	SF	$ 113	$ 88,000	$ 26,500	$ 69,500		$ 184,000
Excavation and Backfill	167.0	CY	$ 225	$ 37,500	$ 11,500	$ 30,000		$ 79,000
60" x 30" SS Slide Gate	4.0	LS	$ 32,799	$ 131,000	$ 39,500	$ 103,500		$ 274,000
24" x 24" SS Slide Gate	3.0	LS	$ 16,183	$ 48,500	$ 14,500	$ 39,000		$ 102,000
Demolition of Existing Aeration Basin Flow Splitter Box	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$ 157,000
Temporary Pumping/Piping during construction	1.0	LS	$ 112,500	$ 112,500	$ 34,000	$ 88,500		$ 235,000
Piping to New Aeration Basin Flow Splitter Box	200.0	LF	$ 897	$ 179,500	$ 54,000	$ 142,500		$ 376,000
Piping From New Aeration Basin Flow Splitter Box	400.0	LF	$ 897	$ 358,500	$ 107,500	$ 283,000		$ 749,000
Installation	25.0	%	N/A	$ 299,400	$ 90,000	$ 236,600		$ 626,000
Additional Site Work	15.0	%	N/A	$ 179,600	$ 54,000	$ 142,400		$ 376,000
Total Anticipated Project Cost								$ 3,507,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 3,507,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,507,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 3,507,000
Total		$ 3,507,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-04
Project Title: Replace Screens and Slide Gates

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing screens and slide gates at the WWTF Headworks to improve the reliability and operation of the screening process. The improvements include replacement of the existing screens/washer compactors with new units and installation of new 66-inch by 48-inch, 66-inch by 36-inch, and 72-inch by 36-inch stainless steel slide gates. The project also includes associated installation, electrical, instrumentation, and controls improvements, as well as additional site work required to complete the improvements. This project is split between growth and R&R becuase componensts of the plant headworks should be replaced because it is near the end of it's useful life and capacity increased to address growth-driven future peak flows to the plant.

Reasoning Growth driven capacity issues and age/condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Replace existing screens/washer compactors with new	1.0	LS	$ 568,000	$ 570,000	$ 171,000	$ 450,000		$1,191,000
66" x 48" SS Slide Gate	2.0	LS	$ 26,161	$ 52,300	$ 15,500	$ 41,200		$109,000
66" x 36" SS Slide Gate	2.0	LS	$ 24,652	$ 49,300	$ 15,000	$ 38,700		$103,000
72" x 36" SS Slide Gate	3.0	LS	$ 37,022	$ 111,000	$ 33,500	$ 87,500		$232,000
Installation	25.0	%	N/A	$ 195,700	$ 58,500	$ 153,800		$408,000
Electrical, Instrumentation, and Controls	15.0	%	N/A	$ 117,400	$ 35,000	$ 92,600		$245,000
Additional Site Work	25.0	%	N/A	$ 195,700	$ 58,500	$ 153,800		$408,000

Total Anticipated Project Cost	$ 2,696,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	50%	$ 1,348,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	50%	$ 1,348,000
Total Anticipated Project Cost	100%	$ 2,696,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2029	$ 2,696,000
Total		$ 2,696,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-05
Project Title: Relocate the Internal Recycle Piping

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Relocate the IR piping to the beginning of the Anoxic Selector. Relocate the internal recycle piping such that the recycle is introduced just upstream of the first of the two anoxic zones and not in the last anerobic zone for the three existing aeration basins. The project also includes associated electrical, instrumentation, and controls improvements, as well as additional site work required to complete the improvements. The City currently has two options for where recycled flow is discharged to: one from the splitter box (currently used) and the other at the end of the selector zone. It is recommended that the City use switch to discharge at the end of the selector zone and to monitor and test before and after the switch to assess improvement in treatment performance from this change to see if it is sufficient. TP-05 could potentially be completed in-house.

Reasoning Existing process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Relocate IR piping	1.0	LS	$ -	$ -	$ -	$ -		$0
Electrical, Instrumentation, and Controls	15.0	%	$ -	$ -	$ -	$ -		$0
Additional Site Work	10.0	%	$ -	$ -	$ -	$ -		$0

Total Anticipated Project Cost	$ -

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ -

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ -
Total		$ -

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-06
Project Title: Modifying Anaerobic Selectors Baffle Wall

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Modifications to the Baffle wall separating the Anaerobic Selectors. The baffle walls that divide the zones within the existing aeration basins' should be repoured to a smooth level. Plywood baffle walls in the anaerobic selector zone should be removed and replaced with 316 stainless steel baffle plates for rigidity. The project also includes associated electrical, instrumentation, and controls improvements.

