Stormwater Annual Report

Submitted to

Oregon Department of
Environmental Quality

November 2023

Clean Water Services

STORMWATER ANNUAL REPORT

Submitted to:

Oregon Department of Environmental Quality

Submitted by:

Clean Water Services

Co-implementers:

Clean Water Services, Washington County, and the cities of Banks, Beaverton, Cornelius, Durham, Forest Grove, Hillsboro, King City, North Plains, Sherwood, Tigard, and Tualatin

Submitted in accordance with the requirements of Integrated, Municipal National Pollutant Discharge Elimination System (NPDES) Permit Numbers 101141, 101142, 101143, 101144, and MS4 File Number 108014 issued on April 22, 2016 and reissued on January 1, 2023.

November 1, 2023

Permit Holder Information

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Clean Water Services

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
MUNICIPAL SEPARATE STORM SEWER SYSTEM ANNUAL REPORT

November 2023

Clean Water Services hereby submits this NPDES Municipal Separate Storm Sewer System Annual Report in accordance with NPDES Permit Numbers 101141, 101142, 101143, 101144, and MS4 File Number 108014. 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 gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for the gathering the 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.

Diane Taniguchi-Dennis
Chief Executive Officer

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Executive Summary

This stormwater annual report includes a summary of the activities and accomplishments for the period July 1, 2022, through June 30, 2023, performed under the Clean Water Services (CWS) Stormwater Management Plan (SWMP). The SWMP was incorporated into CWS' watershed-based NPDES permit (Permit) issued April 22, 2016. The SWMP and the Permit, which was reissued December 8, 2022, and effective January 1, 2023, constitute the Maximum Extent Practicable (MEP) requirement that CWS must meet in reducing the discharge of pollutants from the Municipal Separate Storm Sewer System (MS4). This report covers the period from June 30, 2022, to July 1, 2023. The 2016 Permit was in effect from June 30, 2022, to January 1, 2023; the 2023 Permit was in effect from January 1 to July 1, 2023. This report meets the reporting requirements of the 2016 and 2023 Permit relating to CWS' MS4.

CWS and its 12 co-implementers are committed to continuing the efforts and programs that are in place to ensure compliance with the requirements of the SWMP and the Permit. Each Best Management Practice (BMP) fact sheet in this annual report includes the program elements, goals, and tracking measures contained in the SWMP.

A FEW HIGHLIGHTS OF THIS YEAR'S ACTIVITIES AND ACCOMPLISHMENTS

- Performed 23,938 erosion control inspections.
- Swept 45,830 miles of streets, removing more than 8,067 cubic yards of material.
- Inspected and maintained 1,978 vegetated stormwater treatment facilities.
- Responded to 35 reported illicit discharges.
- Performed compliance inspections at 16 of 69 industrial stormwater 1200-Z permit facilities, conducted nine site verifications at facilities with No Exposure Certifications (NECs), and identified 14 sites to be evaluated for an NEC.
- Presented the Tualatin River Rangers program to 1,192 elementary school students at 26 schools. Provided virtual program materials that were developed during distance learning to an additional 500+ teachers.
- Marked 53 storm drains with "Dump No Waste, Drains to Stream."
- Completed one outfall or water quality retrofit, providing treatment to 0.15 acres, with two additional retrofit projects in planning, design, or under construction.
- Completed retrofitting 110 catch basins with water quality sumps to improve water quality.
- Completed annual dry weather inspection of 55 priority outfalls for illicit discharges.
- Met all of the goals under the SWMP through effective planning, teamwork, and focused effort.

Annual Report

INTRODUCTION

In February 2004, DEQ issued CWS a watershed-based NPDES permit, which was reissued as modified on July 27, 2005. The Permit integrated and consolidated the MS4 requirements with the four CWS municipal wastewater treatment NPDES discharge permits in the watershed. The Permit was renewed on December 8, 2022, and became effective on January 1, 2023. The 2023 Permit includes approval of an updated SWMP and a requirement to update the SWMP by April 1, 2024, to meet new requirements in the 2023 Permit.

Each BMP fact sheet includes the program elements, goals, and tracking measures from the SWMP. In addition to CWS, the co-implementers of the SWMP are Washington County, and the cities of Banks, Beaverton, Cornelius, Durham, Forest Grove, Hillsboro, King City, North Plains, Sherwood, Tigard, and Tualatin. Together these parties implement the applicable provisions of the SWMP. Figure 1 shows the CWS MS4 boundary.

ANNUAL REPORT REQUIREMENTS

As required by Schedule B, section 16, of the 2016 and 2023 Permit, CWS must submit an annual report of its MS4 activities for the period July 1 through June 30 to DEQ by November 1 of each year. This annual report documents CWS and co-implementers' stormwater management activities from July 1, 2022, to June 30, 2023. The Permit specifies the information that the annual report must contain. The required elements and the activities that were conducted to satisfy each element are described below. In addition, the Total Maximum Daily Load (TMDL) Annual Report, which contains information on water quality conditions relative to the Tualatin Basin TMDLs, is included as Appendix D.

1. The status of implementing the stormwater management program and each SWMP program element, including progress in meeting the measurable goals identified in the SWMP.

The SWMP contains eight categories of BMPs that CWS and co-implementers employ to implement the MS4 program. A brief summary of each BMP category is listed below. Complete descriptions, including goals and tracking measures that document the status of implementation, are included in the BMP fact sheets in Appendix A.

a. Illicit Discharge Detection and Elimination. CWS and co-implementers implement an Illicit Discharge Detection and Elimination (IDDE) program to prevent, detect, and eliminate illicit discharges to the MS4. The IDDE program includes an ordinance prohibiting illicit discharges, a written enforcement response plan, a dry-weather field screening program, an information tracking system, and spill prevention and response actions. The IDDE program covers citizen complaints, accidental and intentional discharges of wastes to the MS4, sanitary-to-storm cross connections, and discharges from industrial facilities and construction sites.

b. Industrial and Commercial Facilities. CWS administers the industrial stormwater program (1200-Z NPDES general permit) under a Memorandum of Agreement with DEQ for the entire MS4 service area. In implementing this BMP category, CWS identifies facilities that require an industrial stormwater permit, reviews permit application

materials such as a stormwater pollution control plan, conducts inspections, reviews discharge monitoring reports, solicits voluntary compliance from permittees on low-risk issues, and escalates enforcement to DEQ for compliance cases that require formal enforcement. CWS also responds to site-specific information that may indicate that an industrial or commercial facility may have the potential to contribute a significant pollutant load to the MS4.

c. Construction Site Runoff Control. CWS and co-implementers carry out a construction site stormwater program that includes permitting, education, outreach, inspection, and enforcement. CWS or city staff review erosion prevention and sediment control plans to ensure that appropriate BMPs are included and perform regular site inspections to confirm that the BMPs and other measures are being implemented. Inspectors follow an escalating enforcement response procedure to bring sites into compliance. CWS provides annual training to inspectors.

d. Education and Outreach. CWS and co-implementers employ a public education and outreach program that informs and educates the public, business and industry representatives, and government staff about the causes of stormwater pollution, the effects on local streams and rivers, and the need for stormwater management. These BMP elements encourage appropriate behaviors to protect water quality, reduce discharges of pollutants from the MS4, and promote the health of the Tualatin River Watershed. CWS and co-implementers train their employees involved in MS4-related activities such as illicit discharge response, construction site inspection, and water quality facility design.

e. Public Involvement and Participation. CWS provides opportunities for the public to effectively participate in the development, implementation, and modification of CWS' stormwater management program. The Clean Water Services Advisory Commission meets regularly to provide input from stakeholders on CWS policies and programs. CWS and co-implementers provide many options for public engagement, such as web-based portals and social media, to contact staff regarding complaints or to learn more about stormwater programs.

f. Post-Construction Site Runoff and Retrofit Programs. CWS and co-implementers carry out a program to control the quality and quantity of stormwater runoff from developed sites. Through its *Design and Construction Standards*, CWS imposes requirements on development projects to treat stormwater runoff and control flow. CWS' retrofit program addresses stormwater runoff from previously developed sites.

g. Pollution Prevention for Municipal Operations. CWS and co-implementers reduce the discharge of pollutants to the MS4 from municipal operations by sweeping urban streets, implementing an integrated pest management program, managing their municipal yards, limiting infiltration from the sanitary sewers, controlling releases from firefighting training activities, and retrofitting outfalls and catch basins to remove pollutants.

h. Stormwater Management Facilities Operations and Maintenance Activities. CWS and co-implementers carry out a comprehensive operation and maintenance program that includes catch basin and water quality manhole cleaning, vegetated and proprietary water quality facility maintenance, and private water quality facility inspection.

2. A summary of the adaptive management process implementation during the reporting year, including any proposed changes to the stormwater management program (e.g., new BMPs) identified through implementation of the adaptive management process.

On January 31, 2023, CWS staff met to review the 2021-22 Stormwater Annual Report. The group identified the following issues and proposed changes:

- In 2021-22, CWS did not fully document how many copies of the *Gardening with Native Plants* brochure were distributed. The goal was 500 (Education and Outreach BMP, Goal 2.b). The brochure is usually distributed in mailings to new customers, in response to email and phone requests, and at public events, which were limited due to the ongoing COVID-19 pandemic. The Communications & Community Engagement group coordinated with other CWS groups and external partners to distribute the brochures to the public, but tracking measures were not adjusted. The brochure also was available as a download from the CWS website, but downloads were not included in the total reported. At the January meeting, CWS staff said they will develop better tracking measures or an alternative metric, perhaps tracking the number of native plant sales events.
- The City of Tigard's sweeping contractor fell shy of sweeping their streets 12 times during the year. CWS requested a summary of how the city plans to address this shortfall going forward. The City of Tigard will reach out to its sweeping contractor to express the importance of sweeping all curbed streets in Tigard each month and monitor the progress toward that goal.
- CWS and City of Tigard were not able to meet the annual maintenance frequency of 95% for catch basins in 2022-23 as a result of significant staffing shortages and increased time for fleet vendors to repair mechanical breakdowns and perform routine maintenance, respectively. CWS is taking action to manage staffing shortages and timely contracting of fleet vendors. The City of Tigard is hiring additional staff, has purchased additional fleet vehicles, and will share resources internally to anticipate staffing and vehicle needs next year. Adopting adaptive performance standards for cleaning will help reflect the good work that does get done.
- CWS discussed trends in zinc, copper, and *E. coli* in stormwater. Any trends need to be understood as part of an adaptive management approach, which may require changes to sampling. The reissued Permit requires documentation of follow-up strategies for investigating elevated levels of parameters in stormwater that show the potential to cause or contribute to an exceedance of water quality standards. CWS discussed CWS' strategic approach to respond to stormwater values that appear relatively elevated in the absence of concurrent ambient monitoring, including short-term IDDE or water quality investigations or long-term programmatic changes. CWS' Environmental Services staff members perform source control investigations, and Communications & Community Engagement staff are conducting targeted outreach in sub-watersheds noted as having elevated contaminate levels. CWS staff have conducted local source identification inspections and are continuing the inspections. Documentation of CWS' follow-up strategies for parameters with elevated concentrations are included in Appendix B.

- Reviewers discussed the new Permit requirement to track and report winter maintenance activities in the 2022-23 annual report. CWS communicated the new Permit requirement to the co-implementers and reminded them to begin tracking winter maintenance material usage for the 2022-23 annual report.

The issues identified during the annual review were addressed within the scope of existing BMPs and therefore did not require revising the BMPs in the SWMP.

The 2023 Permit requires CWS to update the SWMP by April 1, 2024, to meet the new Permit requirements. CWS will implement the SWMP that was approved with the issuance of the 2023 Permit until DEQ approves the revised SWMP. After submitting the revised SWMP, CWS plans to work collaboratively with the co-implementers to do a second, more comprehensive, review and update of the SWMP to incorporate adaptive management elements and adjust metrics and tracking measures to better reflect the scope and scale of the stormwater program.

3. Any proposed changes to SWMP program elements that are designed to reduce TMDL pollutants to the MEP.

The reissued 2023 Permit includes a condition to update the SWMP by April 1, 2024. CWS is not proposing any changes to the SWMP program elements that are designed to reduce the discharge of TMDL pollutants.

4. A summary of total stormwater program expenditures and funding sources over the reporting fiscal year, and those anticipated in the next fiscal year.

For Fiscal Year 2022-23 (July 1, 2022 – June 30, 2023) CWS and co-implementers had estimated total expenditures of $79.4 million for stormwater and related watershed operations and capital project investments. CWS and co-implementers had estimated total stormwater funding sources of $159.1 million for the period, including beginning balance, operating reserves, and capital reserves. Available funding exceeds expenditures in part to maintain operating reserves. The expenditures and funding amounts are based on budget estimates and preliminary data because final auditable actuals were not available by the due date for this report. Final actuals will be available on request at a later date.

For Fiscal Year 2023-24 (July 1, 2023 – June 30, 2024) it is estimated that CWS and co-implementers will have expenditures of $83.8 million for stormwater and related watershed operations and capital project investments. It is estimated that CWS and co-implementers will have stormwater funding sources of $168.1 million for the period, including beginning balance, operating reserves, and capital reserves.

5. A summary of monitoring program results, including monitoring data that are accumulated throughout the reporting year and any assessments or evaluations conducted.

CWS conducted stormwater and ambient monitoring and data analysis as described below.

Stormwater Monitoring

The Permit requires land-use based stormwater monitoring at five locations at least three times per year. CWS sampled five land-use based monitoring sites during multiple storm events between July 1, 2022 – June 30, 2023.

The following parameters were analyzed in accordance with the requirements of Table B25 in the 2016 Permit and Table B26 in the 2023 Permit.

Temperature	Ortho-phosphorus as P
Specific conductance	Ammonia (as N)
Turbidity	Nitrite + Nitrate as N
E. coli	Copper
Hardness	Lead
Total Organic Carbon	Zinc
Total Suspended Solids	Mercury
Total Phosphorus as P	

The metals were analyzed as total recoverable and dissolved. The sample dates, data, and other relevant information on stormwater monitoring are presented in Appendix B.

Ambient Monitoring

CWS conducted ambient monitoring in the Tualatin Basin at the minimum 15 sites on the Tualatin River and tributaries, as required by Table B1 in the 2016 Permit and Table B24 in the 2023 Permit. The Tualatin River was sampled at the following sites, located at the given river mile (RM):

Boones Ferry Road (RM 8.7)	Hwy 219 Bridge (RM 45.0)
Jurgens Park (RM 10.6)	Golf Course Road (RM 52.8)
Hwy 210 Bridge (Scholls) (RM 27.1)	Fernhill Road (RM 56.9)
Rood Bridge Road (RM 39.1)	

The following tributaries were sampled:

Scoggins Creek	McKay Creek	Chicken Creek
Gales Creek (2 sites)	Rock Creek	Beaverton Creek
Dairy Creek	Dawson Creek	Fanno Creek

Samples from the sites were analyzed for the following parameters to meet the requirements of Table B1 in the 2016 Permit and Table B24 in the 2023 Permit:

Dissolved oxygen	Phosphorus as P	pH
Orthophosphorus as P	Temperature	Ammonia as N
Specific conductance	Nitrite + Nitrate as N	Turbidity
Copper	*E. coli*	Lead
Hardness	Zinc	Total Organic Carbon
Mercury	Total Suspended Solids	

The metals were analyzed as total recoverable and dissolved. Each site was monitored for non-metal parameters between six and 23 times between July 2022 and June 2023;

copper, lead and zinc were monitored at least quarterly, and mercury was monitored twice yearly. All sites were monitored three or more times each in the wet and dry season.

A description of the ambient monitoring activities and statistical summaries of the data are in Appendices B and C. Ambient monitoring data conform to DEQ's Electronic Data Delivery format and will be submitted in the MS4 Grab Sample Submission Excel workbook version 1.06 through the "Phase I MS4 Monitoring Data Submission – 2022" website.

TMDL Assessment

CWS presented information pertaining to the pollutants regulated under a Tualatin subbasin Total Maximum Daily Load (TMDL). The TMDLs are for the parameters phosphorus, chlorophyll a, dissolved oxygen, temperature, bacteria, and mercury. Appendix D provides general information on Tualatin River mainstem and tributary conditions during 2022.

6. Any proposed modifications to the monitoring plan that are necessary to ensure that adequate data and information are collected to conduct stormwater program assessments.

CWS received approval of the Stormwater Monitoring Plan with the Permit renewal on December 8, 2022. CWS updated the Stormwater Monitoring Plan in May 2023 to reflect the updated Permit requirements. CWS made this modification to the Stormwater Monitoring Plan without prior DEQ approval because Condition 15.b.v.B of the 2023 Permit was met.

7. A summary describing the number and nature of enforcement actions, inspections and public education programs, including, but not limited to, the results of ongoing field screening and follow-up activities related to illicit discharges.

In implementing the MS4 program, CWS and co-implementers undertake a range of enforcement actions, conduct numerous inspections, and provide a variety of public education programs. These actions are part of programs for construction site stormwater, industrial stormwater, and public education.

Construction Site Stormwater

To ensure compliance with erosion control permits and rules, CWS and co-implementers issued 272 Deficiency Notices and 45 Stop Work Orders to operators of site developments, single lot developments, and unpermitted sites during the reporting year. For each Deficiency Notice and Stop Work Order issued, direct and immediate corrective actions were taken by the operator and no civil citations were issued. These enforcement actions were taken as a result of 1,700 initial inspections, 20,334 regular inspections, and 1,904 final inspections of construction sites. In addition, 1,033 wet-weather notices were sent to developers, contractors, engineers, and owners prior to the wet-weather period in fall 2022. Details on these actions are included in the BMP Fact Sheet: Construction Site Runoff Control, in Appendix A.

Industrial Stormwater

CWS utilizes both technical and compliance assistance to achieve voluntary compliance. When noncompliance cannot be resolved through voluntary means, CWS refers the matter to DEQ for formal enforcement action. CWS follows DEQ's *Enforcement Guidance for Field Staff* to evaluate compliance issues and select appropriate responses. During the reporting year, CWS continued implementing an accepted change to the SWMP that allows prioritizing annual compliance inspections. Public education elements are incorporated into the Industrial Stormwater program by providing technical assistance to permittees as needed.

CWS inspected 16 of the 69 facilities permitted under the 1200-Z industrial stormwater general permit over the reporting year and referred 8 cases to DEQ for formal enforcement.

Commercial Stormwater

EcoBiz Program

CWS reduces the discharge of pollutants to the MS4 from select commercial facilities through pollution prevention. CWS continues to contract with Pacific Northwest Pollution Prevention Resource Center (PPRC), a nonprofit organization that provides pollution prevention information. PPRC has provided outreach and technical support for the Eco-Logical Business Program (EcoBiz) for automotive services and landscaping services in Washington County since November 2008. The EcoBiz program certifies businesses that meet statewide standards set by the Pollution Prevention Outreach Team, which includes members from DEQ, Metro, and Oregon municipalities. Certified businesses must comply with environmental laws and implement BMPs to reduce the environmental impact of their operations.

The following tasks were accomplished this reporting year:

- PPRC provided outreach and technical assistance to 140 businesses and five local government agencies within Washington County. Of the total, three received physical inspections followed by detailed environmental reports outlining steps to improve environmental performance: reducing toxics, safely storing hazardous waste, adding secondary containment, managing wash water, covering waste, and conserving energy.
- PPRC re-certified one automotive business and two local government fleets. Outreach and technical assistance led to the following actions:
    - Three businesses and agencies received recommendation reports outlining specific steps needed to gain certification and reduce environmental impacts.
    - Three businesses received spill kits.
    - One business received a spill berm to contain 220 gallons of hazardous materials.
    - No businesses installed storm drain markers.

There are 55 EcoBiz-certified facilities within the CWS service district, including 31 auto repair and body shops, 10 car washes, three landscapers, and 11 public agencies.

Additionally, there are 24 businesses currently working towards becoming EcoBiz-certified facilities.

Private Water Quality Facilities Management Program

CWS and co-implementers carry out the private water quality facilities management program under the CWS SWMP. The program includes inspection of all facilities maintained by private property owners, including residential, commercial, industrial, 1200-Z, NEC, and facilities with wash water permits.

CWS and co-implementer inspectors rate water quality facilities on a scale of 1 (Excellent) through 5 (Very Poor). Facilities rated 1 through 3 are considered to require continued routine maintenance; facilities rated 4 and 5 are considered to require increased maintenance or work beyond maintenance. When the inspection is complete, the inspector provides the owner with the results of the inspection, including a description of suggested improvements for facilities that require increased maintenance or other work. At a later date, CWS or co-implementer contacts the owners of those facilities to determine whether the work has been done. The goal is to ensure that the facilities are maintained and operated appropriately. CWS and co-implementers have a performance standard to inspect 25 percent of the private water quality facilities within their respective areas of responsibility each year. During this reporting year, CWS and co-implementers exceeded the performance standard, inspecting 1,302 private water quality facilities, or 36 percent of the total. Details on the program are included in BMP Fact Sheet: Stormwater Management Facilities Operations and Maintenance Activities in Appendix A.

Public Education

CWS and co-implementers provided public education programs and materials to foster water quality protection, including the *Gardening with Native Plants* poster and the Tualatin River Rangers program. CWS' programs and materials teach proper disposal of hazardous wastes, water-friendly and chemical-free gardening and car washing, pet waste cleanup, and riparian protection. In addition, CWS provided storm drain markers to volunteers to deter illicit discharges, and published information about littering, illegal dumping, and water quality on its website, in billing inserts and in the *Clean Water Connection* electronic newsletter and city newsletters. Additional information regarding CWS' public education activities is included in the BMP Fact Sheet: Education and Outreach in Appendix A.

CWS continued to promote a slow-release fertilizer, Clean Water Grow®, for retail purchase as a stream-friendly alternative to fast-release fertilizers. The fertilizer contains phosphorus recovered at the CWS' water resource recovery facilities.

Ongoing Field Screening of Illicit Discharges

CWS follows its *Illicit Discharge Detection and Elimination Program Description* in inspecting stormwater outfalls for illicit discharges during dry weather. All inspections are performed by CWS Field Operations, generally in July, August, and September when ground water levels are lowest. Inspectors make visual observations, noting flow, turbidity, oil sheen, trash, and other indicators of nonstormwater discharges. If observations suggest the presence of an illicit discharge and the source is unknown, staff

from CWS Environmental Services investigate further. This year, CWS' Field Operations inspected 55 stormwater outfalls and found no suspected illicit discharges. Of the 55 outfalls, 32 were dry. There were no physical indicators at the 23 that had base groundwater flow, so they were not deemed to be illicit discharges.

8. A summary, as it relates to MS4 discharges, describing land use changes, Urban Growth Boundary (UGB) expansion, and land annexations.

During this reporting period the City of Tigard requested and received a UGB expansion. This expansion encompasses areas known as River Terrace South and West, generally located adjacent to the existing River Terrace development. The City of Tigard completed a concept plan and expects to proceed with comprehensive and master planning in the next reporting year, which is likely to take up to two years to complete. The other co-implementers affected by UGB expansions prior to this reporting period have continued their planning efforts and will complete those during the next reporting year or soon after. The current UGB is included in Figure 1 of the Executive Summary and Annual Report and in Figure E-2, Clean Water Services MS4 Boundary with Urban Reserves and UGB Expansion, in Appendix E.

Sixteen annexations totaling just over 428 acres, were made to CWS' service area during the reporting period. There were no de-annexations during this time. These are detailed in Appendix E, Table E-2, Details of Clean Water Services Annexations, and shown on Figure E-3, Clean Water Services FY 2022-23 Annexations, in Appendix E. These annexations allowed properties to be served by urban sanitary sewer and stormwater drainage systems.

9. A summary, as related to MS4 discharges, describing concept planning or other activities conducted in preparation of UGB expansion or land annexation, if anticipated for the following year.

As reported above, the City of Tigard worked on concept planning in the River Terrace South and West areas, which was completed and submitted during the FY 2022-23 reporting year. The final approval for UGB expansion was granted in February 2023. The City of Sherwood completed its update of the Sherwood West concept plan during this reporting year, however, the city is still in discussion about submitting for a UGB expansion during calendar year 2024. The cities of King City, Beaverton, and Hillsboro have continued to prepare their expansion areas for development. Each city began the comprehensive land-use, utility, and transportation planning for their respective areas. These areas will likely undergo annexation either just prior to or once development activities begin. CWS is providing direct planning support for sanitary sewer and stormwater management for the River Terrace West & South and King City areas.

Details of planning activities related to expansion activities are included in Table E-1, Local Long-Range Planning Activity Related to Expansion Areas, and in Figure E-2, Clean Water Services MS4 Boundary with Urban Reserves and UGB Expansion, in Appendix E.

10. A summary of the new development/redevelopment projects and related stormwater management activities that occurred within the MS4 jurisdictional area during the reporting year. The number of new post-construction permits issued and an

estimate of the total new and replaced impervious surface area related to development projects that commenced during the reporting year must also be included.

Development and redevelopment projects in CWS' jurisdiction are subject to CWS' *Design and Construction Standards*, which impose requirements for permitting, stormwater conveyance system design and construction, erosion prevention, sediment control and pollutant discharge during construction, and post-construction stormwater runoff treatment and flow control. Development continued throughout CWS, with several large residential subdivisions and other major construction projects underway. Stormwater management activities related to development and redevelopment projects included review and approval of development plans (including erosion control and post-construction), inspection during construction of stormwater treatment and flow management facilities and conveyance systems, and inspection of runoff control during construction. Details on these activities can be found in the BMP fact sheets on Construction Site Runoff Control and Post-Construction Site Runoff and Retrofit Programs in Appendix A. Table AR-1 provides the number of construction permits issued during the reporting year that included requirements for post-construction stormwater management approaches and an estimate of the impervious area that was permitted for addition or replacement.

Table AR-1: Post-construction Permits and Impervious Area Added and Replaced

Jurisdiction	*New Post-Construction Permits Issued*	*New Impervious Area, Acres*	*Replaced Impervious Area, Acres*
Clean Water Services	65	8.6	1.08
Beaverton	17	21.1	12.7
Cornelius	3	14.9	0.0
Forest Grove	6	30.0	3.0
Hillsboro	52	121.9	2.8
Sherwood	6	44.0	0.6
Tigard	8	33.8	20.2
Tualatin	7	37.4	4.0
TOTAL	**164**	**311.7**	**44.4**

11. Status or results, or both, of any public education program effectiveness evaluation conducted during the reporting year and summary of how the results were or will be used for adaptive management.

CWS generally conducts a Customer Awareness and Satisfaction survey every other year. The last survey was conducted in December 2020 and CWS plans to conduct the next survey in July 2023. CWS did not conduct the survey in 2022 because of the impacts of the COVID-19 pandemic and limited resources.

CWS again applied the Logic Model to the Tualatin River Rangers program this year. In-person River Ranger presentations resumed for the 2022-23 school year, but CWS continued to provide virtual resources produced during distance learning. Detailed results of the Logic Model application and the potential for using those results in adaptive

management are included in the BMP Fact Sheet: Education and Outreach in Appendix A.

ADDITIONAL REPORTING REQUIREMENT

The Permit requires CWS to include a summary report of the status of the retrofit program in each annual report. On April 22, 2019, CWS submitted its Stormwater Retrofit Program Plan. CWS continues to implement the retrofit program, following identified priorities to guide project selection. As described in the BMP Fact Sheet: Pollution Prevention for Municipal Operations, in Appendix A, the City of Tualatin completed one outfall retrofit project. Between the City of Tualatin and the City of Hillsboro, there are three additional retrofit projects in the design phase and one retrofit project under construction. To date, one outfall retrofit has been completed during the 2023 Permit term. In addition, CWS and co-implementers retrofitted or reconstructed 110 catch basins for water quality. To date, 110 catch basins have been retrofitted during the 2023 Permit term.

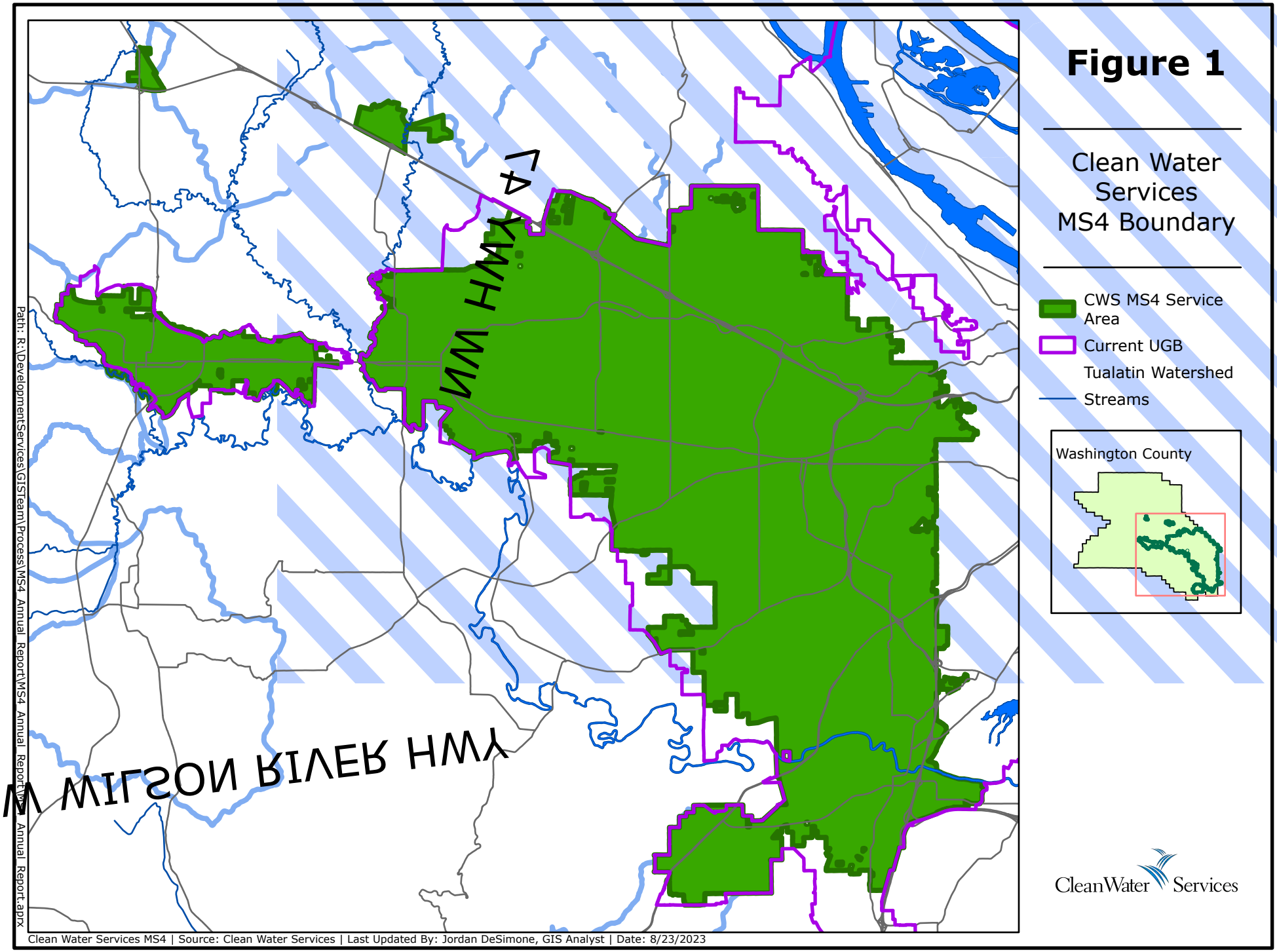
Figure 1
Clean Water Services MS4 Boundary
CWS MS4 Service Area
Current UGB
Tualatin Watershed
Streams
Washington County
SW HWY 217
SW WILSON RIVER HWY
Path: R:\DevelopmentServices\GISTeam\Process\MS4 Annual Report\MS4 Annual Report\MS4 Annual Report.aprx
Clean Water Services MS4 | Source: Clean Water Services | Last Updated By: Jordan DeSimone, GIS Analyst | Date: 8/23/2023
Clean Water Services

Appendix A: BMP Fact Sheets

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BMP Fact Sheet: Illicit Discharge Detection and Elimination

INTRODUCTION

The CWS Illicit Discharge Detection and Elimination (IDDE) program includes activities to prevent, detect, characterize, trace, and eliminate unpermitted discharges of pollutants to the MS4. These activities include inspecting permitted industrial facilities and construction sites, making observations during routine maintenance of MS4 facilities, annually inspecting dry weather outfalls, facilitating public reporting of spills and illicit discharges, and taking action to eliminate reported illicit discharges.

MEASURABLE GOALS AND TRACKING MEASURES

1. Illicit Discharges, Including Sanitary Cross Connections and Accidental Spills

a. Goal: Respond to reports of illicit discharges. Abate identified illicit discharges.

- Tracking measure: Annual number of illicit discharges reported to CWS/co-implementers by the public and illicit discharges identified through routine MS4 work.
- Tracking measure: Annual number of CWS/co-implementer field investigations and other follow-up actions in response to reports.
- Tracking measure: Number of ongoing illicit discharges identified and number abated by the CWS/co-implementers.
- Tracking measure: Number of cross connections identified and number abated.

These tracking measures are reported in Table IDDE-1a(1) and Table IDDE-1a(2). Data from the one sanitary-to-storm cross connection is included in both tables. The majority of illicit discharges were one-time events, including accidental spills and illegal disposal, rather than continuous or recurring discharges. In addition to the discharges reported in the tables, CWS and co-implementers had four sanitary sewer overflows (SSOs) that reached the MS4 during the reporting year. Response to these SSOs was consistent with CWS' *Reporting Procedures Manual for Collection System Overflows and Spills* and the Permit requirements for telephone and written reporting to DEQ. The discharges reported in Table IDDE-1a(1) include those at construction sites.

Table IDDE-1a(1): Illicit Discharge (ID) Reports and Response					
Jurisdiction	*IDs Reported by the Public*	*IDs Identified During Routine MS4 Work or Referred by Other Agencies*	*Field Investigation or Other Response Actions*	*Recurring or Continuous IDs Found*	*Recurring or Continuous IDs Abated*
CWS	8	5	13	3	3
Beaverton	1	1	2	0	0
Cornelius	0	0	0	0	0
Forest Grove	1	1	2	2	2
Hillsboro	1	6	7	5	4[1]
Sherwood	1	0	1	0	0
Tigard	0	1	1	1	1
Tualatin	0	4	4	1	1
Total	**15**	**19**	**34**	**9**	**9**

[1] One of City of Hillsboro's recurring or continuous illicit discharges has been abated to the extent possible, but the source is still being investigated as of the writing of this report. The illicit discharge is believed to be an underground leaking fuel tank and DEQ has taken the lead in a collaborative investigation.

Table IDDE-1a(2): Cross Connections Found and Abated		
Jurisdiction	*Cross Connections Found*	*Cross Connections Abated*
CWS	5	5
Beaverton	0	0
Cornelius	0	0
Forest Grove	0	0
Hillsboro	0	0
Sherwood	0	0
Tigard	0	0
Tualatin	0	0
Total	**5**	**5**

b. **Goal:** Take enforcement actions according to the CWS IDDE program in response to illicit discharges.

- Tracking measure: Number and type of enforcement actions taken to abate illicit discharges.

Table IDDE-1b: Illicit Discharge Enforcement Actions	
Type of Enforcement Action	*Number*
Education (includes informal direction to cease a discharge)	19
Warning letter	3
Abatement order	3
Referral to Code Enforcement	4
Referral to DEQ	7
Referral to county health department	0
Referral to CWS (by a city)	13[1]

[1]CWS also receives referrals for illicit discharge investigations by DEQ.

In some cases where no individual enforcement action can be taken because the responsible party is not identified (such as unobserved disposal to a catch basin), educational materials on proper waste discharge are distributed in the neighborhood. No enforcement action is taken in cases of accidental spills that are not due to negligence. Some incidents required multiple types of enforcement actions.

2. Dry Weather Field Screening

a. **Goal:** Conduct annual dry weather illicit discharge inspections at 55 identified priority locations.

- Tracking measure: Number of priority locations inspected annually.

b. **Goal:** Conduct investigations of suspected illicit discharges. Abate illicit discharges identified through dry weather screening.

- Tracking measure: Number of suspected illicit discharges identified through dry weather screening and follow-up investigations conducted.
- Tracking measure: Number of illicit discharges confirmed and abated through dry weather screening.

Table IDDE-2: Dry Weather Field Screening	
Action	*Number*
Priority locations inspected	55
Suspected illicit discharges identified	0
Follow-up investigations	0
Illicit discharges confirmed	0
Illicit discharges abated	0

c. **Goal:** Annually review and maintain a map of priority locations for dry weather field screening.

- Tracking measure: Changes, and rationale for changes, to priority locations.

In 2016, CWS reviewed the priority locations for dry weather inspections and shifted its focus from "significant outfalls" (based on pipe size or drainage area) to outfalls in areas that lack stormwater treatment. There are three rationales for this change. First, because these untreated areas do not have sumped catch basins or water quality manholes, they do not receive the same level of scrutiny as other areas during maintenance when illicit discharges may be detected during routine inspection. Second, an illicit discharge in an untreated area has a greater potential for environmental impact due to the lack of water quality treatment. Finally, several years of dry weather inspections at significant outfalls uncovered only one illicit discharge, which had previously been uncovered and addressed through the Fats, Oils, and Grease program. CWS generated a new list of 200 priority outfalls to be inspected from the set of outfalls in untreated areas. The list was divided into five groups by geographic area for ease of inspection during the permit term. During summer 2022, CWS continued to work through the list of priority outfalls. The locations of these priority outfalls are maintained in CWS' GIS database.

3. Report and Response Tracking System

a. **Goal:** Within one year of permit issuance have in place a system or approach meeting permit requirements.

- Tracking measure: Submit report on system status with the first MS4 Annual Report.

CWS developed and implemented a web-based system for tracking information on illicit discharges within its jurisdiction, as reported in the 2017 MS4 Annual Report. The system uses the proprietary Lucity asset management system and is integrated with CWS' GIS. Data tracked include complaints, referrals, investigation activities, actions taken to eliminate the discharge, and resolution, including dates.

4. Annual Training

a. **Goal:** Provide annual training for all co-implementer staff who clean and inspect MS4 components where signs of illicit discharges and connections could be observed. The training will cover identification of illicit discharges and connections and proper responses for reporting and responding to them.

- Tracking measure: Number of co-implementer staff attending annual training.

CWS provided training in illicit discharge recognition, response, and reporting as part of the annual wet weather training for CWS and co-implementer staff members who are involved in various aspects of stormwater management. The recorded training was offered online in an on-demand format.

RELATIONSHIP TO TMDLs

Bacteria: This BMP will reduce the human-related sources of bacteria by identifying and removing any cross connections or other illicit discharges of bacteria-contaminated water into the MS4.

Phosphorus: This BMP will reduce the discharge of organic matter into the MS4, which will result in the reduction of phosphorus.

Settleable Volatile Solids: This BMP will reduce the discharge of organic matter into the MS4 and into the streams directly, which will result in the reduction of sediment oxygen demand.

RELATED DOCUMENTS

- IDDE Program Description (2016)
- Environmental Services Industrial Pretreatment Program Enforcement Response Plan (2021)
- Clean Water Services Industrial Stormwater Program Implementation Manual (2021)

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BMP Fact Sheet: Industrial and Commercial Facilities

INTRODUCTION

The purpose of this BMP category is to reduce the discharge of pollutants from the MS4 by regulating select industrial and commercial facilities that discharge to the MS4. CWS' industrial stormwater program operates under a Memorandum of Agreement with DEQ to regulate facilities requiring the 1200-Z stormwater general permit. This BMP is accomplished by identifying facilities subject to industrial permitting requirements, reviewing permit applications and stormwater pollution control plans, conducting inspections, reviewing discharge monitoring data, providing technical assistance, and coordinating with DEQ on enforcement matters. In addition, CWS responds to site-specific information on commercial and industrial facilities that may discharge a significant pollutant load to the MS4.

MEASURABLE GOALS AND TRACKING MEASURES

1.a. **Goal:** Identify industrial facilities that need a 1200-Z stormwater general permit.

- Tracking measure: Number of newly permitted 1200-Z facilities in the service area.

  CWS continues to survey its service area for new 1200-Z facilities using the Sewer Use Information Card system. There were 69 1200-Z permitted facilities at the end of the reporting year. Two facilities submitted permit applications for a 1200-Z permit during the reporting year.

  CWS also responds to site-specific information regarding the discharge of pollutants from industrial and commercial sites.

b.(1) **Goal:** Conduct all of the 1200-Z facility inspections scheduled for the reporting year in the service area.

- Tracking measure: Number of 1200-Z permitted facility inspections scheduled for the reporting year; number of scheduled 1200-Z facility inspections conducted during the reporting year.

  CWS inspected 16 of 69 unique facilities this year, exceeding the target of inspecting 20 percent of permitted facilities each year, regardless of risk or priority. This total included five facilities identified through the use of a prioritization matrix to identify facilities with relatively higher risk of discharges of pollutants or compliance issues. Five of the 16 facilities triggered Tier II at the time of this report.

b.(2) **Goal:** Inspect all 1200-Z permitted facilities in the service area at least once during the permit term.

- Tracking measure: Annually report progress toward this goal and confirm final compliance in the 2020-21 Annual Report.

  Final compliance with achieving the goal of inspecting all 1200-Z permitted facilities in the service area at least once during the 1200-Z permit term was reported in the 2020-21 Stormwater Annual Report. DEQ has since reissued the 1200-Z permit effective July 1, 2021. Forty eight percent of the current 1200-Z permitted facilities have been inspected during the first two years of the reissued 1200-Z permit term. Final compliance with achieving the goal of inspecting all 1200-Z permitted facilities

at least once in the permit term will be reported in the 2025-26 Stormwater Annual Report.

c. **Goal:** Provide technical assistance if requested by owner/operator of a facility.

- Tracking measure: Number of technical assistance inspections performed in response to owner/operator requests.

  CWS performed one technical assistance inspection during the reporting period.

d. **Goal:** Issue "No Exposure" certifications to facilities that meet DEQ qualifying criteria.

- Tracking measure: Number of "No Exposure" certifications issued.

  No Exposure Certifications (NECs) are issued to facilities that would otherwise require a 1200-Z permit, but are requesting conditional exclusion by demonstrating that stormwater is not exposed to pollutants from industrial processes at the facility.

  - Total NECs in service area: 164
  - NECs reissued: 3 (five-year issuance period)
  - NEC reissuance denied: 1
  - Newly issued NECs: 3
  - Indentified sites to be evaluated for a NEC: 14
  - Former 1200-Z facilities that converted to NEC: 0

e. **Goal:** Review monitoring reports from all 1200-Z facilities.

- Tracking measure: Number of monitoring reports submitted and number reviewed.

  On July 1, 2021, DEQ reissued the 1200-Z permit, which requires quarterly monitoring reporting. CWS received and reviewed 274 quarterly Discharge Monitoring Reports for the 2022-23 reporting year. CWS reviewed all reports submitted by permittees. Eleven permittees failed to submit reports on time. Eight of the 11 permittees received warning letters and the other three were forwarded to DEQ for formal enforcement.

f. **Goal:** Identify facilities subject to section 313 of SARA Title III and not already covered by 1200-Z or other stormwater discharge permit and determine their potential to contribute a substantial pollutant loading to the MS4.

- Tracking measure: Number of unpermitted facilities identified through the annual review of the toxic release inventory (TRI).
- Tracking measure: Number of unpermitted facilities identified through the TRI review that were inspected, number determined to have potential to discharge a substantial pollutant loading, action taken.

  The most recent TRI data available are from the 2021 updated data list, released in May 2023. CWS reviewed the TRI on August 29, 2023. Of the facilities listed, 36 industries in our MS4 service area are on the TRI, 12 have 1200-Z permits, one has a 1200-A permit, 16 have No Exposure Certifications, two are no longer operating, two are outside the MS4, two do not discharge stormwater off-site, and one is a state Superfund site under DEQ oversight.

g. **Goal:** Reduce pollutants in stormwater discharges from facilities other than those with SIC codes requiring 1200-Z general permit coverage.

- Tracking measure: Number of facilities (other than those with 1200-Z-qualifying SIC codes) in our MS4 service area where site-specific information leads to a facility inspection, number of facilities determined to be contributing a significant pollutant load to the MS4, action taken.

  No facilities with non-1200-Z SIC codes were determined to be contributing a significant pollutant load to the MS4.

RELATIONSHIP TO TMDLs

Implementing this BMP and the 1200-Z permitting program reduces the potential discharge of all of the TMDL parameters.

RELATED DOCUMENTS

- MOA with DEQ to implement the 1200-Z program (2009)

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BMP Fact Sheet: Construction Site Runoff Control

INTRODUCTION

This BMP category requires the use of erosion prevention and sediment control BMPs and the prevention or control of the discharge of construction-related nonstormwater waste to reduce the discharge of pollutants to the MS4 from construction activities. CWS acts as DEQ's agent for the administration of the 1200-CN and 1200-C general permits and implements its own local program.

MEASURABLE GOALS AND TRACKING MEASURES

1. Erosion Prevention and Sediment Control (EPSC) Inspection and Enforcement

a. **Goal:** Conduct initial, regular, and final inspections for all active site development projects.

- Tracking measure: Annual number of site development inspections – initial, regular, and final.

Table CSRC-1a: Annual Number of Site Development Inspections

Jurisdiction	*Initial Inspections*	*Regular Inspections*	*Final Inspections*	*Total Inspections*
Clean Water Services	45	2,673	54	2,772
Beaverton	19	1,495	14	1,528
Cornelius	4	169	0	173
Forest Grove	9	274	5	288
Hillsboro	54	2,689	42	2,785
Sherwood	11	592	6	609
Tigard	32	1,680	26	1,738
Tualatin	7	460	12	479
Total	**181**	**10,032**	**159**	**10,372**

b. **Goal:** Conduct initial, regular, and final inspections for all active single lot construction sites.

- Tracking measure: Annual number of single lot construction inspections – initial, regular, and final.

Table CSRC-1b: Annual Number of Single Lot Construction Inspections

Jurisdiction	*Initial Inspections*	*Regular Inspections*	*Final Inspections*	*Total Inspections*
Clean Water Services	646	4,242	660	5,548
Beaverton	134	1,505	192	1,831
Cornelius	77	647	134	858
Forest Grove	98	415	114	627
Hillsboro	280	1,651	393	2,324
Sherwood	43	343	46	432
Tigard	214	1,487	191	1,892
Tualatin	27	12	15	54
Total	**1,519**	**10,302**	**1,745**	**13,566**

c. **Goal:** Implement an escalating enforcement system, which may include written warnings (e.g., Deficiency Notices or similar action), Stop Work Orders, and Civil Citations.

- Tracking measure: Annual number of enforcement actions – written warnings (e.g., Deficiency Notices or similar action), Stop Work Orders, and Civil Citations.

Table CSRC-1c: Annual Number of Enforcement Actions

Jurisdiction	*Deficiency Notices*	*Stop Work Orders*	*Civil Citations*
Site Development			
Clean Water Services	34	4	0
Beaverton	14	9	0
Cornelius	1	0	0
Forest Grove	5	0	0
Hillsboro	6	0	0
Sherwood	9	5	0
Tigard	58	4	0
Tualatin	0	0	0
Subtotal Site Development	**127**	**22**	**0**
Single Lot			
Clean Water Services	38	2	0
Beaverton	51	18	0
Cornelius	0	0	0
Forest Grove	19	2	0
Hillsboro	0	0	0
Sherwood	0	0	0
Tigard	37	1	0
Tualatin	0	0	0
Subtotal Single Lot	**145**	**23**	**0**
Total Enforcement Actions	**272**	**45**	**0**

2. Training and Outreach

a. **Goal:** Provide annual inspector training on erosion control techniques and enforcement measures for continuing education. Except for inspectors who have active EPSC certification that includes a continuing education requirement, require all erosion control inspectors to attend annual training on erosion control techniques.

- Tracking measure: Number of noncertified inspectors and number attending annual EPSC training.
- Tracking measure: Number of inspectors with active EPSC certification.

Table CSRC-2a: EPSC Training for Inspectors

Jurisdiction	*Noncertified Inspectors*	*Noncertified Inspectors Attending EPSC Training*	*Certified Inspectors**
Clean Water Services	0	0	9
Beaverton	0	0	5
Cornelius	0	0	1
Forest Grove	5	5	3
Hillsboro	2	2	5
Sherwood	0	0	3
Tigard**	0	0	2
Tualatin**	0	0	0
Total	**7**	**7**	**28**

Note: Certified inspectors have professional training requirements and do not require annual EPSC training.
* The number of inspectors in this column is the number at the beginning of the reporting year.
** Clean Water Services performs erosion control inspections in Tigard and Tualatin, therefore those cities' inspectors are not required to attend training.

- Tracking measure: List of annual training sessions conducted and participating agencies.

  Annual erosion control training was held June 8, 2023; 36 people from CWS and co-implementers attended. Some inspectors attended who were interested in a refresher class on the CWS local erosion control regulations, and others were required to attend because they didn't have a certification.

b. **Goal:** Provide annual notification of wet-weather requirements to active site development (i.e., not single family home construction) permit holders.

- Tracking measure: Number of site development permits active at the time when wet-weather notices are issued; annual number of wet-weather notices issued.

As shown in Table CSRC-2b, CWS and co-implementers notify multiple parties associated with each active site development permit (owner, developer, engineer, contractors). Each co-implementer determines which parties to notify, resulting in different numbers of notices being sent per site.