Reasoning Existing process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Modify baffle walls	1.0	LS	$ 29,000	$ 29,000	$ 8,700	$ 23,300		$61,000
Electrical, Instrumentation, and Controls	15.0	%	N/A	$ 4,400	$ 1,300	$ 3,500		$9,200

Total Anticipated Project Cost	$ 70,200

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 70,200
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 70,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 70,200
Total		$ 70,200

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-07
Project Title: Replace Secondary Clarifier No. 1

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes demolition and replacement of Secondary Clarifier No. 1 to improve the reliability and performance of the secondary treatment process. The new clarifier will be constructed as a 75-foot-diameter clarifier with a 15-foot SWD, matching the size, slope, and other design criteria of Secondary Clarifier No. 3. The improvements include a new concrete foundation slab and walls, sludge collection box, launder and effluent structures, aluminum grating, stairs, platforms, and railings, as well as new internal clarifier mechanisms. New RAS and WAS pumps will also be installed to match the size of those serving Secondary Clarifier No. 3. The project also includes associated demolition, installation, electrical, instrumentation, and controls improvements, and additional site work required to complete the improvements. The City is currently evaluating this project.

Reasoning Existing process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12" Conc Wall, 16'-0" ht.	142.0	CY	$ 1,800	$ 255,500	$ 76,500	$ 202,000		$534,000
18" Fdn Slab	281.0	CY	$ 975	$ 274,000	$ 82,000	$ 216,000		$572,000
Sludge Collection Box	23.0	CY	$ 975	$ 22,500	$ 6,800	$ 17,700		$47,000
Launder Slab	19.0	CY	$ 1,200	$ 23,000	$ 6,900	$ 18,100		$48,000
Launder Wall	9.1	CY	$ 2,400	$ 22,000	$ 6,600	$ 17,400		$46,000
Grout	27.0	CY	$ 750	$ 20,500	$ 6,200	$ 16,300		$43,000
Effluent Box Walls	19.0	CY	$ 1,800	$ 34,000	$ 10,000	$ 27,000		$71,000
Effluent Box Fdn Slab	5.0	CY	$ 975	$ 4,900	$ 1,500	$ 3,600		$10,000
Aluminum Grating	63.0	SF	$ 113	$ 7,100	$ 2,100	$ 5,800		$15,000
Alum. Stairs	12.0	RSR	$ 1,050	$ 12,500	$ 3,800	$ 9,700		$26,000
Small Platform	1.0	LS	$ 7,500	$ 7,500	$ 2,300	$ 6,200		$16,000
Alum. Railing	75.0	LF	$ 150	$ 11,500	$ 3,500	$ 9,000		$24,000
Demolitish existing clarifier	1.0	LS	$ 150,000	$ 150,000	$ 45,000	$ 119,000		$314,000
Construct a new 75-feet diameter, 15-feet SWD Secondary Clarifier No. 1 (Internal Mechanisms)	1.0	LS	$ 536,750	$ 537,000	$ 161,000	$ 424,000		$1,122,000
New RAS and WAS pumps	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Electrical, Instrumentation, and	30.0	%	N/A	$ 437,100	$ 131,000	$ 344,900		$913,000
Installation	25.0	%	N/A	$ 364,300	$ 109,500	$ 288,200		$762,000
Additional Site Work	20.0	%	N/A	$ 291,400	$ 87,500	$ 230,100		$609,000
Total Anticipated Project Cost								$ 5,329,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 5,329,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 5,329,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 5,329,000
Total		$ 5,329,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-08
Project Title: Replace RAS Pumps for SC No. 2

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the return activated sludge (RAS) pumps serving Secondary Clarifier No. 2 to improve pumping capacity and maintain consistency with the existing Secondary Clarifier No. 3 facilities. Two new non-clog submersible RAS pumps, each rated at 1,400 gpm, will be installed to match the pump capacity serving Secondary Clarifier No. 3. The project also includes associated installation, electrical, instrumentation, and controls improvements. This project is driven by growth, predominantly development in the North Shore area.