Table CSRC-2b: Annual Number of Wet-Weather Notices Issued

Jurisdiction	*Active Site Development Permits*	*Wet-Weather Notices Issued*
Clean Water Services/ Washington County	70	354
Beaverton	37	74
Cornelius	4	12
Forest Grove	7	29
Hillsboro	90	360
Sherwood	13	72
Tigard	30	60
Tualatin	30	114
Total	**281**	**1,075**

RELATIONSHIP TO TMDLs

Phosphorus: CWS' Construction Site Runoff Control program was established under the Tualatin Basin Rule (OAR 340-041-0345(4)) to meet the phosphorus allocations in the 1988 Tualatin TMDL.

Settleable Volatile Solids: Erosion prevention and sediment control BMPs significantly reduce the discharge of organic matter associated with soil erosion. Organic matter can result in increased sediment oxygen demand in the receiving waters.

RELATED DOCUMENTS

- Design and Construction Standards for Sanitary Sewer and Surface Water Management, Chapter 6 (2019)
- Erosion Prevention and Sediment Control Planning and Design Manual (2020)
- Construction Site Runoff Inspection Guidance (2023)

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BMP Fact Sheet: Education and Outreach

INTRODUCTION

The purpose of the Education and Outreach BMP category is to inform and educate the public, businesses, industries, and government about the causes of stormwater pollution, the effects on local streams and rivers, and to promote stream-healthy behavior. These BMPs encourage behavior change and participation that will reduce the discharge of pollutants from the MS4.

MEASURABLE GOALS AND TRACKING MEASURES

1. Education and Outreach Strategy

a. **Goal:** Following the CWS *Strategic Communications Plan,* educate the public on stormwater quality issues including the impacts of stormwater discharges and the actions the public can take to reduce pollutants in stormwater, the proper use and disposal of pesticides, and information for reporting illicit discharges. CWS will publish 12 monthly electronic newsletters per year and place inserts in customer bills five times per year covering one or more of these topics.

- Tracking measure: Summarize activities and participation on an annual basis, including the number of electronic newsletters published and billing inserts mailed during the year.

  CWS emailed and mailed *Water Words* billing inserts to nearly 58,000 customers and *Clean Water Words* billing inserts to an additional approximately 13,000 customers every other month. The inserts contained articles on watershed protection and enhancement, proper disposal practices, and reporting information for illicit discharges and water quality impacts. CWS sent *Clean Water Connection* e-newsletters to 3,864 subscribers each month. The e-newsletters contained articles on watershed protection and enhancement, proper disposal practices, and reporting information for illicit discharges and water quality impacts.

b. **Goal:** Following the CWS *Strategic Communications Plan,* carry out campaigns designed to change the behavior of the intended audience relevant to reducing stormwater pollution.

- Tracking measure: Annually track outreach campaigns being conducted and the intended audiences and behaviors targeted through those campaigns.

  The Regional Coalition for Clean Rivers and Streams (Coalition) has been working since the late 1990s to provide coordinated messaging about water health and residential behaviors linked to stormwater pollution from across the Portland metropolitan region in Washington, Multnomah, and Clackamas counties.

  The Coalition focuses its efforts to improve watershed health by changing household behaviors to reduce polluted runoff and connecting people with their local waterways. The Coalition focuses on changing behaviors from residential sources linked to stormwater pollution prevention. Information and messages used by the Coalition are intended to reach those making purchasing and management decisions about yard care, pets, and auto maintenance activities – some of the most likely sources of

stormwater pollution from residents. Coalition activities address a range of surface water contaminants, including nutrients and toxics from fast-releasing synthetic fertilizers and pesticides applied to yards and lawns, pollutant loads from car washing soaps, metals, and other toxics from vehicles, E. coli from pet waste, turbidity from eroded soils, and other contaminants from illicit discharges.

Representatives of member agencies promoted Coalition messages using Facebook, Instagram, YouTube, and Twitter primarily in spring and summer when residents have an increased interest in yard and garden activities relevant to surface water quality. The Coalition used social media to promote outreach activities including 30 in-person events with local watershed councils and community organizations, including river cleanups, restorations, educational workshops, and outdoor celebrations.

In July 2022, the Coalition promoted the winners of the Student Video Contest, which included youth in districts served by Clean Water Services, Portland, and Oak Lodge Water Services. Youths received local recognition and $500 for their achievement category. The 15 best student videos from three successive years of contests were added to the Coalition's YouTube channel.

In 2022-23, the Coalition began coordination efforts with Clearing Magazine and the Honoring Our Rivers Student Anthology of Art and Creative Writing program. It is an annual student art and poetry program celebrating Pacific Northwest rivers and watersheds. Its mission is to encourage stewardship of rivers and watersheds and to nurture the next generation of civic and conservation leaders by engaging the creative capacities of youth.

2. Pesticides/Herbicides/Fertilizers

a. **Goal:** Educate the public on the use of alternatives to pesticides, herbicides, and fertilizers through the annual public awareness campaign.

- Tracking measure: Summarize awareness campaign activities and participation regarding the use of alternatives to pesticides, herbicides, and fertilizers on an annual basis.

  CWS' outreach campaign included the following elements:

  - Website, cleanwatergrow.com, promoting the use of Clean Water Grow®, a stream-friendly slow-release fertilizer.
  - Product and retailer promotion to CWS' 600,000+ ratepayers through billing inserts.
  - Donations to local fundraisers and gardening clubs
  - Shelf talkers and rack cards distributed with sample packets at public events.
  - Web and social media sharing GROW photos, gardening tips, and information on its positive environmental impact.

- Retailer support including product displays, social media marketing, and sale of product at three regional retail locations.
- Environmental industry and civic promotion through customer billing inserts and newsletters.

b. **Goal:** Educate the public on the use of native plants by distributing 500 copies of the *Gardening with Native Plants* brochure.

- Tracking measure: Summarize outreach efforts and participation regarding the use of native plants on an annual basis, including the number of *Gardening with Native Plants* brochures distributed.

  CWS mailed 100 copies of the *Gardening with Native Plants* brochure to new customers and in response to email and phone requests. The brochure is also available as a download from the CWS website. CWS distributed 250 brochures at in-person community events and at the Fernhill Visitor Station.

  CWS distributed *Water Words* and *Clean Water Word*s billing inserts to 71,000 customers and *Clean Water Connection* e-newsletters to 3,864 subscribers throughout the reporting year and conducted public education programs including the Tualatin River Rangers program. These programs and materials teach watershed protection and enhancement, proper disposal practices, and reporting information for illicit discharges and water quality impacts, including the use of native plants.

3. Effectiveness Evaluation and Adaptive Management

a. **Goal:** Assess and improve the effectiveness of CWS' *Strategic Communications Plan* by collecting data on program effectiveness, analyzing the data to determine the effectiveness of CWS' educational and behavioral change efforts, identifying programmatic changes to improve outcomes, and implementing those improvements. Conduct a customer survey every two years. Annually use the Logic Model (or other appropriate process) to evaluate the effectiveness of at least one program in CWS' *Strategic Communications Plan.* Identify and implement needed revisions.

- Tracking measure: Report on status of biannual customer survey and the application of the Logic Model.
- Tracking measure: Track changes made to the public education program as a result of customer surveys and the Logic Model.

  Customer Awareness and Satisfaction Survey: The survey examines the demographics of the service district, customer expectations, values, and needs to help CWS create more effective messaging campaigns. CWS last conducted a Customer Awareness and Satisfaction survey in December 2020 and planned to conduct the next survey in July 2023. CWS did not conduct the survey in 2022 because of the impacts of the COVID-19 pandemic and limited resources. Findings will be presented to the CWS Business Partners, Clean Water Services Advisory Commission, CWS' Board of Directors, and to the public in FY 2023-24.

Application of the Logic Model: This year CWS applied the Logic Model to its River Rangers program. CWS continued in-person River Ranger presentations during the 2022-23 school year but also provided virtual resources produced during distance learning. CWS continued to collect pre- and post-instruction student evaluations for the River Rangers program to better understand if students learn new information from the presentation and are inspired to make changes to support a healthy watershed. A summary of the process, results, and steps for adaptive management are below.

River Rangers, Classroom Program	
Evaluation	• Pre-instruction evaluation • Post-instruction evaluation
Notes	In-person River Ranger presentations continued in the 2022-23 school year. Virtual River Ranger program materials developed during distance learning (lesson plan, video presentations, and extension lessons) were shared with 500+ teachers via the virtual Children's Clean Water Festival website and email outreach.
Results	1,192 students from 26 schools participated in in-person River Ranger classroom presentations. 503 students took the pre-assessment before the presentation while 205 students took the post-assessment after the presentation. Awareness of the Tualatin River and storm drains flowing to the river improved by 40% and 47% respectively after presentations. Knowledge before presentations was relatively low, and repetition of key concepts remains important to long-term understanding.
Recommendations for adaptive management	• Continue to utilize digital content developed during distance learning as pre/post-lesson extension. • Continue to email teacher the day before the presentation and the day of the presentation to remind of pre- and post-assessment. • Continue to focus content on the Tualatin River and the fact that storm drains lead to the Tualatin River. • Seek additional opportunities to engage students who have participated in River Rangers in other field and classroom programs to reinforce key concepts. • Seek additional opportunities to extend messages and concepts through student participation in partner delivered education programming.

Adaptive Management Plan			
Step	*Description*	*Capacity Needed*	*Time Frame*
1	Review River Ranger assessment results to meet learning goals	Staff – 2 hours	Summer 2023
2	Adapt River Ranger program content as necessary	Staff – 4 hours	Summer/Fall 2023
3	Refine teacher communication	Staff – 1 hour	Fall 2023
4	Train staff on content adaptation, assessment delivery	Staff – 3 hours	Fall 2023
5	Collect student assessment and teacher program evaluation	Staff – 10 hours	2023-24 school year
6	Review results, adapt program	Staff – 6 hours	Annually

4. Employee Training

a. **Goal:** Conduct training for CWS and co-implementer employees associated with stormwater management.

b. **Goal:** Include training in recognition and reporting of illicit discharges.

c. **Goal:** Conduct annual training session for CWS and co-implementer personnel on water quality facility design.

- Tracking measure: List of annual training sessions on stormwater management, recognizing and reporting illicit discharges, and design of water quality facilities, participating agencies, and number of staff attending training sessions.

  CWS provided training in illicit discharge recognition, response, and reporting as part of the annual wet weather training for CWS and co-implementer staff members involved in various aspects of stormwater management. In 2023, the training was offered online in an on-demand format.

  On June 7, 2023, CWS held a virtual training on inspection, assessment, and proper maintenance of water quality facilities; 19 CWS and co-implementer staff members attended. On June 14, 2023, 29 CWS and co-implementer staff members participated in a training on design of stormwater management facilities.

5. Education Regarding Illicit Discharges

a. **Goal:** Ensure that CWS and co-implementer websites facilitate public reporting of illicit discharges and water quality problems.

- Tracking measure: Summarize annual progress on developing user-friendly web-based methods for facilitating public reporting of illicit discharges and water quality problems.

  The "Report a Problem" page on the CWS website had 1,353 unique views. CWS and other co-implementers' websites facilitate public reporting of illicit discharges by providing telephone numbers and email addresses for the public to use to report illicit discharges. Below is a list of reporting mechanisms on each co-implementer city's website.

  Beaverton
  - Report a Problem (on homepage as major link under "How Do I…" menu header)
  - A number of questions on their FAQs point to the number to call

  Hillsboro
  - Contact Us – Sewer/Streets/Signals (link within Public Works section)
  - "How Do I…" link on all pages can be used
  - "Report a Stormwater System concern" link on storm sewer page

  Tigard
  - Public Works Service Request (link on Public Works page)
  - Report "Water/Sewer Issue" link available under "Help me to…"

Tualatin

- Contact information on sidebar of Public Works and Contact Us pages
- Contact information on "Sewer Maintenance" page

Cornelius

- Storm Drain page provides contact number
- Email form for reporting concerns

Forest Grove

- Contact Us form
- Public Works contact information

Banks

- Contact Us form
- Public Works emergency contact

Durham

- Contact information link on homepage

Sherwood

- Public Works contact info through City Offices under "Online Services"
- Submit a concern under "Online Services"

North Plains

- Contact info under Public Works page
- Street and Storm drains contact under "Street and Storm Drains" page; Public Works Director listed on "Contact Us" page

King City

- PDF complaint form
- Citizen Problem Reporter
- Contact us page

b. **Goal:** Use a variety of outreach tools (i.e., print, electronic, and other media) to promote proper disposal of oil, household hazardous waste, litter, and yard debris in billing inserts, print and electronic newsletters, and websites.

- Tracking measure: Summarize outreach related to disposal activities on an annual basis.

  CWS sent *Water Words* and *Clean Water Word*s billing inserts to 71,000 customers every other month. Issues contained articles on proper disposal of oil, household hazardous waste, litter, and yard debris.

  CWS sent *Clean Water Connection* e-newsletters to 3,864 subscribers each month. Each issue contained articles on proper disposal of oil, household hazardous waste, litter, and yard debris.

  CWS' website gets an average of 23,702 views from approximately 8,176 unique visitors per month and contains information on proper disposal of oil, household hazardous waste, litter, and yard debris.

c. **Goal:** Conduct the storm drain marking program and distribute educational door hangers regarding the proper disposal of yard debris and toxic materials.

- Tracking measure: Number of drains marked and door hangers distributed.

  Ten volunteers placed 53 storm drain markers and 310 door hangers in Hillsboro, Beaverton, and Garden Home.

RELATIONSHIP TO TMDLS

Phosphorus: Public education regarding how to use products containing phosphorus is critical to the overall reduction in phosphorus in the watershed.

Bacteria: Public education about pet waste management and feeding waterfowl, such as ducks and geese, and other wildlife is important to reducing the concentration of bacteria in stormwater discharges. CWS' strategy to reduce bacteria is greatly dependent on this BMP.

Settleable Volatile Solids: Public education and awareness activities are very important to reducing the loading of settleable volatile solids from the MS4. These include education about the proper use of landscaping materials, leaf disposal, etc.

RELATED DOCUMENTS

- Strategic Communications Plan (Clean Water Services, 2015)

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BMP Fact Sheet: Public Involvement and Participation

INTRODUCTION

The purpose of this BMP category is to provide the public the opportunity to participate in the development, implementation, and modification of the MS4 program. In place of measurable goals and tracking measures for this BMP, the annual report describes CWS' public involvement activities during the reporting year.

CWS uses a documented stakeholder engagement process (STEP) to ensure that CWS project and policy decisions are made with appropriate input from stakeholders. STEP is required for complex or controversial projects and policy decisions. Including stakeholders throughout the decision-making process builds credibility and saves CWS resources. Supervisors are responsible for ensuring appropriate staff members are trained to use STEP and that it is used as required.

PUBLIC INVOLVEMENT DURING THE REPORTING YEAR

CWS posted its 2022 Stormwater Annual Report to its public website.

CWS receives input and guidance on its policies and programs from the Washington County Board of Commissioners serving as the CWS Board of Directors (Board). Staff also provides in-depth updates and education to the Board in periodic training sessions. In FY 2022-23, staff shared information about the Butternut Creek Stormwater Enhancement Project, the climate action roadmap, and the Natural Hazard Mitigation Plan.

CWS receives public input on its policies and programs from the Clean Water Services Advisory Commission (CWAC), which holds monthly meetings that are open to the public. The 15 members of the commission are appointed by the Board to represent neighborhood, business, development, environmental, and agricultural interests. CWS gave presentations on the NPDES permit renewal and provided opportunity for public input. Staff also notified CWAC via email when DEQ posted the draft permit and invited comments. The presentations and supporting documents are posted on the CWS public website.

For the first time, CWS participated as a separate jurisdictional entity in the 2023 update of Washington County's Natural Hazard Mitigation Plan. CWS' portion of the County plan addresses the impact of natural hazards on utility operations and infrastructure including sewer and stormwater pipelines, pump stations, water resource recovery facilities as well as regional water quality and detention facilities. Hazards addressed in the plan include dam failure, drought, earthquake, extreme heat, flood, landslides, volcanic ash, wildland fire, windstorm, and winter storms.

CWS staff gave two presentations on the Natural Hazard Mitigation Plan to CWAC. The CWS section was posted for comments (via a questionnaire) on the Washington County Emergency Management Cooperative website from February 16 to March 5. Notice of availability of the NHMP and CWS section was publicized through the CWS website and social media accounts, in addition to notices distributed by other plan participants including Washington County.

CWS received and responded to oral and written comments before submitting it to FEMA for review and approval. The contents and status of the CWS Annex were also shared periodically with the CWS NPDES permit co-implementers group.

BMP Fact Sheet: Post-Construction Site Runoff and Retrofit Programs

INTRODUCTION

The purpose of this BMP category is to reduce the discharge of pollutants from the MS4 by developing and applying appropriate design and construction standards for development and by constructing capital improvements in previously developed areas.

MEASURABLE GOALS AND TRACKING MEASURES

1. Development Services

a. Goal: Implement Design and Construction Standards that require water quality facilities to be built as part of new development and redevelopment with a goal to provide treatment for 100 percent of impervious areas from new and redevelopment areas (that meet impervious area thresholds) with the exception of the fee-in-lieu projects.

- Tracking measure: New development area (in acres) added annually within the service area.
- Tracking measure: New redevelopment area (in acres) added annually within the service area.
- Tracking measure: New development area (in acres) added annually with structural controls within the service area.
- Tracking measure: New redevelopment area (in acres) added annually with structural controls within the service area.

Table PCSRR-1a(1): Developed and Redeveloped* Area Added with Structural Controls

Jurisdiction	*Developed and Redeveloped Area Added (acres)*	*Developed and Redeveloped Area Added with Structural Controls (acres)*
Clean Water Services	131.86	131.51
Beaverton	83.3	77.8**
Cornelius	14	13.8**
Forest Grove	64.3	64.3
Hillsboro	943.5	943.5
Sherwood	56.01	55.09**
Tigard	56.4	56.4
Tualatin	20.7	20.7
TOTAL	**1,370.07**	**1,363.1****

* CWS' *Design and Construction Standards* do not distinguish between development and redevelopment projects, so they are not tracked separately.

** The difference between area added and area with structural controls represent fee-in-lieu.

- Tracking measure: Percentage of the service area served by structural controls.
- Tracking measure: Percentage of all areas developed or redeveloped annually that is served by structural controls.

Table PCSRR-1a(2): Structural Controls	
Service area, in acres*	79,385
Total area served by structural controls, in acres	28,452
Percentage of service area* served by structural controls	36%
Developed and redeveloped area added annually, in acres	1,370
Percentage of developed and redeveloped areas added annually served by structural controls	99%**

* The total MS4 area, which includes undeveloped areas.

** Areas added that were not served by structural controls met treatment requirements through payment of a fee-in-lieu.

The "Total Area Served by Structural Controls" above represents the acreage served by public and private structural controls (i.e., water quality facilities). There are over 5,500 public and private water quality facilities in the CWS service area. To conduct the Waste Load Allocation Attainment Assessment and TMDL Pollutant Load Evaluation, it was necessary to have data regarding the attributes of the water quality facilities (location, type, and acreage served). These data were available for many water quality facilities and were used in conducting the waste load allocation attainment assessment. However, because of the age of the CWS structural control program, which began in 1991 and predates the MS4 program, and the number of jurisdictions that administer it, comprehensive data regarding water quality facilities in the service area is not available.

CWS continues to work with the co-implementers to improve the quality of the data associated with water quality facilities. Additionally, CWS implements a program to inspect private water quality facilities to ensure they are operated and maintained properly. As part of this program, CWS gathers data including location, type, and acreage served by the private water quality facility. CWS anticipates that the future waste load allocation attainment assessments will include improved water quality facilities data and will provide a better assessment of the scope of structural controls implemented in the service area and their effectiveness.

- Tracking measure: Track all structural controls implemented annually by location, type, and drainage area served.

  The co-implementers track structural controls that are implemented through development, redevelopment, and retrofits using GIS or other mapping systems that record the location, type, and area treated by structural controls.

2. Low Impact Development Approaches (LIDA)

a. **Goal:** Increase the use of LIDA through entering into two public/private partnerships on LIDA projects each year, including one under the School LIDA program. (CWS seeks to complete one project each year through the School LIDA program. Since a school or school district must decide to participate in the program, the goal for this program is to actively seek and develop appropriate projects rather than complete a specified number.)

- Tracking measure: Annual number of LIDA facilities implemented and the type of facility.

Table PCSRR-2a(1): LIDA Sites

Jurisdiction	*Type of Controls*	*Number of LIDA Sites*
Clean Water Services	Extended dry basin, vegetated swale, LIDA swale, rain garden, infiltration planter, flow-through planter, vegetated filter strip, porous pavement	14
Beaverton	Extended dry basin, infiltration planter, flow-through planter	3
Cornelius	Vegetated swale, extended dry basin, rain gardens, filterra	5
Forest Grove	Extended dry basin, vegetated swale, flow-through planter	6
Hillsboro	Extended dry basin, vegetated filter strip, green roof, vegetated swale, LIDA swale, infiltration planter, flow-through planter	11
Sherwood	Flow-through planter, street side planter, LIDA swale, extended dry basin, vegetated swale	3
Tigard	Extended dry basin, LIDA swale, vegetated swale, flow-through planter, rain garden, vegetated filter strip	13
Tualatin	Extended dry basin, vegetated swale, rain garden, filter strip, flow-through planters	4
Total LIDA Sites Added		**59**

- Tracking measure: Annual number of public/private partnerships formed to perform LIDA projects.

  As noted in the *2020 Stormwater Annual Report*, CWS ended the School LIDA and LIDA public/private partnership initiatives. These programs were instituted to encourage the use of LIDA at a time when LIDA was a novel innovation that needed to be promoted; it was not required by the CWS *Design and Construction Standards*. Since that time, the use of LIDA has matured and is now prioritized in the *Design and Construction Standards*.

- Tracking measure: Description of School LIDA outreach and project development efforts during the year.

  As noted above, the District ended the School LIDA initiative. CWS will continue the Tualatin River Rangers program that educates students on stormwater issues, and will work with schools that wish to create LIDA facilities on their grounds as opportunities arise.

b. **Goal:** Provide technical assistance through the *LIDA Guidance Manual.*

- Tracking measure: Revision of the *LIDA Guidance Manual* within two years of permit issuance.

  CWS revised its *Low Impact Development Approaches Handbook* in June 2021.

RELATIONSHIP TO TMDLs

Phosphorus: The CWS *Design and Construction Standards* for water quality facilities are designed for phosphorus removal from 100 percent of the impervious area from newly constructed impervious surfaces that meet the thresholds for requiring treatment.

Settleable Volatile Solids: Structural controls can reduce the discharge of settleable volatile solids through various detention and retention processes.

RELATED DOCUMENTS

- Design and Construction Standards for Sanitary Sewer and Surface Water Management (2019)
- Low Impact Development Approaches Handbook (2021)

BMP Fact Sheet: Pollution Prevention for Municipal Operations

INTRODUCTION

The purpose of this BMP category is to reduce the discharge of pollutants to the MS4 from a variety of municipal operations.

MEASURABLE GOALS AND TRACKING MEASURES

1. Street Sweeping

a. Goal: Sweep public curbed streets 12 times per year.

- Tracking measure: Curbed street miles swept and total number of curbed street miles; and amount of material collected.

Table PPMO-1: Street Sweeping

Jurisdiction	*Curbed Street Miles*	*Curbed Street Miles Swept*	*Amount of Material Collected, Cubic Yards*
Clean Water Services	931	11,172	2,114
Beaverton	442	5,304	501
Cornelius	82	984	288
Forest Grove	136	1,632	714
Hillsboro	508	6,096	1,385
Sherwood	112	1,344	613
Tigard	328	3,751 [1]	968
Tualatin	158	1,896	1,484
Total	**2,697**	**32,179**	**8,067**

[1] The contractor that the City of Tigard uses to sweep streets fell slightly short of the required frequency. City of Tigard staff will monitor their contractor more closely and emphasize the importance of meeting the specified frequency.

2. Integrated Pest Management

a. **Goal:** Conduct one annual training session related to the CWS Integrated Pest Management program.

- Tracking measure: Report date of IPM training

  CWS provided in-person training on the CWS Integrated Pest Management program as outlined in Table PPMO-2a.

Table PPMO-2a: IPM Training

Date	*Location*	*Attendees*	*Audience*	*Type*
12/15/2022	CWS ABC	19	CWS leadership staff	Emerald ash borer (EAB) biology and management strategy
1/11/2023	CWS ABC	15	Clean Water Advisory Committee (CWAC)	EAB biology and management
2/14/2023 - 2/16/2023	CWS ABC, Fernhill	58	CWS staff, regional partner organizations, Oregon Department of Agriculture, Oregon Department of Forestry	EAB biological control training
2/17/2023	Fernhill, field sites	36	CWS staff, regional partner organizations, Oregon Department of Agriculture, Oregon Department of Forestry	Slowing Ash Mortality (SLAM) training
9/20/2023	CWS ABC	24	CWS staff	EAB education for CWS Regional Utility Services department staff
3/21/2023	CWS Field Operations	16	CWS Field Operations staff	EAB identification training
4/12/2023	Hillsboro	6	Public	Tualatin Watershed weed identification training
4/20/2023	CWS ABC	12	CWS staff	CWS EAB response team
6/27/2023	CWS Field Operations	16	CWS staff	Invasive plant identification
Total		**190**		

b. **Goal:** All pesticide applicators employed by co-implementers in positions potentially impacting the MS4 will be licensed as required.

- Tracking measure: Report number of state licensed applicators employed by each co-implementer. See Table PPMO-2b.

Table PPMO-2b: Licensed Pesticide Applicators

Jurisdiction	*Number of State Licensed Applicators Employed*
Clean Water Services [1]	1
Beaverton	14
Cornelius	2
Forest Grove	10
Hillsboro	27
Sherwood	7
Tigard	7
Tualatin	9
Washington County	3
Total	80

[1] Clean Water Services uses contractors for pesticide application

c. **Goal:** Keep the CWS IPM program current by annually evaluating pesticides and surfactants for efficacy and potential ecological effects and evaluating pests and pest control measures.

- Tracking measure: Documentation of annual evaluation.

  In Fiscal Year 2022-23, CWS reviewed new herbicides, surfactants, and other adjuvants in use by CWS or CWS contractors and made the following changes to the IPM:

  Additions:
  - Clethodim 2EC (Cleanse™, Select Max™, Section 3™)
  - Imazamox (ammonium salt) (Clearcast™)
  - Emamectin benzoate (Tree-Age G4™, Tree-Age R10™, Mectinite)
  - Azadirachtin (Neem Oil)
  - Surfactant: Organosilicone (SYL-TAC-EA, Freeway™)
  - Food-grade colorant: Dynamark™ U.V.

  Deletions:
  - Glyphosate formulation with the trade name Rodeo™ (discontinued by manufacturer)

  The IPM is located on the CWS public website at cleanwaterservices.org/wp-content/uploads/2022/05/integrated-pest-management-plan.pdf.

Annual Pest Review: CWS conducts an annual review of its pest lists to identify new noxious weeds, insect pests, or other organisms that pose a threat to the watershed's health. In 2023, no new plant pests were added to or removed from the CWS Invasive Plants Species list.

CWS updated the pesticide applicator's checklist on page 10 of the IPM document. The windspeeds in item 4 of the checklist were changed from 5 miles per hour to 15 miles per hour. This change was suggested by a 2019 University of Florida IFLAS publication on managing pesticide drift to more accurately reflect current science and practice for applicators in the field.

CWS also added a section to the IPM to address the EAB since it was discovered in CWS' service area on July 11, 2022. The EAB is expected to be fatal to most native Oregon ash and many nonnative cultivated ash within the Tualatin basin. To address the management of the forest pest (which to date cannot be eliminated), CWS has outlined a basic management strategy using best management practices applied and tested in 35 other states and Canada.

CWS is collaborating in local EAB management by participating in the EAB statewide task force and leading a local EAB response effort, which includes Metro, the Tualatin Soil and Water Conservation District, Tualatin Hills Park & Recreation District, City of Hillsboro, and the Oregon Department of Forestry.

CWS has planted Oregon ash for stream restoration and as part of the riparian planting portion of the water quality credit trading program for temperature. CWS' strategy going forward includes developing an altered plant pallet for use in stream restoration efforts and for interplanting at existing sites in advance of the loss of Oregon ash due to the EAB.

Annual Pesticide Review: As part of the annual review, CWS updates new pesticides using information supplied by CWS staff, other partner organizations engaged in similar activities, and contracted professional applicators. As mentioned above, CWS updated its IPM in 2023.

3. Stormwater Management at Municipal Facilities

a. **Goal:** Within one year of the permit issuance date, develop an inventory of municipal facilities that treat, store, or transport municipal waste.

b. **Goal:** Within two years of the permit issuance date, develop a strategy to reduce the impact of stormwater runoff from these facilities.

- Tracking measure: Status of the municipal facility inventory and stormwater management strategy development.

  There are no municipal facilities in the CWS service area dedicated to treatment, storage, or transport of municipal wastes; the treatment, storage, and transport of municipal waste from residential, commercial, and industrial sources is handled by private contractors. Solid wastes that are generated during maintenance of public facilities such as parks and open spaces may be temporarily stored at municipal yards managed by co-implementers. These yards have Stormwater Pollution Control Plans in place that include BMPs to reduce the discharge of pollutants in stormwater.

Because there are no municipal facilities in the CWS service area that treat, store, or transport municipal wastes, there is no need to develop a strategy to manage their stormwater. The incidental, temporary storage of wastes at municipal yards is subject to existing Stormwater Pollution Control Plans.

4. Firefighting Training

a. **Goal:** Within one year of permit issuance develop a list of fire department contacts, make initial contact, establish working groups, and identify firefighting training facilities and practices with the potential to discharge pollutants to the MS4.

b. **Goal:** Within two years of permit issuance, in collaboration with fire department personnel, develop best practices to reduce the discharge of pollutants from firefighting training and develop a plan for implementing these practices, including methods to confirm their implementation.

c. **Goal:** Within three years of permit issuance, implement the identified best practices.

- Tracking measure: Annual update of the status of firefighting training pollutant reduction strategy.

  In the 2018-19 reporting year CWS worked with Michael Kinkade, Fire Chief for Forest Grove and Cornelius and Chief of the Washington County Fire Defense Board, to develop BMPs applicable to firefighting training practices. This approach allowed CWS to efficiently reach out to all fire department decision-makers through an existing forum, rather than working with individual fire departments. The Fire Defense Board approved a list of BMPs on March 15, 2018, which was included in firefighting training materials.

  The Tualatin Valley Fire & Rescue North Operating Center at 209th and Blanton in Aloha, identified in the 2017 MS4 Annual Report as having the potential to discharge pollutants to the MS4, ceased training operations. With this change, there are no identified firefighting training facilities that discharge to CWS' MS4.

5. Outfall Retrofits

a. Goal: Complete five outfall retrofit projects during the five-year permit term.

- Tracking measure: Identify the number of outfall retrofit projects in planning, design, construction, or completed; the phase of each project during the year; and the treatment BMP used, including locations and area treated by the retrofit. Report the cumulative number completed during the permit term.

Table PPMO-5a(1): Outfall Retrofit Projects, Details [1]

Project Name	*Treatment BMP Used*	*Project Stage*	*Area Treated With Retrofit, Acre [2,3]*
Hillsboro: 2 Outfall Retrofit Projects			
NE 12th Avenue Storm System Improvement	Proprietary treatment system	Construction	0
Minter Bridge Storm Sewer Regional WQ Facility and Outfall	Extended dry pond	Design	0
Tualatin: 3 Outfall Retrofit Projects			
SW 95th Ave, SW Avery Street and SW 93rd Avenue	Streetside LIDA swale	Complete	0.15
Sandalwood Swale	Vegetated swale	Design	0
Herman Road Expansion	LIDA swales	Design	0
Total area treated by retrofits in 2022-23, acres: 0.15			

[1] Clean Water Services, Beaverton, Forest Grove, Cornelius, Tigard, and Sherwood did not work on any outfall retrofit projects this year.

[2] "Area treated" represents the area treated after the retrofit, including the area previously treated and new.

[3] A "0" in this column indicates projects that are in planning, design, or construction phases and not complete at the end of the reporting year. Area treated will be added in future reports when the project is complete.

Table PPMO-5a(2): Outfall Retrofit Projects, Summary

Total area treated with retrofits this year, acres	0.15
Total retrofit projects in process this year	5
Total retrofit projects completed this year	1
Total cumulative retrofit projects completed during permit term	1

6. Catch Basin Retrofits

a. **Goal:** Retrofit or reconstruct 375 existing catch basins during the five-year permit term to include improvements for water quality.

- Tracking measure: Number of existing catch basins that were retrofitted or reconstructed to include improvements for water quality during the year and cumulatively during the permit term.

Table PPMO-6a(1):
Catch Basins Retrofitted or Reconstructed for Water Quality

Jurisdiction	*Catch Basins Retrofitted*
Clean Water Services	35
Beaverton	39
Cornelius	7
Forest Grove	2
Hillsboro	20
Sherwood	2
Tigard	0
Tualatin	5
Total 2022-2023	110
Total 2023-2024	-
Total 2024-2025	-
Total 2025-2026	-
Total 2026-2027	-
Total cumulative retrofitted catch basins during permit term[1]	**110**

[1] The permit term encompasses the stormwater reporting period of July 1, 2022, through June 30, 2023.

In addition to the outfall and catch basin retrofits listed above, several water quality manholes were also retrofitted this year, as shown in Table PPMO-6a(2).

Table PPMO-6a(2):
Water Quality Manholes Retrofitted or Reconstructed for Water Quality

Jurisdiction	*Manholes Retrofitted*	Area Treated With Retrofit, Acres
Clean Water Services	0	0
Beaverton	3	7.4
Cornelius	0	0
Forest Grove	0	0
Hillsboro	3	27.8
Sherwood	0	0
Tigard	0	0
Tualatin	0	0
Total 2022-2023	**6**	**35.2**

7. Winter Operations and Maintenance Program

a. Goal: Limit impacts to water quality to the degree practicable from winter operations and maintenance activities of public roadways.

- Tracking measure: Materials used, number of winter weather events where winter maintenance materials are used, quantities, and general location of each material used in relation to distance (e.g., pounds per mile), and any other actions taken to protect waters of the state for areas where that data is available or becomes available during the permit term.

Table PPMO-7: Winter Operations and Maintenance

Jurisdiction	*Winter Weather Events* [1]	*Sand (Tons)*	*Magnesium Chloride (Gallons)*	*Salt (Pounds)*
Clean Water Services [2]	N/A	N/A	N/A	N/A
Beaverton	3	102	800	0
Cornelius	0	0	0	0
Forest Grove	2	19.2	700	0
Hillsboro	8	60	7,000	0
Sherwood	8	63	1,450	0
Tigard	1	45	600	0
Tualatin	10	202.3	4,100	0
Washington County	14	1,500	6,000	0
Total	**46**	**1,991.5**	**20,650**	**0**

[1] Number of winter weather events where co-implementers chose to apply winter weather maintenance materials to public roadways.

[2] CWS is not responsible for maintaining public roadways. No tracking measures to report.

Co-implementers take additional precautions to protect waters of the state by applying best management practices for routine road maintenance, sweeping prior winter weather events, sweeping soon after winter weather events where sand is applied, and not applying magnesium chloride to wet roads or when rain is forecasted.

RELATIONSHIP TO TMDLS

Phosphorus: Street sweeping, outfall retrofits, and catch basin retrofits remove phosphorus-bearing sediments.

Bacteria: Addressing discharges from municipal yards through Stormwater Pollution Control Plans reduces the discharge of bacteria from these sites.

Settleable Volatile Solids: Street sweeping, outfall retrofit, and catch basin retrofits will reduce the discharge of settleable volatile solids.

RELATED DOCUMENTS

- Sanitary Sewer and Surface Water Management Work Programs, Performance Standards, Priorities, and Policies (R&O 07-46 and as amended by RO 08-21, RO 09-21, RO 10-13, RO 11-7, RO 17-6, and RO 18-11) (2018)
- Integrated Pest Management Plan (2023)

BMP Fact Sheet: Stormwater Management Facilities Operations and Maintenance Activities

INTRODUCTION

The purpose of this BMP category is to reduce the discharge of pollutants from the MS4 by implementing appropriate operations and maintenance practices for both public and private stormwater management facilities.

MEASURABLE GOALS AND TRACKING MEASURES

1. Public Water Quality Facility Inspections and Maintenance

a. **Goal:** Maintain public vegetated water quality facilities to ensure functionality of facilities through an average of four annual maintenance visits per facility.

- Tracking measure: Number of water quality facility maintenance visits, total number of water quality facilities, total maintenance hours spent.

  As provided in the SWMP, this Goal and Tracking Measure were replaced beginning in the third annual reporting period (July 1, 2018), with Goal 1.b.iii and Tracking Measure 1.b.ii.

b. **Goal:** Ensure the continued efficient maintenance of the functionality of public vegetated water quality facilities by developing and implementing an outcome-based performance standard.

i. By the end of the first complete annual reporting period (June 30, 2017), evaluate all public water quality facilities to determine their need for routine or nonroutine maintenance.

ii. By the end of the second annual reporting period (June 30, 2018), complete development of an outcome-based performance standard for inspecting and maintaining public water quality facilities. The performance standard will include criteria and methods for evaluating the status of public water quality facilities and will require facilities to be characterized as needing either continued routine maintenance or requiring nonroutine maintenance. The performance standard will require facilities needing nonroutine maintenance to be assessed for their specific needs, prioritized and scheduled for corrective measures.

iii. Begin implementing the performance standard in the third annual reporting period (July 1, 2018).

- Tracking measures:

i. Report the status of program development and implementation.

Program status: As reported in the 2017 Stormwater Annual Report, Goal 1.b.i was met through CWS and co-implementers assessing the maintenance needs of their public vegetated water quality facilities. As reported in the 2018 Stormwater Annual Report, Goal 1.b.ii was met on May 22, 2018, when CWS' Board of Directors formally amended the Sanitary, Storm, and Surface Water Management Performance and Reporting Standards to incorporate the outcome-based performance standard by

adopting Resolution and Order 18-11. CWS began implementing the new performance standard on July 1, 2018. Pursuant to the SWMP, beginning with the third annual reporting period (July 1, 2018), Goal 1.a. was replaced by Goal 1.b.iii and Tracking Measure 1.a was replaced by Tracking Measure 1.b.ii.

ii. Number of public water quality facilities, number of public water quality facilities assessed for maintenance needs, number found to need nonroutine maintenance.

CWS and co-implementers assessed their public vegetated water quality facilities for maintenance needs during the reporting year, as documented in Table O&M-1b.

Table O&M-1b: Assessment of Public Vegetated Water Quality Facilities

Jurisdiction	*Public Water Quality Facilities*	*Public Water Quality Facility Assessments*[1]	*Public Water Quality Facilities Needing Nonroutine Maintenance*
Clean Water Services	982	1,024	22
Beaverton	224	224	4
Cornelius	33	66	3
Forest Grove	39	39	0
Hillsboro	274	675	0
Sherwood	127	127	20
Tigard	200	200	46
Tualatin	97	97	34
Washington County	2	2	1
Total	**1,978**	**2,454**	**130**

[1] Assessments in excess of the number of facilities indicate multiple visits to the same facility.

c. **Goal:** Inspect and maintain all public proprietary water quality facilities once per year per manufacturer's specifications to ensure functionality.

- Tracking measure: Total number of public proprietary water quality facility maintenance visits and the total number of public proprietary water quality facilities within the service area.

Data on the tracking measure for Goal 1.c are in Table O&M-1.

d. **Goal:** Replace filters in proprietary filter treatment systems as needed.

- Tracking measure: Number of systems renewed.

Data on the tracking measure for Goal 1.d are in Table O&M-1.

e. **Goal:** Clean all public water quality manholes twice per year.

- Tracking measure: Number of public water quality manholes cleaned, and total number of public water quality manholes within the service area.

Data on the tracking measure for Goal 1.e are in Table O&M-1. All co-implementers, except for the City of Sherwood, met or exceeded the annual cleaning target of twice

per year. City of Sherwood missed cleaning one public water quality manhole due to Washington County paving over the manhole lid. The City will clean the manhole when the lid is uncovered.

f. **Goal:** Clean 95 percent of public sumped catch basins per year.

- Tracking measure: Number of sumped catch basins cleaned, and total number of sumped catch basins within the service area.

  Data on the tracking measure for Goal 1.f are in Table O&M-1. All co-implementers, with the exception of Clean Water Services and City of Tigard met or exceeded the annual target of 95 percent. Clean Water Services and City of Tigard were not able to meet the annual maintenance frequency of 95 percent for catch basins as a result of staffing shortages and increased time for fleet vendors to repair mechanical breakdowns and perform routine maintenance, respectively. The vendor repair and maintenance problems reduced the timely availability of necessary equipment. CWS attempted to overcome these challenges by hiring temporary staff, authorizing overtime for existing staff, and attempting to rent replacement equipment. Despite these actions, CWS was still not able to meet the 95 percent annual target. CWS is taking further action to manage staffing shortages and timely repair of fleet equipment by vendors. In addition to these actions, CWS will include additional mitigation measures by hiring contractors to perform work as needed. City of Tigard is hiring additional staff, has purchased additional fleet vehicles, and will share resources internally to anticipate staffing and vehicle needs next year. Assessments in excess of the number of facilities indicate multiple visits to the same facility.

2. Private Structural Water Quality Facility Maintenance

a. **Goal:** Annually inspect 25 percent of privately maintained structural water quality facilities to ensure system functionality.

- Tracking measure: Total number of facilities and number of facilities inspected.

Table O&M-2a: Inspection of Private Water Quality Facilities (PWQFs)

Jurisdiction	*Number of PWQFs in Service Area*[1]	*Number of PWQF Inspections*	*Percent of PWQFs Inspected*
Clean Water Services Service Delivery Planning	1,023	379	37%
Clean Water Services Environmental Services	61	20	33%
Beaverton	590	148	25%
Cornelius	82	23	28%
Forest Grove	108	45	42%
Hillsboro	813	343	42%
Sherwood	120	120	100%
Tigard	317	96	30%
Tualatin	471	128	27%
Total	**3,585**	**1,302**	**36%**

[1] Number is the inventory at the beginning of the reporting year, July 1, 2022.

b. **Goal:** Conduct annual training for CWS and co-implementer inspection staff on proper water quality facility maintenance:

- Tracking measure: Training sessions conducted and staff/co-implementer attendance.

  On June 7, 2023, CWS held a virtual training on inspection/assessment and proper maintenance of water quality facilities; 19 CWS and co-implementer staff attended.

RELATIONSHIP TO TMDLs

Phosphorus: The CWS *Design and Construction Standards* are developed to remove phosphorus. Efficiency is contingent on maintaining the constructed systems to operate as designed.

Bacteria: Through appropriate maintenance and inspection of both the sanitary and storm sewer systems, cross connections, and other illicit sources of bacterial contamination will be identified and corrected. This will result in lower bacteria concentrations in stormwater.

Settleable Volatile Solids: Adequate maintenance of the stormwater system will reduce the discharge of settleable volatile solids that accumulate in the system.

RELATED DOCUMENTS

- Private Water Quality Facilities Management Program (referenced in CWS' 2020 Stormwater Management Plan)
- Performance Standards (2018)

Table O&M-1
Public Water Quality Facility Inspections and Maintenance Tracking Measures - FY 2022-23

Activity	Units	Frequency Standard	CWS		Beaverton		Cornelius		Forest Grove		Hillsboro		Sherwood		Tigard		Tualatin		Washington County		Total	
			Inventory	Production	Inventory	Production	Inventory	Production	Inventory	Production	Inventory	Production	Inventory	Production	Inventory	Production	Inventory	Production	Inventory	Production	Inventory	Production
1. Public Proprietary Water Quality Facility Maintenance																						
A. Proprietary facility maintenance visits	Visits	1x per year	5	5	122	122	0	0	18	18	46	46	7	7	78	133	9	9	7	7	292	347
B. Filter cartridge replacement	Cartridges replaced	As needed		0		535		0		0		11		10		133		8		0		697
2. Public Water Quality Manhole Cleaning																						
A. Manholes cleaned	Each	2x Per Year	853	1,841	404	808	36	72	77	154	285	579	91	181	132	6	92	191	0	0	1,970	3,832
3. Sumped Catch Basin Cleaning																						
A. Sumped catch basins cleaned	Each	95% Per Year	10,747	8,387	3,264	3,265	1,160	1,219	1,482	1,484	7,458	7,571	1,796	1,787	2,976	2,310	1,294	1,324	0	0	30,177	27,347

Appendix B: Stormwater Monitoring Data

This appendix describes the activities of the Clean Water Services (CWS) stormwater monitoring program and presents the results of these activities. The CWS watershed-based NPDES permit requires land use-based stormwater monitoring at five locations at a minimum frequency of three times per year during characteristic storm events. CWS reviews stormwater data within one month of the data becoming available in CWS' data repository. Since January 1, 2023, when the reissued permit became effective, CWS also reviews the stormwater monitoring data for the potential to cause or contribute to a water quality exceedance in the receiving waterbody within five days of becoming aware of the data.

Stormwater Sampling Activities

CWS' five stormwater sampling sites used in 2022-23 are presented in Table B-1 and in Figure B-1. The sampling procedures used in 2022-23 are consistent with CWS' updated Stormwater Monitoring Plan that was submitted with the NPDES permit renewal application and was approved with the reissued permit on December 8, 2022. The Stormwater Monitoring Plan was updated in May 2023 to include new elements from the reissued permit. One goal of the Stormwater Monitoring Plan is to obtain complete sample sets with results from all analytes at all five sites for each storm event. If the storm event results are incomplete, CWS will take additional samples from individual sites or subsets of analytes from all five sites. In addition, data from monitoring at MS4 sites as part of special projects that met reporting criteria are included here. CWS' Water Quality Laboratory and Environmental Services staff obtained and analyzed at least three samples from each sampling location listed in Table B-1.

Table B-1: NPDES Stormwater Sampling Sites

Station Name	*Station ID*	*Catchment Area (Acres)*	*Subbasin*	*Major Land Use*
MS4 at 209th	7301001	37	Cross Creek	High density
MS4 at Paddington	7301004	22	Bronson Creek	Post-1990 residential
MS4 at 39th Loop	7301005	15	Rock Creek	Industrial
MS4 at Amberglen	7301006	198	Rock Creek	Residential/commercial
MS4 at Maple	7301007	70	Jackson Bottom	Pre-1990 residential

Figure B-1: Map of five stormwater sampling sites.

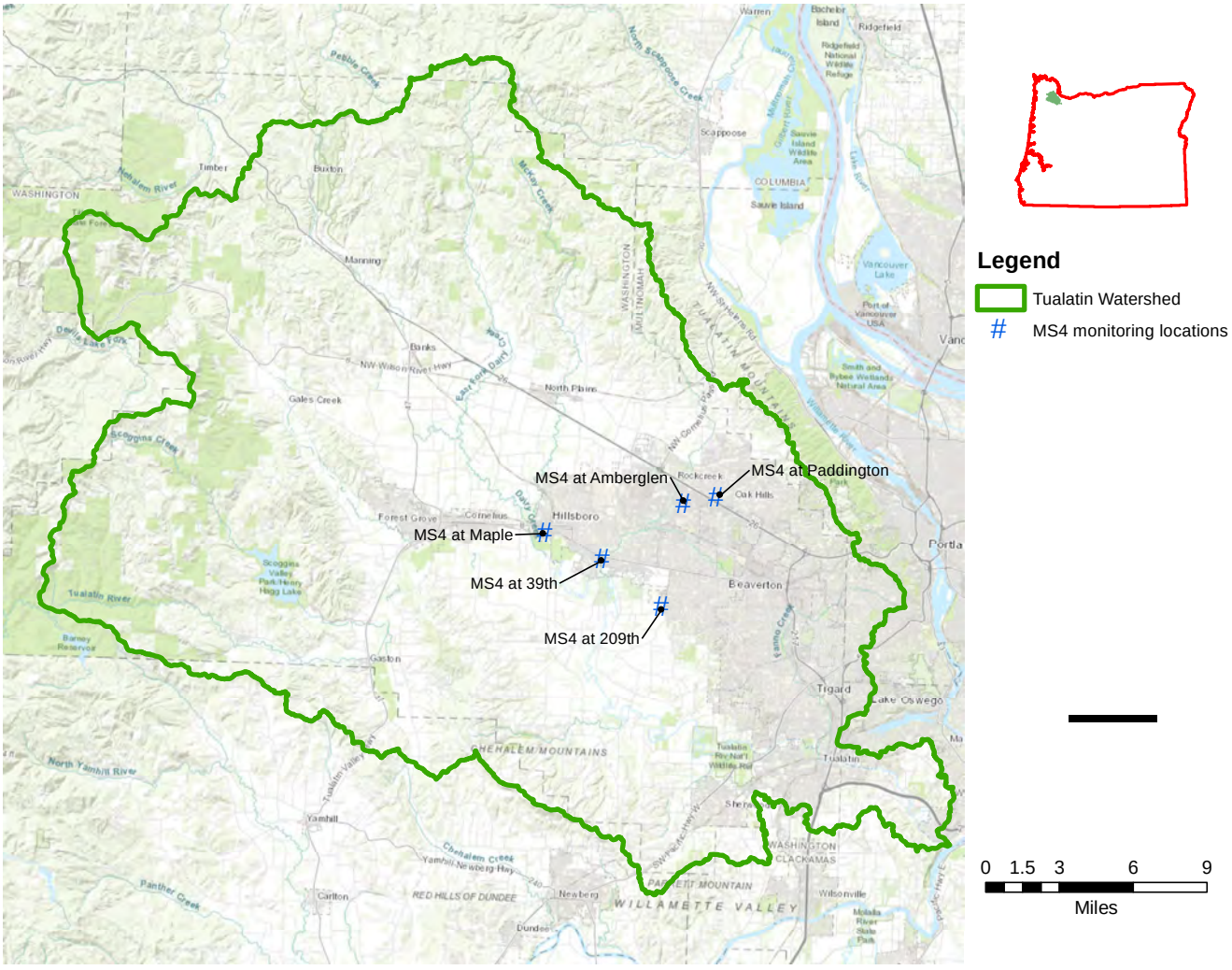


Table B-2 displays the analysis name, sample type, unit, Method Reporting Limit (MRL), and analytical method reference for samples collected and analyzed under the stormwater monitoring program for stormwater sampling sites during the 2022-23 monitoring year.