Reasoning Aging infrastructure

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
RAS Pumps (2) for SC No. 2 (1,400 gpm, non-clog submersible pumps)	2.0	LS	$ 68,000	$ 136,000	$ 41,000	$ 108,000		$285,000
Installation	25.0	%	N/A	$ 34,000	$ 10,000	$ 27,000		$71,000
Electrical, Instrumentation, and Controls	N/A	30	N/A	$ 40,800	$ 12,000	$ 31,200		$84,000

Total Anticipated Project Cost	$ 440,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 440,000
Total Anticipated Project Cost	100%	$ 440,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 440,000
Total		$ 440,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-09
Project Title: Replace Plant Drain PS No. 1

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Lift Station No. 1 be rehabilitated by:

1. Replacing the pumps (500 gpm each).
2. Installing a liner in the wet well to extend the line of the existing structure.
3. Replacing control panel, pump guide rails, and discharge piping within the wet well.
4. Adding a totalizing flow meter and composite sampler.

The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace No. 1 and 2. This project is timed to align with TP-02.

Reasoning Aging infrastructure and condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Demolition and Temporary Piping	1.0	LS	$ 60,000	$ 60,000	$ 18,000	$ 47,000		$125,000
Plant Drain Pumps and Piping	1.0	LS	$ 85,000	$ 85,000	$ 25,500	$ 66,500		$177,000
Wet Well Liner	1.0	LS	$ 135,000	$ 135,000	$ 40,500	$ 106,500		$282,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 84,000	$ 25,000	$ 67,000		$176,000
Installation	25.0	%	N/A	$ 70,000	$ 21,000	$ 56,000		$147,000
Additional Site Work	10.0	%	N/A	$ 28,000	$ 8,400	$ 21,600		$58,000

Total Anticipated Project Cost	$ 965,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 965,000
Total Anticipated Project Cost	100%	$ 965,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 965,000
Total		$ 965,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-10
Project Title: Replace Plant Drain PS No. 2

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: The condition assessment noted signs of concrete corrosion, and its pumps are nearing the end of useful life. As such, it is recommended that Lift Station No. 2 be rehabilitated by:

1. Replacing the pumps (500 gpm each).
2. Installing a liner in the wet well to extend the line of the existing structure.
3. Replacing control panel, pump guide rails, and discharge piping within the wet well.
4. Adding a totalizing flow meter and composite sampler.

The project includes associated demolition and temporary piping, electrical, instrumentation, and controls improvements, installation, and additional site work required to complete the rehabilitation. The City may consider constructing a single Plant Drain Pump Station to replace No. 1 and 2. This project is timed to align with TP-02.

Reasoning Aging infrastructure and condition

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Demolition and Temporary Piping	1.0	LS	$ 60,000	$ 60,000	$ 18,000	$ 47,000		$125,000
Plant Drain Pumps and Piping	1.0	LS	$ 85,000	$ 85,000	$ 25,500	$ 66,500		$177,000
Wet Well Liner	1.0	LS	$ 135,000	$ 135,000	$ 40,500	$ 106,500		$282,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 84,000	$ 25,000	$ 67,000		$176,000
Installation	25.0	%	N/A	$ 70,000	$ 21,000	$ 56,000		$147,000
Additional Site Work	10.0	%	N/A	$ 28,000	$ 8,400	$ 21,600		$58,000

Total Anticipated Project Cost	$ 965,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 965,000
Total Anticipated Project Cost	100%	$ 965,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 965,000
Total		$ 965,000

Project Location Map:

Go to Maps Tab

N/A

Project ID: TP-10
Project Title: Replace Plant Drain PS No. 2

Facility Type: Treatment Plant

Go to CIP Summary Table

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-11
Project Title: PLANTWIDE: Electrical Conduit & Stand Replace

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: The project includes plantwide replacement of existing electrical conduit and support stands to improve the reliability and condition of the plant electrical infrastructure. Existing conduit and support stands will be demolished, with existing conductors protected for reuse where feasible. New electrical conduit and support stands will be installed throughout the plant as needed.

Reasoning Aging infrastructure

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
DEMO Conduit & Support Stand - Protect Conductors for Reuse	1.0	LS	$ 55,000	$ 55,000	$ 16,500	$ 43,500		$115,000
Electrical Conduit & Support Stand Replacement	500.0	Units	$ 204	$ 102,000	$ 30,500	$ 80,500		$213,000
Total Anticipated Project Cost								$ 328,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	100%	$ 328,000
Total Anticipated Project Cost	100%	$ 328,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 328,000
Total		$ 328,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-12 **Facility Type:** Treatment Plant
Project Title: NETWORK: Equipment Enclosure & Cabled Protect Upgrade
Priority: 0-10 years **Project Status (Completed?):** N

Go to CIP Summary Table

Project Description:

Project Description: This project includes plantwide improvements to equipment enclosures and cable protection to improve the reliability and protection of the instrumentation and control system. Improvements include installation of new instrumentation and control cabinets, de-termination and re-termination of existing conductors, and installation of conduit to provide additional protection for cables and conductors. Cost is split between upgrade and R&R becuase it addresses aging infrastructure and upgrades to more modern equipment.