Table B-2: Method Reporting Limits and Laboratory Methods for Stormwater Samples

Analysis Name	*Sample Type*	*Unit*	*MRL*	*Method Reference**
Ammonia-N, Dissolved	Composite	mg/L	0.010	SM 4500-NH3 G
Conductivity, Field	Field	µS/cm	1	SM 2510 B
Copper, Dissolved	Composite	µg/L	0.4	EPA 200.8
Copper, Total Recoverable	Composite	µg/L	0.4	EPA 200.8
E. coli, Most Probable Number	Grab	MPN/100 mL	1	SM 9223 B
Hardness, Total	Composite	mg/L	0.50	EPA 200.8
Lead, Dissolved	Composite	µg/L	0.1	EPA 200.8
Lead, Total Recoverable	Composite	µg/L	0.1	EPA 200.8
Mercury by Purge & Trap, Dissolved	Grab	ng/L	0.2	EPA 1631E
Mercury by Purge & Trap, Total	Grab	ng/L	0.2	EPA 1631E
Nitrate/Nitrite-N, Dissolved	Composite	mg/L	0.01	EPA 300.0
Organic Carbon, Total Non-purgeable	Composite	mg/L	0.1	SM 5310 B
Ortho-Phosphate-P, Dissolved	Composite	mg/L	0.005	SM 4500-P F
Temperature	Field	°C	NA	SM 2550 B
Total Phosphorus-P	Composite	mg/L	0.025	EPA 365.1
Total Suspended Solids	Composite	mg/L	0.5	SM 2540 D
Turbidity, Field	Field	FNU	0.1	SM 2130 B
Zinc, Dissolved	Composite	µg/L	2.5	EPA 200.8
Zinc, Total Recoverable	Composite	µg/L	2.5	EPA 200.8

* SM = Standard Methods

The stormwater monitoring period begins July 1 and ends June 30 of the following year. For the reporting period ending on June 30, 2023, thirteen storm events were monitored at CWS' MS4 monitoring sites for the pollutants listed in Table B-2. Table B-3 displays a summary of rainfall data collected at one of CWS' rain gauge sites called Sunset (Fire Station at 185th and Hwy 26), which corresponds to the sampling events at the MS4 monitoring sites. The rainfall data used to determine the storm magnitude in 24 hours and rainfall in the antecedent period of 24 hours or 12 hours displayed in Table B-3. When the permit was renewed in December 2022, the antecedent dry period requirement changed from 24 hours to 12 hours, when possible. An antecedent dry period has less than 0.1 inches of precipitation. Two dry weather events where no rain was observed in the antecedent 72 hours were monitored on October 3, 2022 and April 26, 2023. CWS uses a flow weighted composite method for stormwater event sampling. The TSS samples were taken as composite samples in the previous permit. The reissued permit requires TSS samples to be taken concurrently with mercury samples, which are required to be taken as grab samples; therefore CWS now takes composite and grab TSS samples.

Table B-3: Rainfall Data Summary

Sample Date(s)	*Rainfall Preceding 24 Hours (2022) or 12 Hours (2023) (Inches)*	*Storm Magnitude (Inches in 24 hours)*
9/28-29/2022	0.00	0.14
10/3/2022	0.00	0.00
10/22/2022*	0.00	0.26
11/22/2022	0.00	0.28
12/20/2022	0.00	0.09
1/11-12/2023	0.04	0.60
2/7/2023**	0.01	0.13
3/23/2023**	0.00	0.10
3/31/2023-4/1/2023	0.00	0.35
4/26/2023	0.00	0.00
6/9/2023	0.00	0.10
6/18-19/2023	0.00	0.52

*Total metals only
***E. coli* samples only

Stormwater Monitoring Results

Table B-4 explains the qualifier codes used to describe the stormwater monitoring data.

Table B-4: Qualifier Codes and Description	
Qualifier/Flag	*Description*
<	Less than the specified value (generally the Method Reporting Limit)
>	Greater than the specified value (generally the Method Reporting Limit)
E	Qualitatively estimated value due to *minor* suspected sampling or analytical anomalies
Q	Questionable value due to suspected significant sampling or analytical anomalies

Stormwater monitoring data for this reporting period are presented in Table B-5. The samples from the locations listed in Table B-1 were analyzed for the water quality parameters listed in Table B-2.

Table B-5: Stormwater Monitoring Data							
MS4 at 209th (7301001)							
		Sample Date					
Analyte	*Unit*	*9/28/2022*	*11/22/2022*	*3/31/2023-4/1/2023*	*6/9/2023*	*6/18/2023*	*6/19/2023*
Ammonia-N, Dissolved	mg/L	0.188	0.306	0.045		0.81	0.551
Conductivity, Field	µS/cm	563	316.6	25.8	139.2	214.7	74.3
Copper, Dissolved	µg/L	17.1	6.4	1.76	83.6	48.1	12.3
Copper, Total Recoverable	µg/L	38	12.4	2.21	163	69.3	27.4
E. coli, Most Probable Number	MPN/100 mL	921	3	75	2	4870	1870
Hardness, Total	mg/L	40.2	23.4	14.5	189	92.1	30
Lead, Dissolved	µg/L	<0.1015	<0.1015	<0.1015	0.168	0.235	<0.1015
Lead, Total Recoverable	µg/L	3.22	1.15	0.201	3.18	2.56	3.06
Mercury by Purge & Trap, Dissolved	ng/L	15.4	6.34		1.26	7.94	5.60
Mercury by Purge & Trap, Total	ng/L	18.2	8.39	2.12	2.36	10.8	11.4
Nitrate/Nitrite-N, Dissolved	mg/L	0.66	0.31	0.18		1.2	0.373
Organic Carbon, Total Non-purgeable	mg/L	64	41.5	32.5		141	37.3
Orthophosphate-P, Dissolved	mg/L	0.024	0.267	0.012		0.06	0.107
Temperature	°C	17.764	13.008	8.218	17.423	16.4	15.87
Total Phosphorus-P	mg/L	0.517	1.04	0.042		0.878	0.462
Total Suspended Solids	mg/L	76	49	10.8	6.5	8.8	165
Turbidity, Field	FNU	10.86	12.97	3.09	4.53	7.83	52.87
Zinc, Dissolved	µg/L	3340	16600	285	5550	2840	829
Zinc, Total Recoverable	µg/L	4370	17300	335	7140	3770	1350

Table B-5: Stormwater Monitoring Data (cont.)									
MS4 at Paddington (7301004)									
		Sample Date							
Analyte	*Unit*	*9/28-29/2022*	*10/3/22*	*11/22/2022*	*12/20/2022*	*1/11-12/2023*	*3/31/2023-4/1/2023*	*6/9/2023*	*6/18/2023*
Ammonia-N, Dissolved	mg/L	0.596				0.02	0.102		0.114
Conductivity, Field	µS/cm		97.1	21.9	189.5	86.7	113.3	356.7	87.1
Copper, Dissolved	µg/L	115				3.15	5.95		61.2
Copper, Total Recoverable	µg/L	225				37.7	19.2		170
E. coli, Most Probable Number	MPN/100 mL	860		308	3	261	3	4	11400
Hardness, Total	mg/L	37.8				16.9	22.9		35.6
Lead, Dissolved	µg/L	0.148				<0.1015	<0.1015		<0.1015
Lead, Total Recoverable	µg/L	2.49				0.726	1.12		5.22
Mercury by Purge & Trap, Dissolved	ng/L	4.23		2.79	0.931	1.54		11.9	6.73
Mercury by Purge & Trap, Total	ng/L	11.0		4.59	1.34	2.23	1.74	14.7	7.74
Nitrate/Nitrite-N, Dissolved	mg/L	0.6				0.268	0.359		0.307
Organic Carbon, Total Non-purgeable	mg/L	49				4	5.13		22.1
Orthophosphate-P, Dissolved	mg/L	0.236				0.02	0.02		0.036
Temperature	°C		21.711	7.887	12.719	10.699	11.065	16.315	15.799
Total Phosphorus-P	mg/L	0.714				0.088	0.154		0.562
Total Suspended Solids	mg/L	146				21.8	58.8	20	1.2
Turbidity, Field	FNU		27.71	25	0.96	4.89	2.69	4.05	2.31
Zinc, Dissolved	µg/L	2740				36	46.7		85.8
Zinc, Total Recoverable	µg/L	3780				85.3	107		543

Table B-5: Stormwater Monitoring Data (cont.)						
MS4 at 39th Loop (7301005)						
		Sample Date				
Analyte	*Unit*	*9/28/2022*	*11/22/2022*	*3/31/2023-4/1/2023*	*6/9/2023*	*6/18/2023*
Ammonia-N, Dissolved	mg/L	0.728	0.308	0.054	2.76	1.49
Conductivity, Field	µS/cm	88.5	17.9	4.1	70.9	63.9
Copper, Dissolved	µg/L	36	9.76	2.89	33	15.8
Copper, Total Recoverable	µg/L	42.4	37.1	6.06	36.1	26.1
E. coli, Most Probable Number	MPN/100 mL	63	4	1	4*	116
Hardness, Total	mg/L	12.8	9.71	1.78	23.8	13.4
Lead, Dissolved	µg/L	0.206	0.891	<0.1015	0.206	0.112
Lead, Total Recoverable	µg/L	1.42	7.78	0.999	1.01	2.95
Mercury by Purge & Trap, Dissolved	ng/L	5.57	2.35	na	17.2	13.6
Mercury by Purge & Trap, Total	ng/L	7.00	5.19	3.61	22.1	17.3
Nitrate/Nitrite-N, Dissolved	mg/L	0.444	0.199	<0.1	2.01	1.23
Organic Carbon, Total Non-purgeable	mg/L	18	5.54	1.62	34.8	16.4
Orthophosphate-P, Dissolved	mg/L	0.112	0.203	0.014	0.425	0.16
Temperature	°C	16.159	8.776	8.8	16.728	16.574
Total Phosphorus-P	mg/L	0.272	1.05	0.065	0.644	0.419
Total Suspended Solids	mg/L	14.8	39.6	10.4	10.5*	38.8
Turbidity, Field	FNU	17.49	5.67	3.92	12.81	25.39
Zinc, Dissolved	µg/L	350	600	37	1420	650
Zinc, Total Recoverable	µg/L	366	1370	47.8	1540	726

*Two grab samples were collected and analyzed for E. coli and TSS during the June 9, 2023 storm event. The grab sample results in the table above were collected concurrently with the mercury sample. The second grab sample results for E. coli and TSS were <1 MPN/100 mL and 6.67 mg/L, respectively.

Note: In addition to the grab samples collected above, during the 6/9/2023 storm event, TSS was analyzed from the 24-hour composite sample. The 24-hour composite TSS result was 200 mg/L.

Table B-5: Stormwater Monitoring Data (cont.)						
MS4 at Amberglen (7301006)						
		Sample Date				
Analyte	*Unit*	*9/28/2022*	*11/22/2022*	*3/31/2023-4/1/2023*	*6/9/2023*	*6/18/2023*
Ammonia-N, Dissolved	mg/L	0.454	0.299	0.024		0.089
Conductivity, Field	µS/cm	282.3	63.4	137.3	446.1	261.5
Copper, Dissolved	µg/L	23.9	10.6	2.35	9.5	12.4
Copper, Total Recoverable	µg/L	79.8	33.9	42.8	38.3	28.3
E. coli, Most Probable Number	MPN/100 mL	13300	517	93	48	61
Hardness, Total	mg/L	106	56.9	187	182	93.4
Lead, Dissolved	µg/L	0.493	0.253	<0.1015	0.24	0.299
Lead, Total Recoverable	µg/L	18.4	6.41	9.57	6.03	2.72
Mercury by Purge & Trap, Dissolved	ng/L	5.17	1.53		2.45	2.19
Mercury by Purge & Trap, Total	ng/L	7.91	2.13	2.36	3.63	5.23
Nitrate/Nitrite-N, Dissolved	mg/L	1.03	0.274	0.257		0.547
Organic Carbon, Total Non-purgeable	mg/L	36	25.3	5.11		25
Orthophosphate-P, Dissolved	mg/L	0.072	0.256	0.081		0.027
Temperature	°C	18.526	8.179	9.69	15.781	16.071
Total Phosphorus-P	mg/L	0.707	0.894	1.18		0.512
Total Suspended Solids	mg/L	176	168	352	1.5	17.2
Turbidity, Field	FNU	11.36	15.91	32.99	3.58	12.44
Zinc, Dissolved	µg/L	559	97.4	16.5	1290	1810
Zinc, Total Recoverable	µg/L	1410	312	260	3120	2500

Table B-5: Stormwater Monitoring Data (cont.)

MS4 at Maple (7301007)							
		Sample Date					
Analyte	*Unit*	*9/28/2022*	*11/22/2022*	*12/20/2022*	*1/11-12/2022*	*3/31/2023-4/1/2023*	*6/18/2023*
Ammonia-N, Dissolved	mg/L		0.472		0.158	0.194	1.34
Conductivity, Field	µS/cm	108		150.8	55.1	27.5	107.1
Copper, Dissolved	µg/L		7.62		1.98	2.21	14.2
Copper, Total Recoverable	µg/L		26.3		7.27	46.3	45
E. coli, Most Probable Number	MPN/100 mL	36500	1300	59	816	185	11100
Hardness, Total	mg/L		44.9		10.8	28	36.9
Lead, Dissolved	µg/L		0.228		<0.1015	<0.1015	0.466
Lead, Total Recoverable	µg/L		9.48		2.16	14.8	16.7
Mercury by Purge & Trap, Dissolved	ng/L	3.87	2.04	1.69	0.819		3.84
Mercury by Purge & Trap, Total	ng/L	9.10	6.12	4.02	4.60	2.26	6.42
Nitrate/Nitrite-N, Dissolved	mg/L		0.457		0.152	0.223	0.929
Organic Carbon, Total Non-purgeable	mg/L		26.1		3.51	5.47	35.6
Orthophosphate-P, Dissolved	mg/L		0.342		0.016	0.016	0.043
Temperature	°C	17.012		10.498	9.221	8.565	16.509
Total Phosphorus-P	mg/L		0.841		0.121	0.68	0.611
Total Suspended Solids	mg/L		70		38.8	272	68.8
Turbidity, Field	FNU	63.8		20.16	53.15	38.47	36.67
Zinc, Dissolved	µg/L		300		79.1	79.3	332
Zinc, Total Recoverable	µg/L		550		141	608	849

In addition to the collecting data according to the Stormwater Monitoring Plan, CWS is conducting a Microbial Source Tracking study. While the methods to identify sources of E. coli are under development, CWS is taking additional E. coli samples, which are

reported in Table B-6. Windshield surveys were taken at each of the following events: 10/21, 22, 10/22/22, 11/22/22, 12/20/22, 2/7/2023, 3/23/2023, and 4/26/2023. The event on 4/26/2023 was a dry weather event.

Table B-6: Microbial Source Tracking

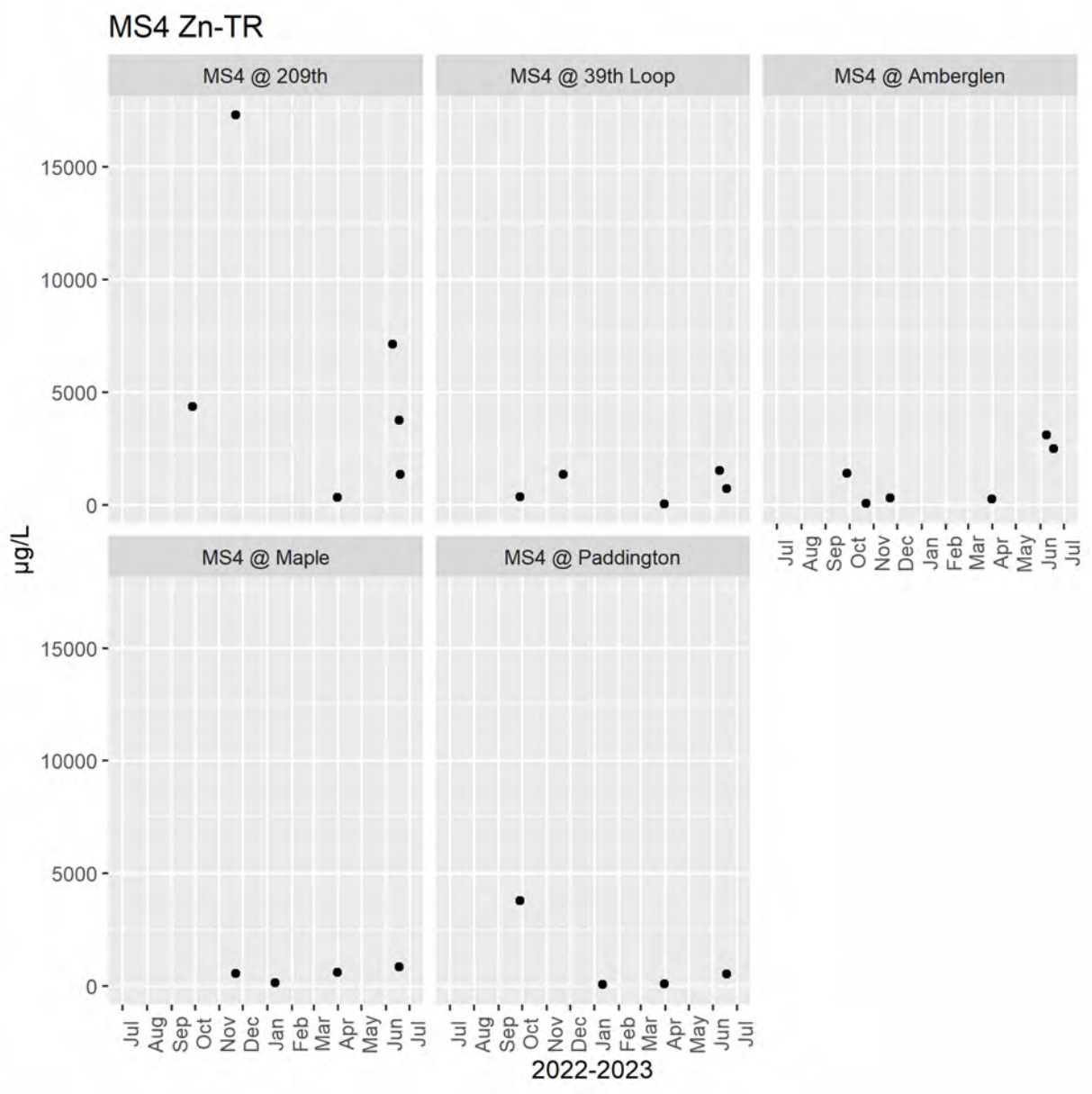
E. coli MPN/100 mL

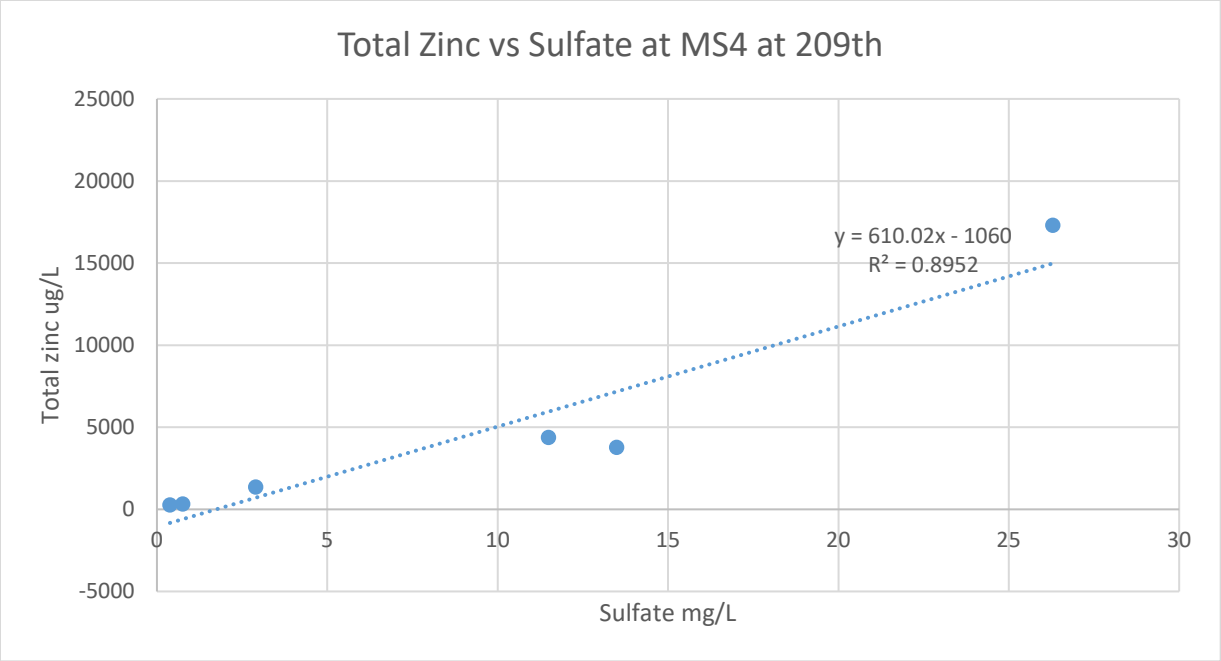
Station	*Sample Date*		
	2/7/2023	*3/23/2023*	*4/26/2023*
MS4 at 209th (7301001)	59	11	4
MS4 at Paddington (7301004)	72	517	5
MS4 at 39th	11		
MS4 at Amberglen	816	114	2
MS4 at Maple	687	1050	411

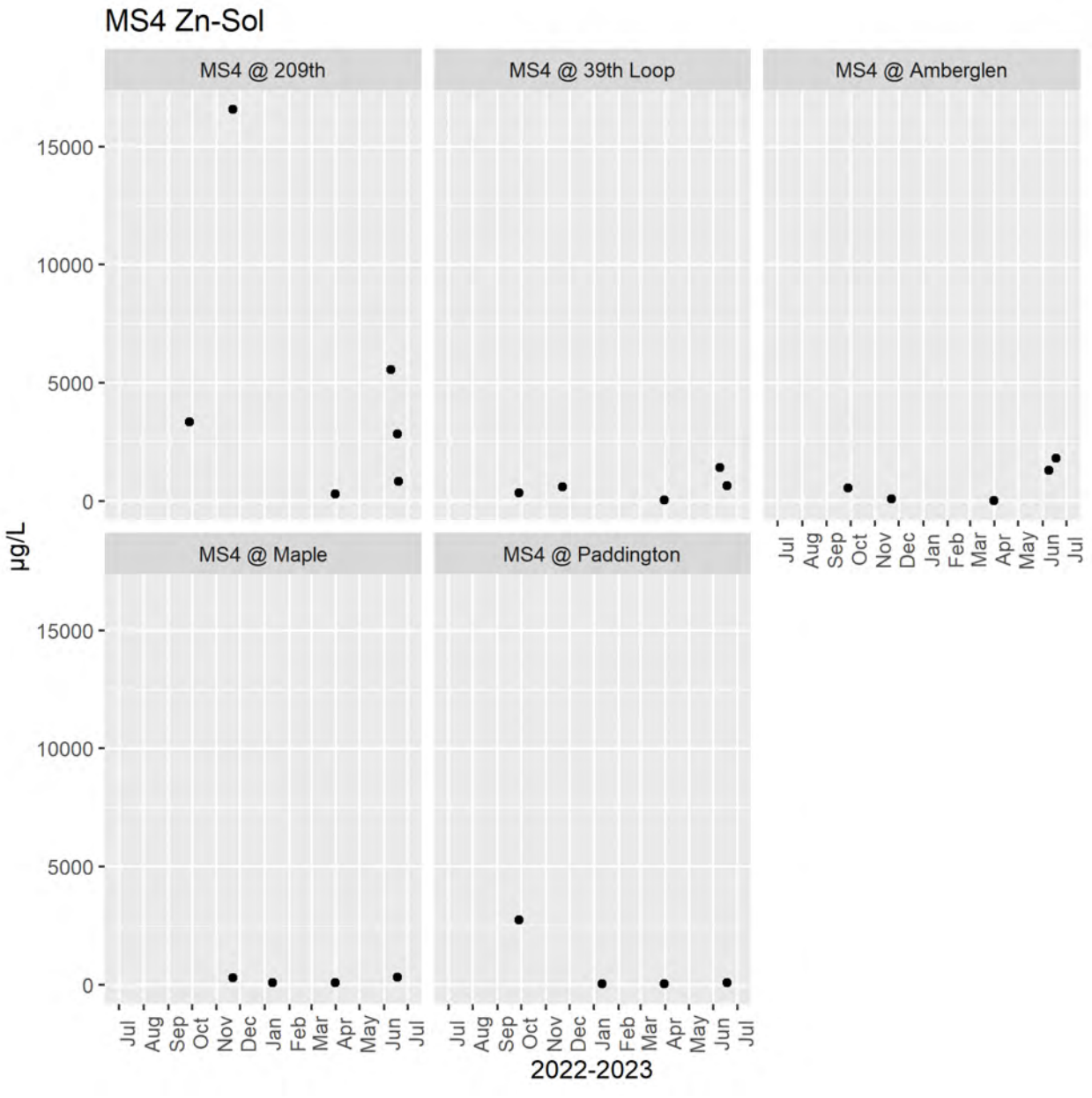
Discussion of Stormwater Monitoring Results

CWS staff followed internal cause and contribute assessment protocols to review the MS4 data in a timely manner. There were no MS4 samples that showed reasonable potential to cause or contribute to a water quality standard exceedance. One total phosphorus result from the MS4 at Amberglen monitoring location on March 31, 2023 exceeded internal thresholds for further action. This result was referred to CWS' Environmental Services staff to investigate for potential illicit discharges.

Similar to the previous stormwater year, the MS4 at 209th site showed highly elevated concentrations of zinc during stormwater sampling events. The zinc concentrations from stormwater sampling events between July 2022 and June 2023 are shown below. The concentrations of zinc were strongly correlated with concentrations of sulfate.

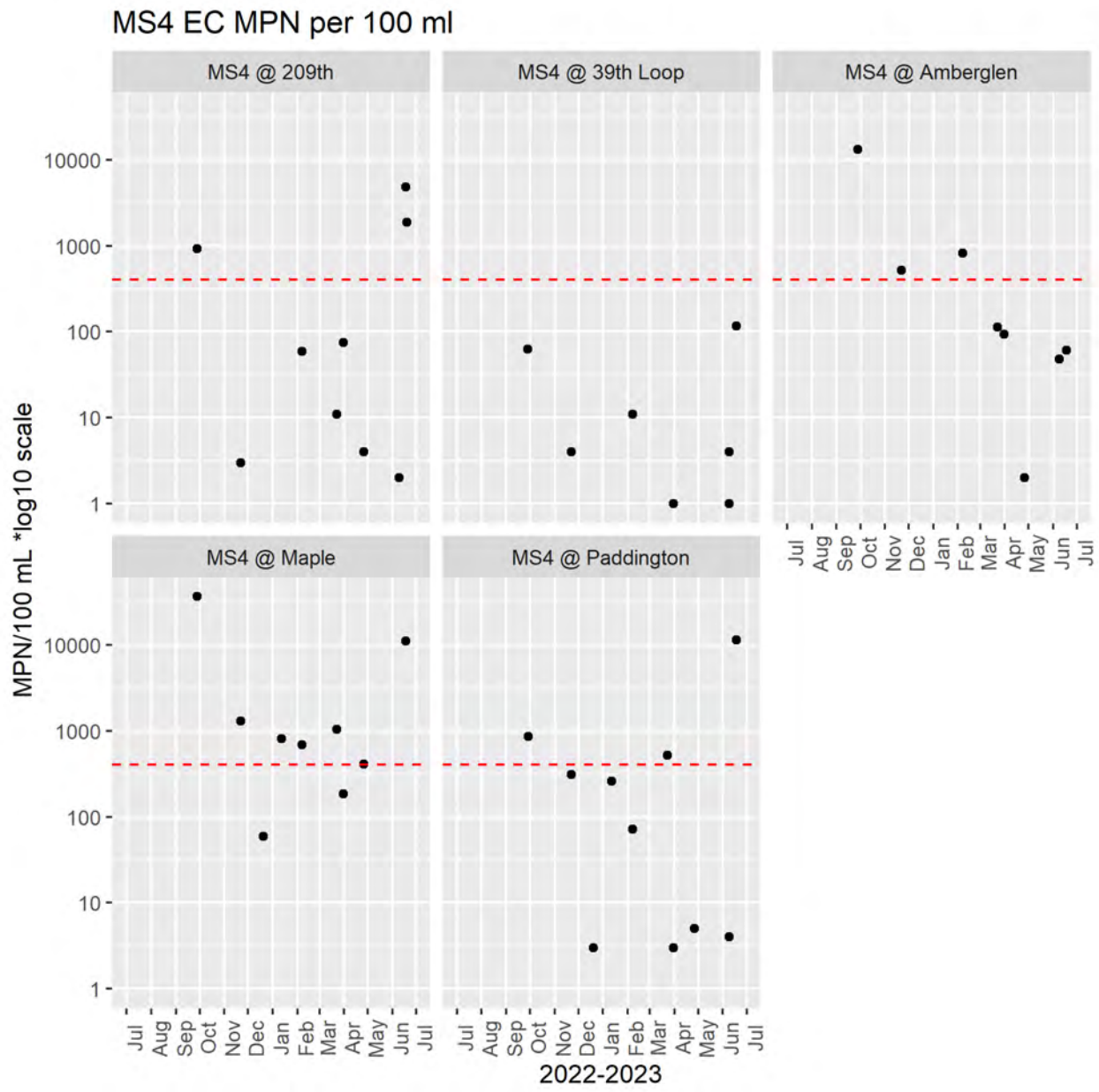



Total Zinc vs Sulfate at MS4 at 209th
25000
20000
15000
10000
5000
0
-5000
Total zinc ug/L
0
5
10
15
20
25
30
Sulfate mg/L
y = 610.02x - 1060
R² = 0.8952

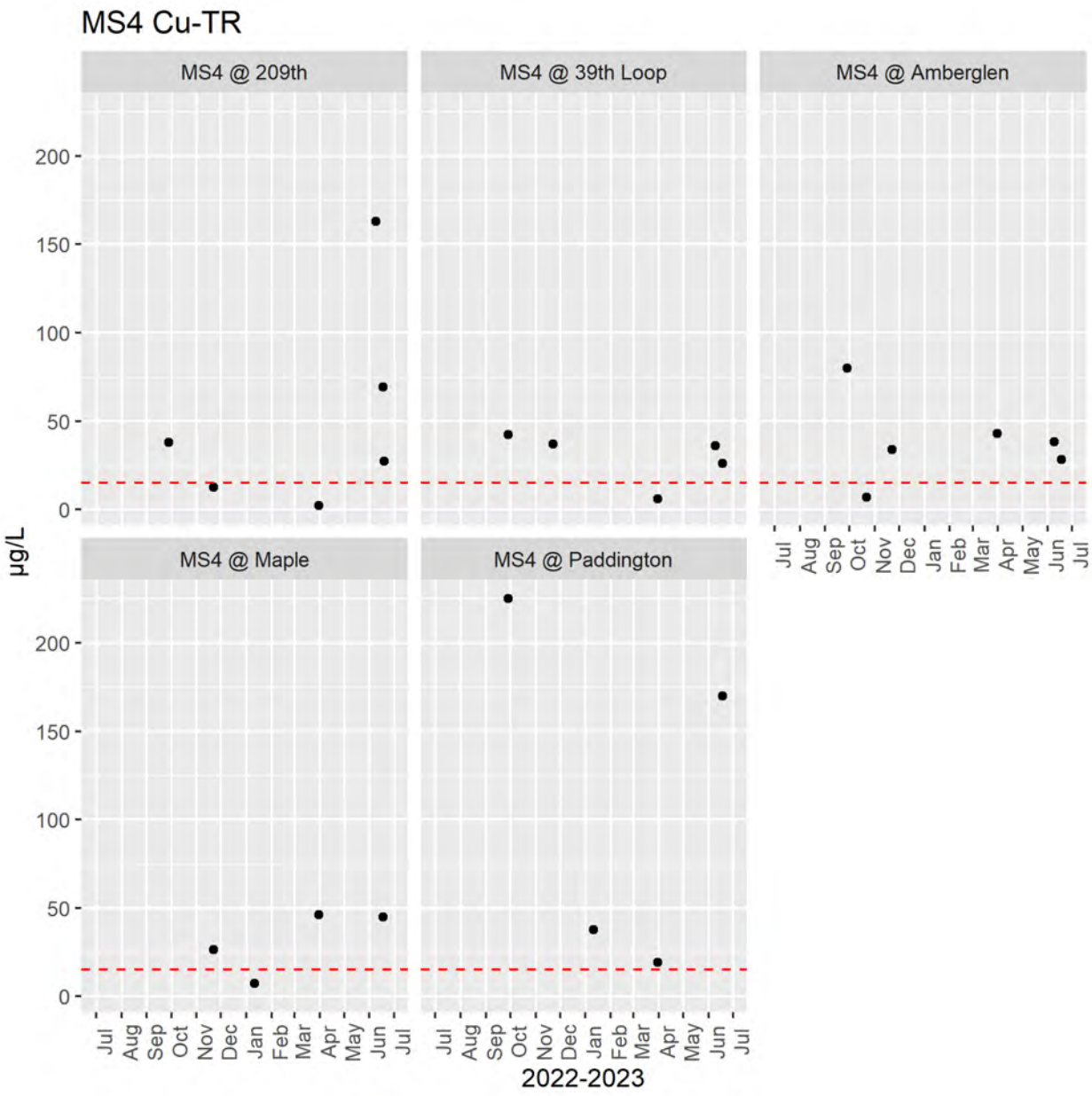


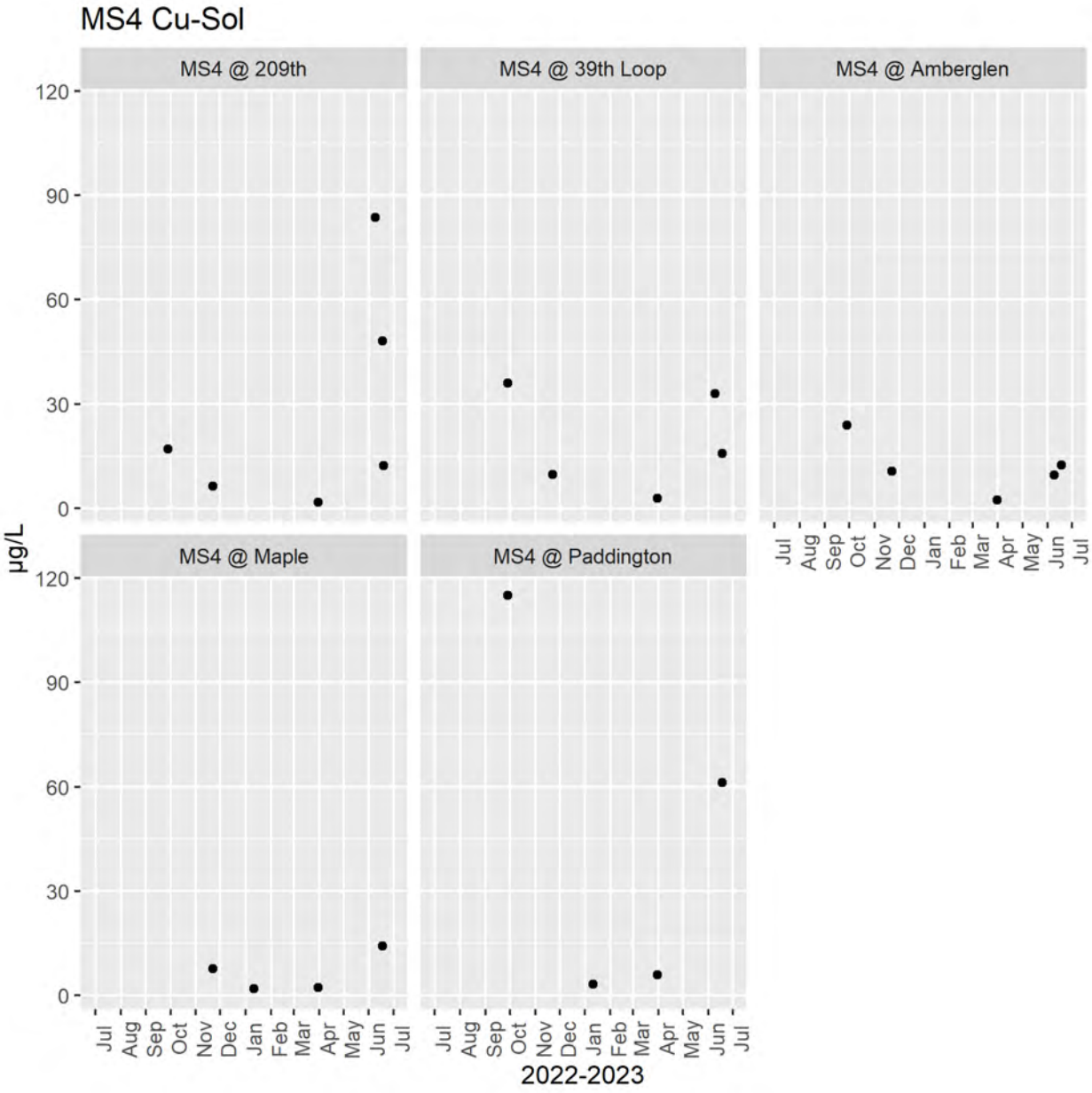
The most likely source of zinc sulfate is moss inhibitor commonly used to treat roofs, driveways, and lawns. CWS is conducting windshield surveys and providing outreach and education materials to homeowners and contractors via the local homeowners association to reduce the runoff of these chemicals to the stormwater system. A postcard (Figure B-1) was sent to residents of the neighborhood and a poster of the same was posted in community areas around the neighborhood.

Concentrations of *E. coli* greater than 406 MPN/100 mL (red line) were observed at the MS4 at 209th, MS4 at Amberglen, MS4 at Maple, and MS4 at Paddington monitoring sites. Similar to the previous stormwater monitoring year, CWS conducted GIS and field source assessments of the sites. Additional E. coli samples were taken. No obvious sources of bacteria or sewage appeared at the sites. There were no visible signs that suggest the elevated bacteria levels are the result of a cross connection. No other specific sources of the elevated bacteria levels were evident. The elevated bacteria levels may be due to waste from pets and wildlife. Potential follow-up actions include CWS' Communications and Community Engagement team conducting outreach regarding management of pet waste and microbial source tracking studies.



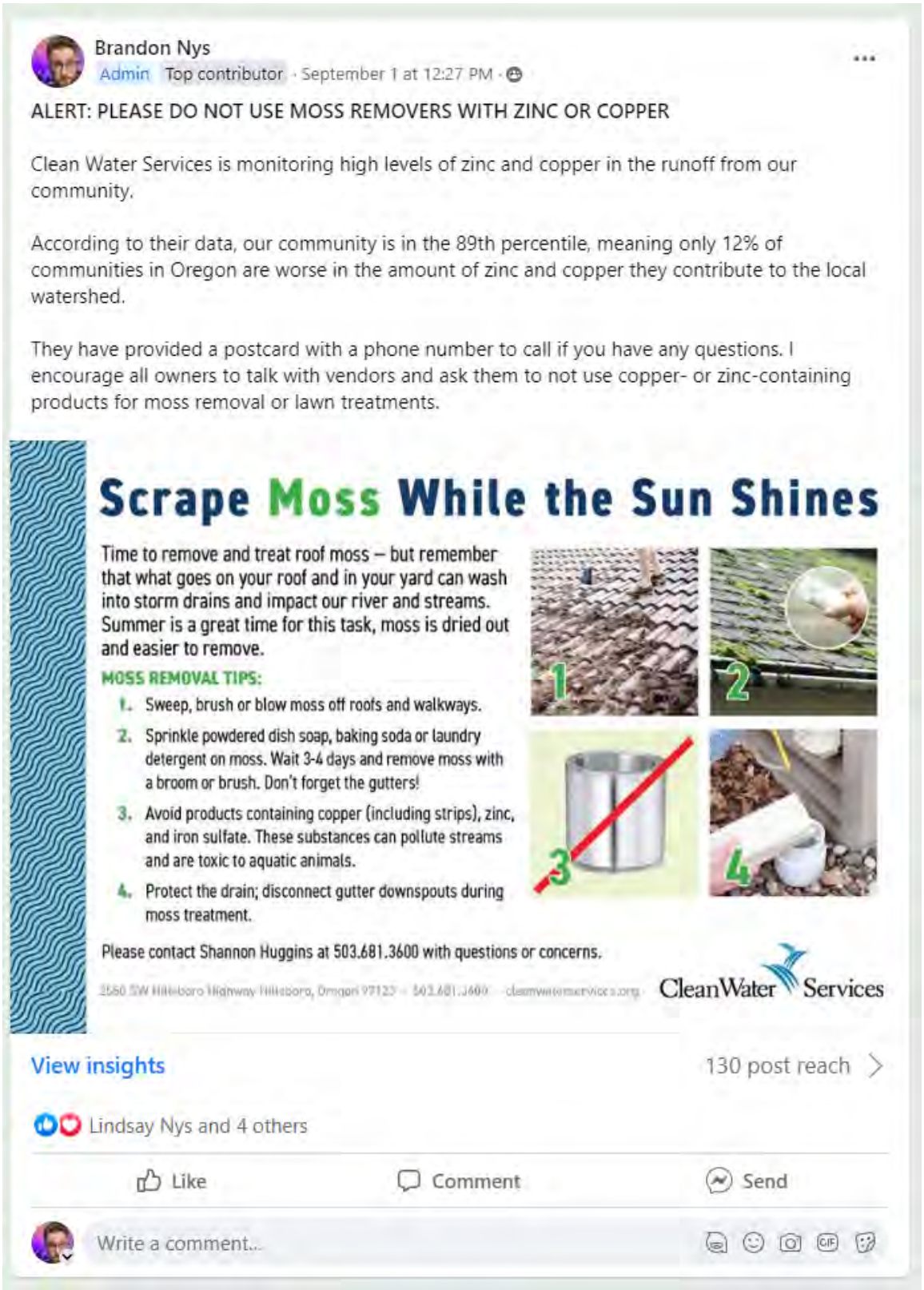
MS4 monitoring sites are not required to meet 1200-Z permitted discharge benchmark concentrations. In the 2022-23 reporting year, all of the MS4 monitoring sites had at least one total copper concentration greater than the 1200-Z benchmark concentration for the Willamette Valley of 15 ug/L (red line). CWS' Environmental Services team are undertaking a project to evaluate copper concentrations in stormwater starting with the MS4 at Paddington monitoring site. More information on this evaluation will be reported in the next annual report.


MS4 Cu-TR
MS4 @ 209th
MS4 @ 39th Loop
MS4 @ Amberglen
MS4 @ Maple
MS4 @ Paddington
µg/L
200
150
100
50
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2022-2023



The predominant land use at each of the MS4 monitoring locations is presented in Table B-1; however, the monitoring locations often encompass multiple land uses. The catchment areas range from 15 to 198 acres; the MS4 at Amberglen location has a larger catchment area (198 acres). The intermittent nature of these discharges, the size of the drainage area, the land uses they encompass, the diffuse nature of potential sources, the voluntary, outreach-based approach in dealing with unregulated residential and commercial sources, and resource limitations make it difficult to identify specific sources and management actions. CWS will provide an update on its follow-up actions in the next annual report.

Figure B-1: Moss Control Postcard Outreach



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Appendix C: Ambient Monitoring Program

This appendix provides an overview of the ambient monitoring plan and the data specifically required by Table B-1 of the CWS watershed-based NPDES permit. Table B-1 of the Permit requires annual reporting on ambient monitoring that CWS conducts at 15 locations, including the upper and lower portions of the Tualatin River and its tributaries. CWS collects samples at 17 monitoring locations to ensure compliance with this requirement.

Discrete samples are collected and analyzed by the CWS Water Quality Laboratory. In addition, CWS funds the collection of continuous flow and temperature data for many of the ambient sites with continuous monitors. CWS also participates in a cooperative study with the United States Geological Survey (USGS). As part of the study, the USGS collects continuous water quality monitoring data at selected sites in the Tualatin River and its tributaries. Data from these monitoring programs are used to identify trends, calibrate and verify models, and assess the effectiveness of co-implementers' activities.

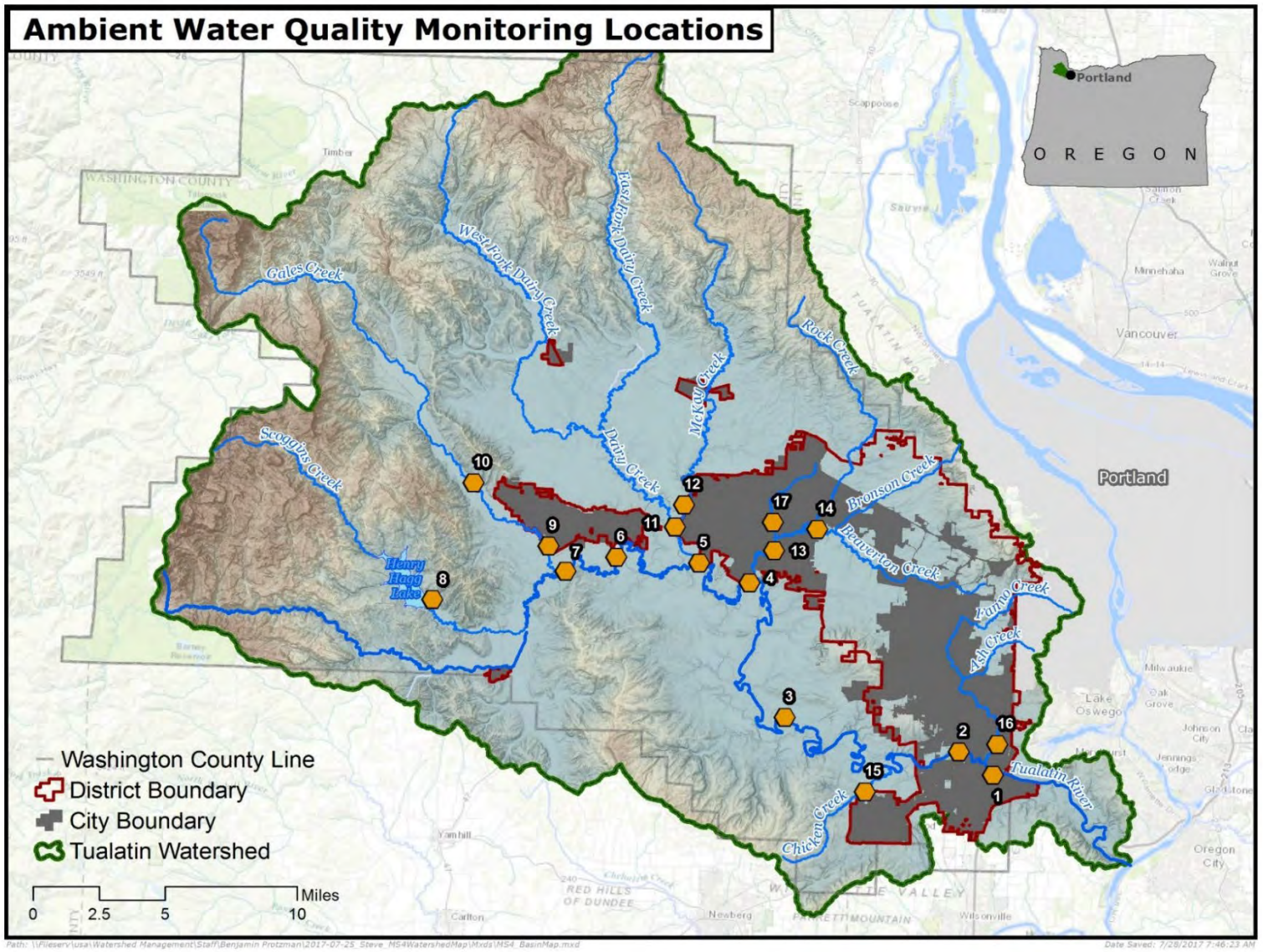
SAMPLING

Monitoring and sample analysis are conducted in accordance with the CWS Stormwater Monitoring Plan and Quality Assurance/Quality Control Program Document. Table C-1 presents the monitoring locations that were sampled in accordance with Permit requirements. Monitoring categories reflect the type of tributary monitoring station. Figure C-1 is a map displaying the ambient water quality monitoring locations. This map indicates the monitoring sites with symbols and associated map identification numbers that are included in Table C-1 to allow the reader to associate the monitoring table station name and location code with locations on the map.