Reasoning Aging infrastructure and upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Instrumentation and Control Cabinet	2.0	LS	$ 6,000	$ 12,000	$ 3,600	$ 9,400		$25,000
DE-Terminate Conduit (Assumed 30 LF)	1.0	LS	$ 9,000	$ 9,000	$ 2,700	$ 7,300		$19,000
Total Anticipated Project Cost								$ 44,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	50%	$ 22,000
General:	0%	$ -
R&R:	50%	$ 22,000
Total Anticipated Project Cost	100%	$ 44,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 44,000
Total		$ 44,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-13
Project Title: Replace MCC-A & Relocate Electric Equipment

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Reference section 7.9.8 of the WWTF Evaluation Report in Appendix I for more information on the current electrical system and background on previous upgrades.
This project includes replacement of MCC-A and relocation of associated electrical equipment to improve the reliability and maintainability of the plant electrical system. MCC-A currently serves two WAS pumps, one general-purpose sludge pump, a compressor, two heaters, and a hoist. MCC-A will be removed from the plant distribution system, and its remaining loads will be re-fed from nearby electrical sources. PLC-A will also be removed from the Old Controls Building, with its current loads transferred to another nearby PLC. This will allow the Old Controls Building to be fully utilized as a maintenance and workshop area, consistent with its current use. The project includes replacement of MCC-A and relocation of electrical equipment from the Old Controls Building, along with associated electrical, instrumentation, and controls work. The City is currently evaluating this project.

Reasoning Upgrade equipment

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
MCC To Replace MCC-A	1.0	LS	$ 63,000	$ 63,000	$ 19,000	$ 50,000		$132,000
Relocate Electrical Equipment from Old Controls Bldg	1.0	LS	$ 172,000	$ 172,000	$ 51,500	$ 135,500		$359,000

Total Anticipated Project Cost	$ 491,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 491,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 491,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 491,000
Total		$ 491,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-14
Project Title: Replace and Add Diffusers in the Aeration Basins

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing diffusers in the three aeration basins and installation of additional diffusers in the second of the two anoxic zones within each basin. The additional diffusers will allow the anoxic zones to function as swing zones, providing greater operational flexibility and treatment capacity. New diffuser supports within the swing zones will be designed to withstand the forces exerted by the existing submersible mixers.

Reasoning Process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Replace existing diffusers in the Aeration Basins and add diffusers to one of the Anoxic Zones	1.0	LS	$ 425,000	$ 425,000	$ 127,500	$ 335,500		$888,000

Total Anticipated Project Cost	$ 888,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 888,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 888,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 888,000
Total		$ 888,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-15
Project Title: Replace Disk Filtration Units

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Replace the two existing Disk Filtration Units with new Units (6.0 mgd). Plant staff indicated the filters are backwashing 30% of the time, which is higher than the anticipated 20% or less.

This project includes replacement of the two existing disk filtration units with new units to improve filtration performance and operational reliability. The new disk filtration units will be sized for a capacity of 6.0 mgd. Plant staff indicated that the existing filters are currently backwashing approximately 30 percent of the time, which is higher than the anticipated 20 percent or less. The project includes removal of the existing disk filtration units, installation of the new units, and associated electrical, instrumentation, and controls improvements. The City will assess the need for the disk filters, which are currently not run all the time, prior to completing this project. This project is assigned to 75% growth and 25% to upgrade. It is primarily driven by growth but will also address existing issues reported by staff.

Reasoning Growth driven capacity issue and existing process improvement

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Disk Filter Unit	1.0	LS	$ 705,484	$ 705,500	$ 211,500	$ 557,000		$1,474,000
Remove existing Disk Filtration Units	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Installation	25.0	%	N/A	$ 195,100	$ 58,500	$ 154,400		$408,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 234,200	$ 70,500	$ 184,300		$489,000

Total Anticipated Project Cost	$ 2,528,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	75%	$ 1,896,000
Upgrade:	25%	$ 632,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,528,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 2,528,000
Total		$ 2,528,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-16
Project Title: Second UV Channel