Table C-1: Monitoring Sites						
Tualatin River Station Name	*Map ID*	*LOCCOD*	*Tributary Station Name*	*Map ID*	*LOCCOD*	*Category*
Boones Ferry Road	1	3701087	Scoggins Creek below Hagg Lake	8	3805050	Source Water
Jurgens Park	2	3701106	Gales Creek at New Hwy 47	9	3810015	Mouth
Hwy 210 Bridge (Scholls)	3	3701271	Gales Creek at Stringtown	10	3810070	Boundary
Rood Bridge Road	4	3701391	Dairy Creek at Hwy 8	11	3815021	Mouth
Hwy 219 Bridge[1]	5	3701450	McKay Creek at Padgett	12	3816010	Boundary
Golf Course Road	6	3701528	Rock Creek at Brookwood	13	3820022	Mouth
Fern Hill Road[2]	7	3701569	Beaverton Creek near Orenco	14	3821012	Urban
			Chicken Creek at Scholls-Sherwood	15	3835020	Mouth
			Fanno Creek at Durham Road	16	3840012	Mouth
			Dawson Creek at Brookwood	17	3850006	Urban

[1] Field parameters are obtained from the USGS continuous gauge at the time and date most similar to the grab sample.
[2] Alternate site for this location is Tualatin River at the Springhill Water Plant, at river mile 58.0.

Figure C-1: Ambient Monitoring Locations



PARAMETERS

Table C-2 displays a summary of the routine monitoring parameters. These are the parameters specified by Permit Table B-24.

Table C-2: Water Quality Parameters	
Field	*Method Reporting Limits*
Dissolved Oxygen	-- mg/L
pH	-- S.U.
Temperature	-- °C
Conductivity	-- µS/cm
Turbidity	-- FNU
Conventional/Nutrients	
E. coli	1 MPN/100 mL
Hardness	0.5 mg/L
Total Organic Carbon (NPOC)	0.25 mg/L
Total Suspended Solids	0.5 mg/L
Total Phosphorus	0.025 mg/L
Soluble Ortho-Phosphorus	0.005 mg/L
Ammonia-Nitrogen	0.01 mg/L
Nitrite + Nitrate Nitrogen	0.01 mg/L
Metals (Total and Dissolved)	
Copper, dissolved	0.406 µg/L
Copper, total	0.406 µg/L
Lead, dissolved	0.1015 µg/L
Lead, total	0.1015 µg/L
Zinc, dissolved	2.5375 µg/L
Zinc, total	2.5375 µg/L
Mercury, dissolved	0.2 ng/L
Mercury, total	0.2 ng/L

RESULTS

The qualifier codes were described in Table B-4 in Appendix B.

Tables C-3 to C-19 present summary statistics of the ambient monitoring data for July 1, 2022 to June 30, 2023. CWS is including the monitoring results at two additional ambient monitoring sites (Tualatin River at Golf Course Road and Gales Creek at Stringtown). Monitoring at Chicken Creek at Scholls-Sherwood was temporarily suspended due to construction limiting access at the site. These sites were monitored for the full complement of water quality parameters specified in the Permit. All sites were sampled three or more times during May 1 – October 31 and three or more times during November 1 – April 30, quarterly for metals and semiannually for mercury.

Tables C-3 to C-19 display the minimum, median, maximum, and selected percentiles of the data. The MRL values were used in the calculation of summary statistics for cases where the

result was less than the MRL (nondetects). For example, if the result was <2, the value 2 was used in the statistical calculations.

Table C-3: Ambient Monitoring Data Statistical Summary for Tualatin River at Boones Ferry Road									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	22	0.018	0.055	0.065	0.113	0.181	0.302	0.708
Conductivity, Field	µS/cm	23	101.7	109.7	117.6	232.1	271.5	284.5	310.6
Copper, Dissolved	µg/L	6	1.060	1.080	1.158	1.345	1.578	1.695	1.740
Copper, Total Recoverable	µg/L	10	1.220	1.238	1.403	1.560	1.790	2.135	2.180
Dissolved Oxygen	mg/L	23	5.37	5.70	6.30	8.78	10.21	10.58	11.06
E. coli, Most Probable Number	MPN/100 mL	23	9	19	21	26	41	48	548
Hardness, Total	mg/L	10	38.5	40.8	47.7	64.5	70.1	73.0	75.7
Lead, Dissolved	µg/L	8	<0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	<0.102
Lead, Total Recoverable	µg/L	10	0.109	0.135	0.139	0.179	0.261	0.330	0.465
Mercury by Purge & Trap, Dissolved	ng/L	2	0.524	0.529	0.536	0.548	0.560	0.567	0.572
Mercury by Purge & Trap, Total	ng/L	2	0.994	1.029	1.081	1.167	1.254	1.305	1.340
Nitrate/Nitrite-N, Dissolved	mg/L	23	1.190	1.360	1.695	2.650	3.350	4.040	4.410
Organic Carbon, Total Non-purgeable	mg/L	23	1.97	2.12	2.23	3.01	3.49	3.87	4.79
Orthophosphate-P, Dissolved	mg/L	22	0.027	0.037	0.054	0.076	0.103	0.385	0.542
pH, Field	S.U.	23	6.72	6.95	7.07	7.11	7.15	7.21	7.32
Temperature	°C	23	6.222	7.058	7.641	12.424	18.510	21.538	22.468
Total Phosphorus-P	mg/L	23	0.0620	0.0872	0.1050	0.1240	0.1715	0.4554	0.6290
Total Suspended Solids	mg/L	23	1.8	2.8	3.9	5.4	10.4	12.7	19.2
Turbidity, Field	NTU	23	1.65	1.90	2.67	4.28	8.63	12.93	19.68
Zinc, Dissolved	µg/L	8	2.70	2.70	2.96	5.41	7.25	8.72	10.60
Zinc, Total Recoverable	µg/L	10	6.78	6.80	6.87	7.35	10.22	10.67	13.10

Table C-4: Ambient Monitoring Data Statistical Summary for Tualatin River at Jurgens Park									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	22	0.011	0.057	0.063	0.088	0.131	0.211	0.751
Conductivity, Field	µS/cm	23	95.2	102.7	111.0	207.1	253.1	260.5	318.5
Copper, Dissolved	µg/L	7	0.930	0.966	1.010	1.080	1.435	1.594	1.630
Copper, Total Recoverable	µg/L	10	1.160	1.196	1.298	1.460	1.593	1.898	2.150
Dissolved Oxygen	mg/L	23	5.27	5.61	6.40	8.68	10.19	10.62	11.09
E. coli, Most Probable Number	MPN/100 mL	23	5	16	20	30	45	63	138
Hardness, Total	mg/L	10	36.9	39.1	45.1	58.8	65.0	66.7	68.9
Lead, Dissolved	µg/L	8	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	10	< 0.102	0.102	0.114	0.134	0.222	0.261	0.450
Mercury by Purge & Trap, Dissolved	ng/L	2	0.458	0.462	0.468	0.478	0.488	0.494	0.498
Mercury by Purge & Trap, Total	ng/L	2	1.010	1.056	1.125	1.240	1.355	1.424	1.470
Nitrate/Nitrite-N, Dissolved	mg/L	23	1.030	1.178	1.540	2.040	2.900	3.230	3.590
Organic Carbon, Total Non-purgeable	mg/L	23	1.79	1.94	2.05	2.76	3.03	3.70	4.40
Orthophosphate-P, Dissolved	mg/L	22	0.023	0.026	0.041	0.053	0.092	0.283	0.389
pH, Field	S.U.	23	6.69	6.98	7.06	7.12	7.16	7.24	7.38
Temperature	°C	23	6.028	6.611	7.304	12.201	18.433	21.611	22.391
Total Phosphorus-P	mg/L	23	0.0640	0.0782	0.0865	0.1020	0.1290	0.3396	0.4610
Total Suspended Solids	mg/L	23	2.4	2.8	3.5	5.4	10.2	11.8	18.6
Turbidity, Field	NTU	23	1.94	2.11	2.84	4.21	8.63	12.88	19.61
Zinc, Dissolved	µg/L	8	< 2.54	< 2.54	< 2.54	3.49	4.57	5.02	5.72
Zinc, Total Recoverable	µg/L	10	< 2.54	3.50	4.37	5.40	5.96	7.89	10.90

Table C-5: Ambient Monitoring Data Statistical Summary for Tualatin River at Highway 210 Bridge (Scholls)									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	22	0.055	0.055	0.063	0.103	0.202	0.299	0.757
Conductivity, Field	µS/cm	23	98.7	105.7	115.1	192.8	243.3	256.2	267.1
Copper, Dissolved	µg/L	5	0.921	0.993	1.100	1.230	1.430	1.454	1.470
Copper, Total Recoverable	µg/L	9	1.420	1.420	1.440	1.640	1.840	1.962	2.130
Dissolved Oxygen	mg/L	23	6.80	7.20	7.81	9.15	10.28	10.87	11.01
E. coli, Most Probable Number	MPN/100 mL	23	17	29	34	42	59	86	488
Hardness, Total	mg/L	9	38.6	42.5	48.0	58.5	63.1	64.9	70.7
Lead, Dissolved	µg/L	6	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	9	0.135	0.139	0.158	0.183	0.269	0.298	0.410
Mercury by Purge & Trap, Dissolved	ng/L	2	0.442	0.447	0.454	0.466	0.478	0.485	0.490
Mercury by Purge & Trap, Total	ng/L	2	0.983	1.046	1.140	1.297	1.453	1.547	1.610
Nitrate/Nitrite-N, Dissolved	mg/L	23	1.080	1.236	1.610	1.930	2.970	3.632	4.060
Organic Carbon, Total Non-purgeable	mg/L	23	1.75	1.89	2.10	2.67	3.09	3.58	5.33
Orthophosphate-P, Dissolved	mg/L	22	0.019	0.029	0.042	0.054	0.068	0.254	0.276
pH, Field	S.U.	23	6.75	7.01	7.09	7.15	7.22	7.28	7.37
Temperature	°C	23	6.363	6.930	7.541	12.483	16.918	19.765	20.842
Total Phosphorus-P	mg/L	23	0.0660	0.0754	0.0960	0.1020	0.1215	0.2988	0.3600
Total Suspended Solids	mg/L	23	5.2	5.4	7.4	9.5	13.4	16.2	23.0
Turbidity, Field	NTU	23	3.59	3.87	4.93	6.56	9.79	12.82	17.20
Zinc, Dissolved	µg/L	6	2.61	2.65	2.86	4.27	6.32	6.80	6.90
Zinc, Total Recoverable	µg/L	8	3.94	5.03	6.00	7.01	8.55	8.72	8.99

Table C-6: Ambient Monitoring Data Statistical Summary for Tualatin River at Rood Bridge Road									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	22	< 0.010	0.017	0.021	0.027	0.034	0.040	0.151
Conductivity, Field	µS/cm	23	81.9	87.1	90.1	95.5	102.5	117.3	148.9
Copper, Dissolved	µg/L	6	0.613	0.641	0.686	0.862	1.064	1.125	1.160
Copper, Total Recoverable	µg/L	10	1.200	1.263	1.328	1.645	1.853	2.161	2.170
Dissolved Oxygen	mg/L	23	7.87	8.46	8.90	9.80	10.87	11.27	11.48
E. coli, Most Probable Number	MPN/100 mL	24	21	22	29	55	78	155	579
Hardness, Total	mg/L	10	33.0	33.4	35.5	38.3	40.0	41.8	42.9
Lead, Dissolved	µg/L	8	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	10	0.109	0.123	0.126	0.182	0.283	0.436	0.494
Mercury by Purge & Trap, Dissolved	ng/L	2	0.396	0.403	0.414	0.431	0.449	0.459	0.466
Mercury by Purge & Trap, Total	ng/L	2	1.220	1.275	1.358	1.495	1.633	1.715	1.770
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.075	0.161	0.239	0.644	1.085	1.544	1.940
Organic Carbon, Total Non-purgeable	mg/L	23	1.44	1.50	1.66	1.85	2.26	2.75	3.73
Orthophosphate-P, Dissolved	mg/L	22	0.011	0.017	0.024	0.028	0.031	0.047	0.057
pH, Field	S.U.	23	6.82	7.06	7.13	7.22	7.30	7.34	7.38
Temperature	°C	23	5.268	6.208	6.992	10.613	15.653	18.019	19.833
Total Phosphorus-P	mg/L	23	0.0500	0.0546	0.0605	0.0660	0.0820	0.0908	0.1110
Total Suspended Solids	mg/L	23	5.2	6.0	7.4	9.0	17.3	19.2	27.6
Turbidity, Field	NTU	23	3.83	4.69	5.28	6.68	10.63	13.24	17.00
Zinc, Dissolved	µg/L	8	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	2.59	2.69
Zinc, Total Recoverable	µg/L	10	< 2.54	< 2.54	2.91	3.57	5.56	6.14	6.46

Table C-7: Ambient Monitoring Data Statistical Summary for Tualatin River at Hwy 219 Bridge									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	13	< 0.010	0.014	0.016	0.022	0.029	0.032	0.035
Conductivity, Field	µS/cm	13	23.0	80.4	90.0	93.0	107.0	120.6	175.0
Copper, Dissolved	µg/L	5	0.658	0.707	0.781	0.798	1.080	1.146	1.190
Copper, Total Recoverable	µg/L	7	1.390	1.522	1.650	1.730	1.870	1.878	1.890
Dissolved Oxygen	mg/L	13	5.20	7.64	8.80	9.80	10.40	11.36	11.70
E. coli, Most Probable Number	MPN/100 mL	13	21	27	32	66	135	184	313
Hardness, Total	mg/L	8	31.5	32.5	34.0	36.5	37.6	38.8	40.8
Lead, Dissolved	µg/L	7	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	7	0.118	0.155	0.198	0.227	0.333	0.424	0.453
Mercury by Purge & Trap, Dissolved	ng/L	2	0.358	0.374	0.399	0.440	0.481	0.506	0.522
Mercury by Purge & Trap, Total	ng/L	2	1.110	1.155	1.223	1.335	1.448	1.515	1.560
Nitrate/Nitrite-N, Dissolved	mg/L	14	0.110	0.179	0.277	0.584	1.072	1.447	1.780
Organic Carbon, Total Non-purgeable	mg/L	13	1.40	1.44	1.64	1.76	1.90	2.96	3.70
Orthophosphate-P, Dissolved	mg/L	13	0.018	0.018	0.023	0.024	0.030	0.046	0.057
pH, Field	S.U.	13	6.80	6.90	7.00	7.10	7.30	7.30	7.40
Temperature	°C	13	5.400	6.340	6.900	10.100	15.300	16.440	18.300
Total Phosphorus-P	mg/L	13	0.0480	0.0570	0.0620	0.0710	0.0750	0.0944	0.1110
Total Suspended Solids	mg/L	13	6.4	7.0	8.3	11.9	15.6	17.7	21.2
Turbidity, Field	NTU	13	4.20	5.46	5.70	9.00	12.50	16.10	17.10
Zinc, Dissolved	µg/L	7	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54
Zinc, Total Recoverable	µg/L	7	3.05	3.21	3.34	3.76	4.88	7.23	9.86

Table C-8: Ambient Monitoring Data Statistical Summary for Tualatin River at Golf Course Road									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	21	< 0.010	< 0.010	< 0.010	0.015	0.020	0.024	0.066
Conductivity, Field	µS/cm	22	73.2	75.0	78.9	88.3	91.7	104.0	109.9
Copper, Dissolved	µg/L	4	0.744	0.767	0.800	0.945	1.133	1.245	1.320
Copper, Total Recoverable	µg/L	5	1.410	1.602	1.890	2.170	2.390	2.426	2.450
Dissolved Oxygen	mg/L	22	8.88	9.26	9.64	10.22	11.34	11.47	11.65
E. coli, Most Probable Number	MPN/100 mL	22	10	21	40	72	122	152	219
Hardness, Total	mg/L	6	29.1	29.5	30.6	33.5	35.7	36.8	37.4
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	< 0.102	0.124	0.158	0.206	0.223	0.272	0.304
Mercury by Purge & Trap, Dissolved	ng/L	2	0.309	0.314	0.322	0.336	0.349	0.357	0.362
Mercury by Purge & Trap, Total	ng/L	2	1.160	1.183	1.218	1.275	1.333	1.367	1.390
Nitrate/Nitrite-N, Dissolved	mg/L	22	0.037	0.098	0.138	0.380	0.545	0.797	1.160
Organic Carbon, Total Non-purgeable	mg/L	22	1.16	1.20	1.26	1.51	1.95	2.21	2.42
Orthophosphate-P, Dissolved	mg/L	21	0.009	0.011	0.011	0.016	0.019	0.025	0.031
pH, Field	S.U.	22	6.93	7.07	7.12	7.25	7.30	7.38	7.46
Temperature	°C	22	5.307	6.429	6.663	9.361	14.201	15.503	16.446
Total Phosphorus-P	mg/L	22	0.0270	0.0290	0.0330	0.0530	0.0580	0.0650	0.0840
Total Suspended Solids	mg/L	22	3.2	4.4	5.8	11.6	16.4	19.4	26.0
Turbidity, Field	NTU	22	3.05	3.61	3.83	6.80	9.68	11.01	19.01
Zinc, Dissolved	µg/L	5	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54
Zinc, Total Recoverable	µg/L	5	3.14	3.32	3.58	3.78	4.48	4.81	5.03

Table C-9: Ambient Monitoring Data Statistical Summary for Tualatin River at Fern Hill Road									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	22	< 0.010	< 0.010	0.011	0.014	0.020	0.022	0.032
Conductivity, Field	µS/cm	23	70.8	72.1	73.1	80.0	85.7	96.2	97.9
Copper, Dissolved	µg/L	12	0.661	0.717	0.761	0.987	1.088	1.215	1.220
Copper, Total Recoverable	µg/L	14	1.140	1.235	1.375	1.660	2.385	2.555	2.780
Dissolved Oxygen	mg/L	23	8.93	9.35	9.87	10.51	11.42	11.58	11.65
E. coli, Most Probable Number	MPN/100 mL	24	7	10	33	65	101	117	194
Hardness, Total	mg/L	14	28.0	28.1	29.4	32.9	33.9	36.3	37.7
Lead, Dissolved	µg/L	13	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	14	< 0.102	0.102	0.104	0.141	0.259	0.362	0.419
Mercury by Purge & Trap, Dissolved	ng/L	2	0.305	0.310	0.317	0.328	0.340	0.346	0.351
Mercury by Purge & Trap, Total	ng/L	2	1.200	1.212	1.230	1.260	1.290	1.308	1.320
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.029	0.055	0.130	0.220	0.411	0.755	1.070
Organic Carbon, Total Non-purgeable	mg/L	23	< 1.00	1.16	1.26	1.49	1.79	2.16	2.56
Orthophosphate-P, Dissolved	mg/L	22	0.005	0.006	0.007	0.013	0.014	0.016	0.024
pH, Field	S.U.	23	6.86	7.14	7.20	7.25	7.32	7.36	7.44
Temperature	°C	23	4.933	6.078	6.504	10.725	13.510	15.111	16.547
Total Phosphorus-P	mg/L	23	< 0.025	< 0.025	0.0260	0.0390	0.0525	0.0630	0.0760
Total Suspended Solids	mg/L	23	3.6	4.8	5.2	10.2	15.6	17.9	22.4
Turbidity, Field	NTU	23	2.96	3.24	3.54	5.85	8.79	10.68	18.08
Zinc, Dissolved	µg/L	13	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	2.89	2.94
Zinc, Total Recoverable	µg/L	14	< 2.54	< 2.54	< 2.54	3.38	4.33	5.04	6.38

Table C-10: Ambient Monitoring Data Statistical Summary for Scoggins Creek below Hagg Lake									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	23	< 0.010	< 0.010	< 0.010	< 0.010	0.016	0.028	0.037
Conductivity, Field	µS/cm	22	60.3	60.7	61.2	62.4	67.8	70.4	71.3
Copper, Dissolved	µg/L	5	0.513	0.545	0.593	0.770	0.787	0.864	0.915
Copper, Total Recoverable	µg/L	5	0.658	0.754	0.897	1.010	1.010	1.100	1.160
Dissolved Oxygen	mg/L	22	10.23	10.51	11.69	12.37	13.19	13.47	13.56
E. coli, Most Probable Number	MPN/100 mL	23	< 1	< 1	< 1	< 1	1	2	5
Hardness, Total	mg/L	6	23.8	24.0	24.2	24.3	24.3	25.5	26.6
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	< 0.102	0.102	0.102	0.102	0.102	0.107	0.110
Mercury by Purge & Trap, Dissolved	ng/L	2	0.233	0.248	0.272	0.310	0.349	0.372	0.387
Mercury by Purge & Trap, Total	ng/L	2	0.643	0.675	0.723	0.803	0.883	0.931	0.963
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.014	0.024	0.075	0.182	0.196	0.199	0.208
Organic Carbon, Total Non-purgeable	mg/L	23	< 1.00	1.04	1.07	1.20	1.47	1.60	2.35
Orthophosphate-P, Dissolved	mg/L	23	< 0.005	0.005	0.005	0.005	0.005	0.006	0.008
pH, Field	S.U.	22	6.69	6.75	6.94	7.27	7.39	7.60	7.79
Temperature	°C	22	5.553	6.134	6.314	7.743	10.432	15.296	18.033
Total Phosphorus-P	mg/L	23	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	0.0260
Total Suspended Solids	mg/L	23	< 0.5	0.6	1.4	1.6	2.0	2.2	3.6
Turbidity, Field	NTU	22	0.99	1.40	1.78	2.22	4.38	5.53	7.29
Zinc, Dissolved	µg/L	5	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	3.31	3.83
Zinc, Total Recoverable	µg/L	5	< 2.54	< 2.55	< 2.56	2.96	3.40	3.52	3.60

Table C-11: Ambient Monitoring Data Statistical Summary for Gales Creek at New Highway 47									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	23	< 0.010	< 0.010	< 0.010	0.012	0.017	0.023	0.037
Conductivity, Field	µS/cm	23	71.3	77.4	84.1	117.2	131.7	138.7	146.3
Copper, Dissolved	µg/L	5	0.604	0.649	0.716	0.766	0.772	0.957	1.080
Copper, Total Recoverable	µg/L	5	1.140	1.156	1.180	1.420	1.580	1.922	2.150
Dissolved Oxygen	mg/L	23	7.48	7.66	8.56	10.37	11.45	11.80	11.87
E. coli, Most Probable Number	MPN/100 mL	23	6	7	22	86	219	449	649
Hardness, Total	mg/L	6	28.8	31.9	35.4	41.6	49.0	53.4	57.0
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	< 0.102	0.102	0.102	0.123	0.156	0.208	0.242
Mercury by Purge & Trap, Dissolved	ng/L	2	0.329	0.331	0.334	0.340	0.345	0.348	0.350
Mercury by Purge & Trap, Total	ng/L	2	0.990	0.991	0.991	0.993	0.994	0.995	0.995
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.058	0.070	0.096	0.187	0.438	0.677	0.717
Organic Carbon, Total Non-purgeable	mg/L	23	0.78	1.00	1.05	1.22	1.37	1.52	2.04
Orthophosphate-P, Dissolved	mg/L	23	0.013	0.014	0.015	0.017	0.025	0.026	0.029
pH, Field	S.U.	23	6.57	7.08	7.23	7.37	7.41	7.46	7.49
Temperature	°C	23	5.280	5.793	6.568	10.374	16.547	19.876	20.543
Total Phosphorus-P	mg/L	23	0.0250	0.0314	0.0355	0.0430	0.0490	0.0558	0.1270
Total Suspended Solids	mg/L	23	2.0	3.5	4.6	5.4	12.4	20.2	41.2
Turbidity, Field	NTU	23	1.85	2.10	2.33	3.71	7.14	10.75	34.88
Zinc, Dissolved	µg/L	5	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	3.78	4.61
Zinc, Total Recoverable	µg/L	5	< 2.54	< 2.54	< 2.54	3.65	3.97	5.45	6.44