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This City recently constructed a second UV disinfection channel which will be used going forward while the existing channel will serve as bypass. This project is to rehabilitate the existing channel and put back into service for UV disinfection to provide sufficient disinfection capacity for the entire plant effluent at peak hour flow conditions of 22.2 mgd. The project includes installation of the new UV equipment and associated electrical, instrumentation, and controls improvements will also be included.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
UV Equipment	1.0	LS	$ 1,507,286	$ 1,507,500	$ 452,500	$ 1,190,000		$3,150,000
Aluminum Grating	1.0	LS	$ 113	$ 100	$ -	$ -		$100
Installation	30.0	%	N/A	$ 452,300	$ 135,500	$ 357,200		$945,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 452,300	$ 135,500	$ 357,200		$945,000

Total Anticipated Project Cost	$ 5,040,100

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 5,040,100
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 5,040,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2032	$ 5,040,100
Total		$ 5,040,100

Project Location Map:

Go to Maps Tab

N/A

Project ID: TP-16
Project Title: Second UV Channel

Facility Type: Treatment Plant

Go to CIP Summary Table

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-17
Project Title: Replace Effluent Transfer Pumps

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: Replace the existing Effluent Transfer Pumps with larger impeller, motor, and associated VFDs to allow pumping of the entire plant effluent (22.2 mgd). Under high river water level conditions, when the headloss is too great for gravity flow to the Columbia River, the effluent is pumped using three vertical propeller effluent pumps, located in the second compartment of the effluent wet well. Each pump has a capacity of 4,550 gpm (6.54 mgd). The total capacity of the effluent transfer Lift Station is 19.6 mgd with a firm capacity of 13.09 mgd. The process implications of exceeding the effluent pumps' capacity are catastrophic, under the high river level conditions. Such conditions could quickly submerge upstream plant processes.
The replacement pumps will be rated at approximately 4,700 gpm and will include associated structural and mechanical modifications, installation, and electrical, instrumentation, and controls improvements. This project is driven by future growth and is timed to align with TP-18.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
4700 gpm centrfugal pumps	3.0	LS	$ 230,000	$ 690,000	$ 207,000	$ 545,000		$1,442,000
Structural and Mechanical Modifications	1.0	LS	$ 15,500	$ 15,500	$ 4,700	$ 12,800		$33,000
Installation	25.0	%	N/A	$ 176,400	$ 53,000	$ 139,600		$369,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 211,700	$ 63,500	$ 167,800		$443,000

Total Anticipated Project Cost	$ 2,287,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 2,287,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 2,287,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2035	$ 2,287,000
Total		$ 2,287,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-18
Project Title: Construct a New Plant Outfall

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a second plant outfall to the Columbia River to provide additional discharge capacity and improve the reliability and flexibility of the plant effluent discharge system. The new outfall will consist of approximately 36-inch corrugated metal pipe with a 16-port, 160-foot diffuser. The project includes mobilization, cleanup, and demobilization; erosion control; additional pipe fittings; trench safety; excavation and backfill; and installation of the new outfall. Associated electrical, instrumentation, and controls improvements will also be included. This project is timed to align with TP-17.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
36-in corrugated metal pipe	850.0	LF	$ 3,245	$ 2,758,500	$ 827,500	$ 2,177,000		$5,763,000
16-port, 160 ft diffuser	1.0	LS	$ 500,000	$ 500,000	$ 150,000	$ 395,000		$1,045,000
Mobilization, cleanup, and demobilization	1.0	LS	$ 1,120,000	$ 1,120,000	$ 336,000	$ 884,000		$2,340,000
Erosion control	1.0	LS	$ 133,800	$ 134,000	$ 40,000	$ 106,000		$280,000
Additional pipe fittings	20000.0	LB	$ 16	$ 320,000	$ 96,000	$ 253,000		$669,000
Trench safety programs	1.0	LS	$ 145,000	$ 145,000	$ 43,500	$ 114,500		$303,000
Excavation and Backfill	10000.0	CY	$ 225	$ 2,250,000	$ 675,000	$ 1,777,000		$4,702,000
Installation	30.0	%	N/A	$ 2,168,300	$ 650,500	$ 1,711,200		$4,530,000
Electrical, Instrumentation, and Controls	5.0	%	N/A	$ 361,400	$ 108,500	$ 285,100		$755,000

Total Anticipated Project Cost	$ 20,387,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 20,387,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 20,387,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2035	$ 20,387,000
Total		$ 20,387,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-19
Project Title: Construct a New Electrical Building

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a new electrical building west of the Digester complex to house electrical equipment serving the digester facilities. The new CMU block electrical building will be designed to meet the hazardous area classification requirements of NFPA 820 and provide a suitable location for electrical equipment serving the digester process. The project includes construction of the new building, electrical equipment and installation, and associated electrical, instrumentation, and controls improvements. This project is timed to align with TP-09 and TP-10. This project is driven by the need to move the existing electrical equipment to make room for the new digester and it will also address code issues, therefore it reiceves a 75%/25% split for future and existing cost, respectively.

Reasoning Code/Growth - secondary gravity thickener driven by growth, which drives electrical upgrade (can do both at same time)

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
CMU Block Electrical Building	1.0	LS	$ 306,000	$ 306,000	$ 92,000	$ 242,000		$640,000
Electrical Equipment and Installation	1.0	LS	$ 300,000	$ 300,000	$ 90,000	$ 237,000		$627,000
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A

Total Anticipated Project Cost	#N/A

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	75%	#N/A
Upgrade:	25%	#N/A
General:	0%	#N/A
R&R:	0%	#N/A
Total Anticipated Project Cost	100%	#N/A

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	#N/A
Total		#N/A

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-20 **Facility Type:** Treatment Plant
Project Title: Construct a Second Rotary Drum Thickener for WAS Thickening

Go to CIP Summary Table

Priority: 0-10 years **Project Status (Completed?):** N

Project Description:

Project Description: This project includes construction of a second Rotary Drum Thickener (RDT) for waste activated sludge (WAS) thickening to provide redundancy and improve the reliability of the thickening process. The existing RDT has been in service for more than 10 years, and a second unit is recommended to provide additional operational flexibility and backup capacity. The project includes a new RDT, associated polymer blending unit, thickened sludge pump, access platform, stairs, and supporting structures. The project also includes installation, additional site work, and associated electrical, instrumentation, and controls improvements. This project is timed to align with TP-09 and TP-10.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
New RDT (2nd unit) for redundancy	1.0	LS	$ 300,000	$ 300,000	$ 90,000	$ 237,000		$627,000
Associated polymer blending unit	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Thickened Sludge Pump	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
Access platform, stairs, supporting structure etc.	10.0	%	N/A	$ 45,000	$ 13,500	$ 35,500		$94,000
Installation	25.0	%	N/A	$ 112,500	$ 34,000	$ 88,500		$235,000
Additional Site Work	15.0	%	N/A	$ 67,500	$ 20,500	$ 53,000		$141,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 135,000	$ 40,500	$ 106,500		$282,000

Total Anticipated Project Cost	$ 1,693,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 1,693,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,693,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2030	$ 1,693,000
Total		$ 1,693,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-21
Project Title: Construct a New Primary Clarifier

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a new Primary Clarifier No. 3 to improve primary treatment performance and provide additional process capacity. The additional clarifier will help maintain high BOD_5 and TSS removals during normal flow conditions, allow the aeration basins to operate at lower MLSS concentrations during maximum month organic loadings, and reduce oxygen demands in the BNR process while increasing gas production in the digesters. The new clarifier will be approximately 60 feet in diameter with a 10-foot SWD and will include new internal mechanisms, sludge collection box, concrete foundation and walls, launder structure, aluminum stairs, catwalk framing, grating, and railing. The project also includes new LS pumps, excavation and backfill, installation, additional site work, and associated electrical, instrumentation, and controls improvements.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12" Conc Wall, 12'-6" ht.	89.0	CY	$ 1,800	$ 160,000	$ 48,000	$ 126,000		$334,000
18" Fdn Slab	175.0	CY	$ 975	$ 170,500	$ 51,000	$ 134,500		$356,000
Sludge Collection Box	15.0	CY	$ 975	$ 14,500	$ 4,400	$ 11,100		$30,000
Launder Slab	12.0	CY	$ 1,200	$ 14,500	$ 4,400	$ 11,100		$30,000
Launder Wall	6.6	CY	$ 2,400	$ 16,000	$ 4,800	$ 12,200		$33,000
Grout	17.4	CY	$ 750	$ 13,000	$ 3,900	$ 10,100		$27,000
Alum. Stairs	15.0	RSR	$ 1,050	$ 16,000	$ 4,800	$ 12,200		$33,000
Alum. Catwalk Framing	10306.0	LB	$ 11	$ 108,000	$ 32,500	$ 85,500		$226,000
Alum. Grating	720.0	SF	$ 113	$ 81,500	$ 24,500	$ 64,000		$170,000
Alum. Railing	409.0	LF	$ 150	$ 61,500	$ 18,500	$ 49,000		$129,000
Excavation and Backfill	1902.0	CY	$ 225	$ 428,000	$ 128,500	$ 337,500		$894,000
Construct a new 60-feet diameter, 10-feet SWD Primary Clarifier No. 3 (Internal Mechanisms and other items)	1.0	LS	$ 541,250	$ 541,500	$ 162,500	$ 428,000		$1,132,000
New PS pumps	1.0	LS	$ 58,000	$ 58,000	$ 17,500	$ 46,500		$122,000
Additional Site Work	25.0	%	N/A	$ 420,800	$ 126,000	$ 331,200		$878,000
Installation	25.0	%	N/A	$ 420,800	$ 126,000	$ 331,200		$878,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 504,900	$ 151,500	$ 398,600		$1,055,000

Total Anticipated Project Cost	$ 6,327,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 6,327,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 6,327,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2039	$ 6,327,000
Total		$ 6,327,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-22
Project Title: Construct a New Secondary Clarifier

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes construction of a new Secondary Clarifier No. 4 to provide additional secondary treatment capacity and accommodate future growth. The new clarifier will be approximately 75 feet in diameter with a 15-foot SWD and will include new internal mechanisms, sludge collection box, effluent box, launder structure, concrete foundation and walls, aluminum grating, stairs, platforms, and railings. The project also includes new RAS and WAS pumps and approximately 36-inch piping to connect the new clarifier to the existing system. Associated excavation and backfill, installation, additional site work, and electrical, instrumentation, and controls improvements will also be included.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
12" Conc Wall, 16'-0" ht.	142.0	CY	$ 1,800	$ 255,500	$ 76,500	$ 202,000		$534,000
18" Fdn Slab	281.0	CY	$ 975	$ 274,000	$ 82,000	$ 216,000		$572,000
Sludge Collection Box	23.0	CY	$ 975	$ 22,400	$ 6,700	$ 17,900		$47,000
Launder Slab	18.0	CY	$ 1,200	$ 21,600	$ 6,500	$ 16,900		$45,000
Launder Wall	9.1	CY	$ 2,400	$ 21,800	$ 6,500	$ 16,700		$45,000
Grout	27.0	CY	$ 750	$ 20,300	$ 6,100	$ 15,600		$42,000
Effluent Box Walls	19.0	CY	$ 1,800	$ 34,200	$ 10,500	$ 27,300		$72,000
Effluent Box Fdn Slab	5.0	CY	$ 975	$ 4,900	$ 1,500	$ 3,600		$10,000
Aluminum Grating	63.0	SF	$ 113	$ 7,100	$ 2,100	$ 5,800		$15,000
Alum. Stairs	12.0	RSR	$ 1,050	$ 12,600	$ 3,800	$ 9,600		$26,000
Small Platform	1.0	LS	$ 7,500	$ 7,500	$ 2,300	$ 6,200		$16,000
Alum. Railing	75.0	LF	$ 150	$ 11,300	$ 3,400	$ 8,300		$23,000
Excavation and Backfill	5200.0	CY	$ 225	$ 1,170,000	$ 351,000	$ 924,000		$2,445,000
Construct a new 75-feet diameter, 15-feet SWD Secondary Clarifier No. 4 (Internal Mechanisms)	1.0	LS	$ 536,750	$ 537,000	$ 161,000	$ 424,000		$1,122,000
New RAS and WAS pumps	1.0	LS	$ 75,000	$ 75,000	$ 22,500	$ 59,500		$157,000
New 36-inch pipe to new Secondary Clarifier No. 4	36.0	in	$ 1,203	$ 722,000	$ 216,500	$ 569,500		$1,508,000
Installation	25.0	%	N/A	$ 799,300	$ 240,000	$ 631,700		$1,671,000
Additional Site Work	20.0	%	N/A	$ 639,400	$ 192,000	$ 505,600		$1,337,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 959,200	$ 288,000	$ 757,800		$2,005,000
Total Anticipated Project Cost								$ 11,692,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 11,692,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 11,692,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2039	$ 11,692,000
Total		$ 11,692,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-23
Project Title: Replace Centrifugal Blowers

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 0-10 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the two existing 150-hp multistage centrifugal blowers with two new 150-hp HST blowers to provide sufficient aeration capacity for future peak oxygen demands. The existing centrifugal blowers will be removed and replaced with two HST blowers (Model HST 10-3600-1-U150-48). It is assumed that all four blowers will need to operate simultaneously to meet the projected 2045 peak oxygen demand. The project also includes associated installation and electrical, instrumentation, and controls improvements. The City is currently working on a project to increase capacity of blowers 3 and 4.

Reasoning Existing capacity and process upgrade

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
Two new HST Blowers (Model - HST 10-3600-1-U150-48)	1.0	LS	$ 416,000	$ 416,000	$ 125,000	$ 329,000		$870,000
Installation	15.0	%	N/A	$ 62,400	$ 18,500	$ 49,100		$130,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 124,800	$ 37,500	$ 98,700		$261,000

Total Anticipated Project Cost	$ 1,261,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	0%	$ -
Upgrade:	100%	$ 1,261,000
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 1,261,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2027	$ 1,261,000
Total		$ 1,261,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-24
Project Title: Replace Sludge Dryer

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing sludge dryer with new sludge drying equipment to maintain reliable biosolids processing as the existing equipment approaches the end of its useful life. The existing sludge dryer was installed in 2014 and is more than 10 years old. Typical sludge drying equipment may require a major overhaul within approximately 10 years, and the City should plan for potential replacement within the next 10 to 15 years. However, a firm recommendation for replacement is not made as part of this 2025 GSP, because regulations related to biosolids, particularly per- and polyfluoroalkyl substances (PFAS), continue to evolve and may affect future biosolids management requirements. The project includes new sludge belt drying equipment (BDS-10) and associated components, partial demolition and expansion of the existing building, additional site work, installation, and associated electrical, instrumentation, and controls improvements. The City has contracted for an evaluation of the dryer and alternatives for solids handling.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
New Sludge Belt Drying equipment (BDS-10) and associated components	1.0	LS	$ 5,883,000	$ 5,883,000	$ 1,765,000	$ 4,644,000		$12,292,000
Demo part of existing building	1.0	LS	$ 20,000	$ 20,000	$ 6,000	$ 16,000		$42,000
Expand existing building Building	2400.0	SF	$ 130.00	$ 312,000	$ 93,500	$ 246,500		$652,000
Additional Site Work	30.0	&	N/A	$ 1,864,500	$ 559,500	$ 1,472,000		$3,896,000
Installation	15.0	%	N/A	$ 932,300	$ 279,500	$ 736,200		$1,948,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 1,864,500	$ 559,500	$ 1,472,000		$3,896,000

Total Anticipated Project Cost	$ 22,726,000

Notes on Cost Estimation:

Go to Assumptions Tab

Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 22,726,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 22,726,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2042	$ 22,726,000
Total		$ 22,726,000

Project Location Map:

Go to Maps Tab

N/A

City of Camas
General Sewer Plan
Capital Improvement Plan

Project ID: TP-25
Project Title: Replace Biofilters

Facility Type: Treatment Plant

Go to CIP Summary Table

Priority: 10-20 years

Project Status (Completed?): N

Project Description:

Project Description: This project includes replacement of the existing biofilters with new biofilters to maintain reliable odor control as the existing tertiary filters approach the end of their useful life. The new biofilter odor control system will be designed for approximately 10,000 cfm and will include associated ductwork, sump pumps, water panels, and other necessary components. The project also includes construction of a structural pad, installation, and associated electrical, instrumentation, and controls improvements. Prior to completion of this project, the City may consider replacing the biofilters with trickling filters which have a smaller footprint.

Reasoning Growth

Anticipated Project Cost:

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Subtotal	Construction 30%	General 64%		Total Cost
New Biotrickling Filter Odor Control System with Ductwork, sump pumps, water panel etc. (10,000 cfm)	1.0	LS	$ 1,200,000	$ 1,200,000	$ 360,000	$ 947,000		$2,507,000
Structural pad	56.0	CY	$ 975.00	$ 54,500	$ 16,500	$ 44,000		$115,000
Installation	15.0	%	N/A	$ 188,200	$ 56,500	$ 148,300		$393,000
Electrical, Instrumentation, and Controls	30.0	%	N/A	$ 376,400	$ 113,000	$ 297,600		$787,000

Total Anticipated Project Cost	$ 3,802,000

Notes on Cost Estimation:

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Cost Allocation:

Project Type	Percent	Cost
Growth:	100%	$ 3,802,000
Upgrade:	0%	$ -
General:	0%	$ -
R&R:	0%	$ -
Total Anticipated Project Cost	100%	$ 3,802,000

Project Timing:

Project Element	Timing	Cost
Entire Project	2043	$ 3,802,000
Total		$ 3,802,000

Project Location Map:

Go to Maps Tab

N/A

APPENDIX M

FINANCIAL BACKUP

~ To be included in a future submittal. ~