Table C-12: Ambient Monitoring Data Statistical Summary for Gales Creek at Stringtown									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	15	< 0.010	< 0.010	< 0.010	< 0.010	0.016	0.017	0.034
Conductivity, Field	µS/cm	15	71.2	75.7	81.1	112.7	130.9	143.7	150.2
Copper, Dissolved	µg/L	2	0.566	0.595	0.637	0.709	0.780	0.823	0.851
Copper, Total Recoverable	µg/L	2	1.010	1.022	1.040	1.070	1.100	1.118	1.130
Dissolved Oxygen	mg/L	15	8.63	8.82	9.41	11.25	12.04	12.17	12.35
E. coli, Most Probable Number	MPN/100 mL	15	6	11	19	50	104	124	145
Hardness, Total	mg/L	3	32.1	35.3	40.1	48.0	52.5	55.1	56.9
Lead, Dissolved	µg/L	2	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	2	< 0.102	0.103	0.104	0.106	0.107	0.108	0.109
Mercury by Purge & Trap, Dissolved	ng/L	1	0.344	0.344	0.344	0.344	0.344	0.344	0.344
Mercury by Purge & Trap, Total	ng/L	1	0.795	0.795	0.795	0.795	0.795	0.795	0.795
Nitrate/Nitrite-N, Dissolved	mg/L	15	0.022	0.030	0.040	0.092	0.304	0.427	0.522
Organic Carbon, Total Non-purgeable	mg/L	15	0.869	0.924	1.02	1.10	1.37	2.02	2.43
Orthophosphate-P, Dissolved	mg/L	15	0.012	0.014	0.016	0.019	0.021	0.023	0.025
pH, Field	S.U.	15	6.69	7.11	7.38	7.44	7.48	7.49	7.52
Temperature	°C	15	4.949	5.692	6.472	7.623	15.689	18.209	19.100
Total Phosphorus-P	mg/L	15	< 0.025	0.0278	0.0310	0.0370	0.0415	0.0520	0.0580
Total Suspended Solids	mg/L	15	1.4	1.6	1.9	4.2	5.6	8.9	22.8
Turbidity, Field	NTU	15	0.76	1.06	1.46	2.20	3.98	5.51	12.67
Zinc, Dissolved	µg/L	2	< 2.54	2.64	2.78	3.02	3.25	3.40	3.49
Zinc, Total Recoverable	µg/L	2	2.64	2.84	3.15	3.65	4.16	4.46	4.66

Table C-13: Ambient Monitoring Data Statistical Summary for Dairy Creek at Highway 8									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	23	< 0.010	0.013	0.019	0.033	0.041	0.052	0.060
Conductivity, Field	µS/cm	21	82.8	87.9	95.5	104.4	114.6	118.6	144.1
Copper, Dissolved	µg/L	4	0.548	0.612	0.707	0.823	1.005	1.218	1.360
Copper, Total Recoverable	µg/L	5	0.768	0.811	0.875	0.989	0.991	1.152	1.260
Dissolved Oxygen	mg/L	23	6.90	7.37	7.78	9.10	10.60	10.93	11.12
E. coli, Most Probable Number	MPN/100 mL	23	35	39	57	93	143	170	387
Hardness, Total	mg/L	6	35.1	35.9	37.3	40.2	43.1	47.0	50.2
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	0.165	0.169	0.175	0.281	0.351	0.443	0.504
Mercury by Purge & Trap, Dissolved	ng/L	2	0.462	0.475	0.494	0.526	0.557	0.576	0.589
Mercury by Purge & Trap, Total	ng/L	2	1.110	1.187	1.303	1.495	1.688	1.803	1.880
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.246	0.302	0.438	0.649	1.580	2.098	3.010
Organic Carbon, Total Non-purgeable	mg/L	23	1.70	1.79	2.14	2.54	2.91	3.80	5.55
Orthophosphate-P, Dissolved	mg/L	23	0.013	0.017	0.024	0.040	0.055	0.065	0.090
pH, Field	S.U.	23	6.34	6.75	6.92	7.06	7.20	7.28	7.34
Temperature	°C	23	5.005	5.933	6.945	10.869	15.925	19.061	19.647
Total Phosphorus-P	mg/L	23	0.0510	0.0582	0.0815	0.0960	0.1120	0.1242	0.2290
Total Suspended Solids	mg/L	23	4.0	4.6	6.8	9.4	15.5	18.2	31.5
Turbidity, Field	NTU	23	3.55	4.88	5.82	6.34	9.54	14.88	19.49
Zinc, Dissolved	µg/L	5	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	7.98	11.60
Zinc, Total Recoverable	µg/L	5	< 2.54	2.84	3.30	3.43	5.08	8.51	10.80

Table C-14: Ambient Monitoring Data Statistical Summary for McKay Creek at Padgett									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	23	< 0.010	< 0.010	0.013	0.019	0.027	0.030	0.041
Conductivity, Field	µS/cm	23	95.8	109.8	119.5	141.8	147.8	159.8	178.1
Copper, Dissolved	µg/L	4	0.481	0.504	0.540	0.595	0.676	0.756	0.810
Copper, Total Recoverable	µg/L	5	0.518	0.540	0.572	0.717	0.768	0.780	0.788
Dissolved Oxygen	mg/L	23	6.47	6.56	7.07	9.31	10.50	10.91	11.04
E. coli, Most Probable Number	MPN/100 mL	23	20	40	46	91	173	203	225
Hardness, Total	mg/L	6	47.2	49.3	52.4	58.9	62.5	62.9	63.1
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	< 0.102	0.114	0.132	0.132	0.163	0.172	0.178
Mercury by Purge & Trap, Dissolved	ng/L	2	0.498	0.498	0.499	0.500	0.500	0.501	0.501
Mercury by Purge & Trap, Total	ng/L	2	0.948	0.956	0.969	0.989	1.010	1.022	1.030
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.145	0.192	0.276	0.614	1.895	2.434	3.570
Organic Carbon, Total Non-purgeable	mg/L	23	1.51	1.65	1.78	2.72	3.05	3.31	5.75
Orthophosphate-P, Dissolved	mg/L	23	0.016	0.019	0.023	0.041	0.062	0.071	0.085
pH, Field	S.U.	23	6.73	7.05	7.16	7.28	7.34	7.40	7.41
Temperature	°C	23	4.847	5.864	6.822	10.983	16.221	18.886	20.720
Total Phosphorus-P	mg/L	23	0.0390	0.0432	0.0545	0.0810	0.1135	0.1216	0.1440
Total Suspended Solids	mg/L	23	0.8	2.1	2.6	3.4	4.8	9.4	15.1
Turbidity, Field	NTU	23	2.05	2.53	3.02	3.92	7.02	10.21	25.26
Zinc, Dissolved	µg/L	5	< 2.54	< 2.54	< 2.54	< 2.54	3.02	3.51	3.84
Zinc, Total Recoverable	µg/L	5	< 2.54	< 2.55	< 2.56	4.43	5.09	5.32	5.47

Table C-15: Ambient Monitoring Data Statistical Summary for Rock Creek at Brookwood									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	23	< 0.010	0.017	0.024	0.034	0.043	0.047	0.055
Conductivity, Field	µS/cm	22	108.3	144.9	155.4	217.9	296.8	320.3	392.3
Copper, Dissolved	µg/L	4	1.330	1.417	1.548	1.625	1.840	2.218	2.470
Copper, Total Recoverable	µg/L	5	1.700	1.768	1.870	2.050	2.340	2.448	2.520
Dissolved Oxygen	mg/L	22	5.47	5.80	6.09	8.66	10.63	10.87	11.46
E. coli, Most Probable Number	MPN/100 mL	23	35	46	81	152	200	242	1300
Hardness, Total	mg/L	6	60.3	69.6	83.9	105.4	121.8	127.0	129.0
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	0.244	0.339	0.482	0.489	0.573	0.617	0.646
Mercury by Purge & Trap, Dissolved	ng/L	2	0.417	0.427	0.441	0.466	0.490	0.504	0.514
Mercury by Purge & Trap, Total	ng/L	2	0.917	0.984	1.085	1.254	1.422	1.523	1.590
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.172	0.213	0.292	0.373	0.692	1.030	1.260
Organic Carbon, Total Non-purgeable	mg/L	23	2.77	2.93	3.30	4.52	5.02	6.08	7.29
Orthophosphate-P, Dissolved	mg/L	23	0.027	0.035	0.039	0.065	0.130	0.150	0.161
pH, Field	S.U.	22	6.78	7.05	7.29	7.43	7.46	7.52	7.68
Temperature	°C	22	5.771	6.437	7.555	12.475	17.100	20.314	20.663
Total Phosphorus-P	mg/L	23	0.0800	0.0890	0.1020	0.1220	0.2350	0.2490	0.2600
Total Suspended Solids	mg/L	23	2.8	5.3	6.7	11.0	15.7	27.5	46.4
Turbidity, Field	NTU	22	3.85	4.50	6.20	7.63	10.02	11.51	21.11
Zinc, Dissolved	µg/L	5	< 2.54	2.56	2.58	4.81	12.50	13.82	14.70
Zinc, Total Recoverable	µg/L	5	5.47	7.60	10.80	22.60	23.80	23.80	23.80

Table C-16: Ambient Monitoring Data Statistical Summary for Beaverton Creek near Orenco									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	22	0.010	0.022	0.031	0.040	0.047	0.053	0.069
Conductivity, Field	µS/cm	22	101.7	140.8	159.6	215.7	249.4	265.8	277.1
Copper, Dissolved	µg/L	4	1.720	1.780	1.870	2.070	2.365	2.626	2.800
Copper, Total Recoverable	µg/L	5	2.210	2.266	2.350	2.550	2.910	2.922	2.930
Dissolved Oxygen	mg/L	22	5.01	5.36	5.66	8.82	10.55	10.98	11.37
E. coli, Most Probable Number	MPN/100 mL	22	35	50	69	167	299	360	1410
Hardness, Total	mg/L	5	62.4	67.7	75.6	100.0	102.0	106.2	109.0
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	0.104	0.105
Lead, Total Recoverable	µg/L	5	0.411	0.442	0.489	0.589	0.646	0.651	0.655
Mercury by Purge & Trap, Dissolved	ng/L	2	0.411	0.414	0.418	0.425	0.432	0.436	0.439
Mercury by Purge & Trap, Total	ng/L	2	1.320	1.330	1.345	1.370	1.395	1.410	1.420
Nitrate/Nitrite-N, Dissolved	mg/L	22	0.240	0.289	0.327	0.530	0.685	0.848	1.030
Organic Carbon, Total Non-purgeable	mg/L	22	2.91	2.99	3.41	4.70	5.20	6.07	7.30
Orthophosphate-P, Dissolved	mg/L	22	0.030	0.039	0.041	0.077	0.142	0.157	0.190
pH, Field	S.U.	22	6.80	7.17	7.35	7.42	7.49	7.53	7.70
Temperature	°C	22	5.428	6.298	7.407	10.991	17.458	20.832	22.119
Total Phosphorus-P	mg/L	22	0.0860	0.0958	0.1085	0.1495	0.2453	0.2574	0.2690
Total Suspended Solids	mg/L	22	3.2	4.0	4.9	6.5	8.6	14.1	55.8
Turbidity, Field	NTU	22	4.42	4.63	5.31	6.92	9.12	10.46	26.62
Zinc, Dissolved	µg/L	5	3.05	3.11	3.21	4.71	19.10	19.76	20.20
Zinc, Total Recoverable	µg/L	5	6.85	7.11	7.49	8.93	29.50	30.28	30.80

Table C-17: Ambient Monitoring Data Statistical Summary for Chicken Creek at Scholls-Sherwood									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	8	< 0.010	< 0.010	0.013	0.020	0.037	0.040	0.045
Conductivity, Field	µS/cm	8	77.5	78.5	80.9	88.0	123.7	127.9	134.0
Copper, Dissolved	µg/L	3	0.496	0.527	0.573	0.650	0.653	0.654	0.655
Copper, Total Recoverable	µg/L	3	0.790	0.791	0.792	0.794	1.032	1.175	1.270
Dissolved Oxygen	mg/L	8	7.17	7.62	8.43	10.18	11.17	11.34	11.54
E. coli, Most Probable Number	MPN/100 mL	8	35	38	41	146	158	171	179
Hardness, Total	mg/L	3	28.3	30.0	32.7	37.0	44.3	48.6	51.5
Lead, Dissolved	µg/L	3	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	3	0.259	0.268	0.281	0.302	0.364	0.400	0.425
Mercury by Purge & Trap, Dissolved	ng/L	1	0.502	0.502	0.502	0.502	0.502	0.502	0.502
Mercury by Purge & Trap, Total	ng/L	1	1.640	1.640	1.640	1.640	1.640	1.640	1.640
Nitrate/Nitrite-N, Dissolved	mg/L	8	0.551	0.564	0.603	1.140	1.480	1.642	1.670
Organic Carbon, Total Non-purgeable	mg/L	8	1.25	1.34	1.48	1.62	2.34	2.46	2.73
Orthophosphate-P, Dissolved	mg/L	8	0.012	0.013	0.014	0.017	0.031	0.039	0.049
pH, Field	S.U.	8	7.09	7.10	7.12	7.14	7.17	7.20	7.20
Temperature	°C	8	6.366	7.018	7.939	10.353	13.541	16.131	17.286
Total Phosphorus-P	mg/L	8	0.0400	0.0414	0.0458	0.0660	0.1035	0.1215	0.1530
Total Suspended Solids	mg/L	8	3.0	4.7	6.6	8.4	11.9	19.8	29.3
Turbidity, Field	NTU	8	5.55	5.58	6.15	6.46	7.21	8.27	8.51
Zinc, Dissolved	µg/L	3	< 2.54	2.72	3.00	3.45	3.68	3.81	3.90
Zinc, Total Recoverable	µg/L	3	7.68	7.73	7.82	7.95	9.48	10.39	11.00

Table C-18: Ambient Monitoring Data Statistical Summary for Fanno Creek at Durham									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	22	< 0.010	0.014	0.022	0.037	0.048	0.057	0.075
Conductivity, Field	µS/cm	23	111.7	155.1	190.3	222.3	359.1	445.4	538.0
Copper, Dissolved	µg/L	4	1.350	1.419	1.523	1.660	1.760	1.796	1.820
Copper, Total Recoverable	µg/L	5	1.410	1.474	1.570	1.850	1.850	2.174	2.390
Dissolved Oxygen	mg/L	23	6.15	6.44	7.08	10.38	10.87	11.13	11.65
E. coli, Most Probable Number	MPN/100 mL	23	21	54	79	155	388	679	> 2420
Hardness, Total	mg/L	6	71.6	75.8	84.3	110.2	144.8	159.0	166.0
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	0.215	0.243	0.286	0.317	0.391	0.498	0.570
Mercury by Purge & Trap, Dissolved	ng/L	2	0.394	0.401	0.412	0.429	0.447	0.457	0.464
Mercury by Purge & Trap, Total	ng/L	2	0.998	1.019	1.051	1.104	1.157	1.189	1.210
Nitrate/Nitrite-N, Dissolved	mg/L	23	0.204	0.286	0.347	0.409	0.654	0.848	0.959
Organic Carbon, Total Non-purgeable	mg/L	23	3.00	3.26	3.52	3.97	4.20	6.16	7.68
Orthophosphate-P, Dissolved	mg/L	22	0.024	0.027	0.033	0.045	0.051	0.060	0.071
pH, Field	S.U.	23	6.76	7.04	7.18	7.36	7.45	7.50	7.84
Temperature	°C	23	5.245	6.714	7.295	12.706	17.584	20.060	20.986
Total Phosphorus-P	mg/L	23	0.0730	0.0786	0.0955	0.1060	0.1210	0.1470	0.1790
Total Suspended Solids	mg/L	23	0.6	3.7	4.2	6.6	10.2	16.2	44.2
Turbidity, Field	NTU	23	1.84	4.34	5.16	7.06	10.61	13.61	22.78
Zinc, Dissolved	µg/L	5	4.26	4.35	4.48	6.33	12.30	15.72	18.00
Zinc, Total Recoverable	µg/L	5	7.36	8.34	9.81	12.10	21.50	25.16	27.60

Table C-19: Ambient Monitoring Data Statistical Summary for Dawson Creek at Brookwood									
Analysis Name	*Unit*	*n*	*MIN*	*10th Percentile*	*25th Percentile*	*Median*	*75th Percentile*	*90th Percentile*	*MAX*
Ammonia-N, Dissolved	mg/L	23	0.012	0.016	0.025	0.036	0.049	0.070	0.131
Conductivity, Field	µS/cm	23	177.5	211.9	260.4	312.1	415.8	727.6	840.0
Copper, Dissolved	µg/L	4	0.545	0.607	0.701	0.772	0.840	0.929	0.988
Copper, Total Recoverable	µg/L	5	0.556	0.600	0.666	0.955	0.966	0.986	0.999
Dissolved Oxygen	mg/L	23	4.00	5.11	6.20	9.48	10.70	11.54	12.18
E. coli, Most Probable Number	MPN/100 mL	23	16	27	42	201	534	761	1300
Hardness, Total	mg/L	6	123.0	125.0	137.5	169.0	173.5	178.0	181.0
Lead, Dissolved	µg/L	5	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102	< 0.102
Lead, Total Recoverable	µg/L	5	< 0.102	0.108	0.118	0.124	0.147	0.154	0.159
Mercury by Purge & Trap, Dissolved	ng/L	2	0.207	0.211	0.218	0.229	0.240	0.247	0.251
Mercury by Purge & Trap, Total	ng/L	2	0.345	0.366	0.398	0.451	0.504	0.536	0.557
Nitrate/Nitrite-N, Dissolved	mg/L	23	< 0.200	0.184	0.200	0.362	0.471	0.627	0.917
Organic Carbon, Total Non-purgeable	mg/L	23	2.29	2.41	2.73	3.14	3.69	4.36	6.37
Orthophosphate-P, Dissolved	mg/L	23	0.033	0.040	0.051	0.068	0.084	0.119	0.151
pH, Field	S.U.	23	6.92	7.22	7.27	7.46	7.66	7.72	7.78
Temperature	°C	23	5.709	6.816	7.778	11.633	17.285	20.097	20.932
Total Phosphorus-P	mg/L	23	0.0670	0.0740	0.0895	0.1160	0.1580	0.1736	0.2060
Total Suspended Solids	mg/L	22	1.5	2.4	3.1	4.4	5.5	7.8	11.6
Turbidity, Field	NTU	23	1.77	2.06	2.48	3.27	3.86	5.30	7.15
Zinc, Dissolved	µg/L	5	< 2.54	< 2.54	< 2.54	3.42	7.05	7.30	7.47
Zinc, Total Recoverable	µg/L	5	3.68	4.19	4.95	6.69	10.00	10.06	10.10

Appendix D: Water Quality Status Report

This appendix presents information and data pertaining to the pollutants regulated under a Tualatin subbasin Total Maximum Daily Load (TMDL), which became effective in August 2001. The 2001 TMDL modified previous TMDLs for phosphorus and ammonia and added new TMDLs for temperature, bacteria, and volatile solids (to address sediment oxygen demand impacts on dissolved oxygen in the tributaries). A TMDL update in 2012 includes phosphorus and ammonia allocations for all four of CWS' water resource recovery facilities. The Willamette Basin Mercury TMDL was approved in 2021.

The TMDL parameters include:

- Total phosphorus target concentrations designed to limit nuisance algal growth and achieve the instream pH criterion.
- Ammonia allocations designed to achieve the dissolved oxygen criterion in the Tualatin River.
- Settleable volatile solids allocations designed to achieve the dissolved oxygen criterion in the Tualatin River and its tributaries.
- Temperature and bacteria allocations designed to achieve ambient water quality standards in the basin.
- Mercury allocations designed to meet criteria for human health throughout the Willamette Basin including the Tualatin subbasin.

This summary provides general information on Tualatin River mainstem and tributary conditions during 2022. This information does not provide an assessment of compliance with permit conditions or TMDL requirements. Compliance is addressed through a separate mechanism which, for the NPDES permit, includes monthly discharge monitoring reports. Different statistics and reporting periods are used to report for permit compliance than are used for this annual summary.

The primary monitoring period for most of the Tualatin subbasin TMDLs is the dry season, May 1 to October 31. For ammonia, the monitoring period is May 1 to November 15. For bacteria, the monitoring period is the entire year. Mercury data is collected throughout the year. This report covers the 2022 monitoring year.

Total Phosphorus TMDL

The phosphorus TMDL was developed to protect the beneficial uses of aesthetics, indicated by chlorophyll a, and aquatic life, indicated by pH. The 2001 Tualatin TMDL established river and tributary loading capacities for total phosphorus expressed as concentrations (mg/L). Table D-1 shows the loading capacities and the data for the key sites for the most recent monitoring year, as well as other monitoring years selected from the period of time the TMDLs have been in effect.

Table D-1: History of Total Phosphorus Summer Medians (mg/L) May 1 – October 31						
Location	*2001 TMDL Loading Capacity*	*1990*	*2000*	*2010*	*2015*	*2022*
Tualatin River at Weiss Br	**0.10**	0.22	0.08	0.09	0.08	0.117
Tualatin River at Stafford Rd	**0.10**	0.23	0.08	0.10	0.09	0.122
Tualatin River at Boones Ferry Rd	**0.11**	0.23	0.08	0.10	0.09	0.124
Tualatin River at Hwy 210 Bridge	**0.10**	0.15	0.08	0.10	0.08	0.102
Tualatin River at Rood Bridge Road	**0.09**	0.10	0.06	0.08	0.06	0.066
Tualatin River at Hwy 219 Bridge	**0.04**	-	0.05	0.07	0.06	0.071
Tualatin River at Golf Course Rd	**0.04**	0.05	0.03	0.04	0.03	0.053
Tualatin River at Cherry Grove	**0.04**	-	< 0.025	< 0.025	< 0.025	<0.025
Scoggins Creek at Old Hwy 47[1]	**0.04**	0.43	< 0.025	< 0.025	< 0.025	<0.025
Gales Creek at New Hwy 47	**0.04**	0.06	0.04	0.04	0.05	0.043
Dairy Creek at Hwy 8	**0.09**	0.13	0.11	0.11	0.12	0.0960
Rock Creek at Brookwood	**0.19**	-	-	0.16	0.22	0.122
Chicken Cr on Scholls-Sherwood	**0.14**	0.23	0.11	0.11	0.11	0.066
Fanno Creek at Durham Rd	**0.13**	0.15	0.15	0.13	0.16	0.106

[1] Monitoring location changed to Scoggins below Hagg Lake in 2013.

Since 1988, the Tualatin River has had a phosphorus TMDL for both the mainstem Tualatin River and its tributaries. Total phosphorus has the potential to impact beneficial uses in the reservoir-like section of the river, where nuisance algal growth historically occurred and elevated pH levels were observed. CWS upgraded its water resource recovery facilities and for more than two decades has used a combination of biological phosphorus removal and alum (aluminum sulfate) addition in the tertiary process to meet the phosphorus wasteload allocations in the TMDL.

Since the development of the original TMDL in 1988, the river has changed dramatically in terms of operations, flows, and water quality. Water quality modeling suggests that the Tualatin River is not as sensitive to phosphorus inputs as it once was because river flows are much higher and the residence time in the lower river is much lower than when the TMDL wasteload allocations were originally established. Moreover, EPA has recently promulgated a new aluminum standard in Oregon that will make it impractical to continue to use alum in the tertiary process at current application rates.

CWS entered into an agreement with Oregon DEQ to study the effectiveness of biological processes in removing phosphorus at the water resource recovery facilities while balancing and optimizing the use of alum and the effects of the higher phosphorus concentrations in the Tualatin River. As expected, the phosphorus concentrations in the lower Tualatin River in 2022 were higher than in previous years; however, there was no indication of nuisance algae or

concerns with pH. Results indicate that the water resource recovery facilities can effectively reduce total phosphorus using biological processes and no additional alum in the tertiary process without negatively impacting water quality in the river. CWS is continuing the study in 2023.

Dissolved Oxygen TMDL

The ammonia TMDL is designed to achieve the dissolved oxygen criteria in the reservoir-like section of the Tualatin River, in part by ensuring that discharges from CWS' water resource recovery facilities do not measurably reduce dissolved oxygen due to ammonia discharge. The TMDL allows higher loads of ammonia in the spring and early summer when river conditions are favorable for the assimilation of ammonia, and lower ammonia loads in the fall when sediment oxygen demand consumes more oxygen, leaving less assimilative capacity.

The reservoir-like section of the Tualatin River is designated cold water habitat and has the following dissolved oxygen criteria.

- Grab samples: > 6.5 mg/L
- Continuous monitoring:
    - 30-day average of daily means > 6.5 mg/L
    - 7-day average of daily minimums > 5.0 mg/L
    - Daily minimum > 4.0 mg/L

CWS and the United States Geological Survey (USGS) are partners in a study where the USGS maintains continuous monitoring stations throughout the Tualatin subbasin. Two of these continuous monitoring stations are located in the reservoir section of the river:

1) Near Scholls (river mile 24.5), downstream of the Rock Creek Water Resource Recovery Facility (river mile 37.7).
2) At the Oswego Diversion Dam (river mile 3.4), downstream of the Durham Water Resource Recovery Facility (river mile 9.2).

Graphs of the dissolved oxygen concentrations at these two locations are presented as Figure D-1 (RM 24.5) and Figure D-2 (RM 3.4). In July 2022, USGS continuous monitors at RM 24.5 and Oswego Dam stations captured an unregulated discharge of algae moving downstream from a beaver dam breach on Wapato Creek, as indicated by increases in chlorophyll-a, pH, and dissolved oxygen. The coinciding peaks indicate that photosynthesis occurred along with the slug of algae moving through the river. The dissolved oxygen values were less than 6.5 mg/L in late September 2022 and coincide with the first storm of the season; early fall precipitation events tend to mobilize highly labile organic material in the tributaries, which causes a decrease in dissolved oxygen.

Figure D-1

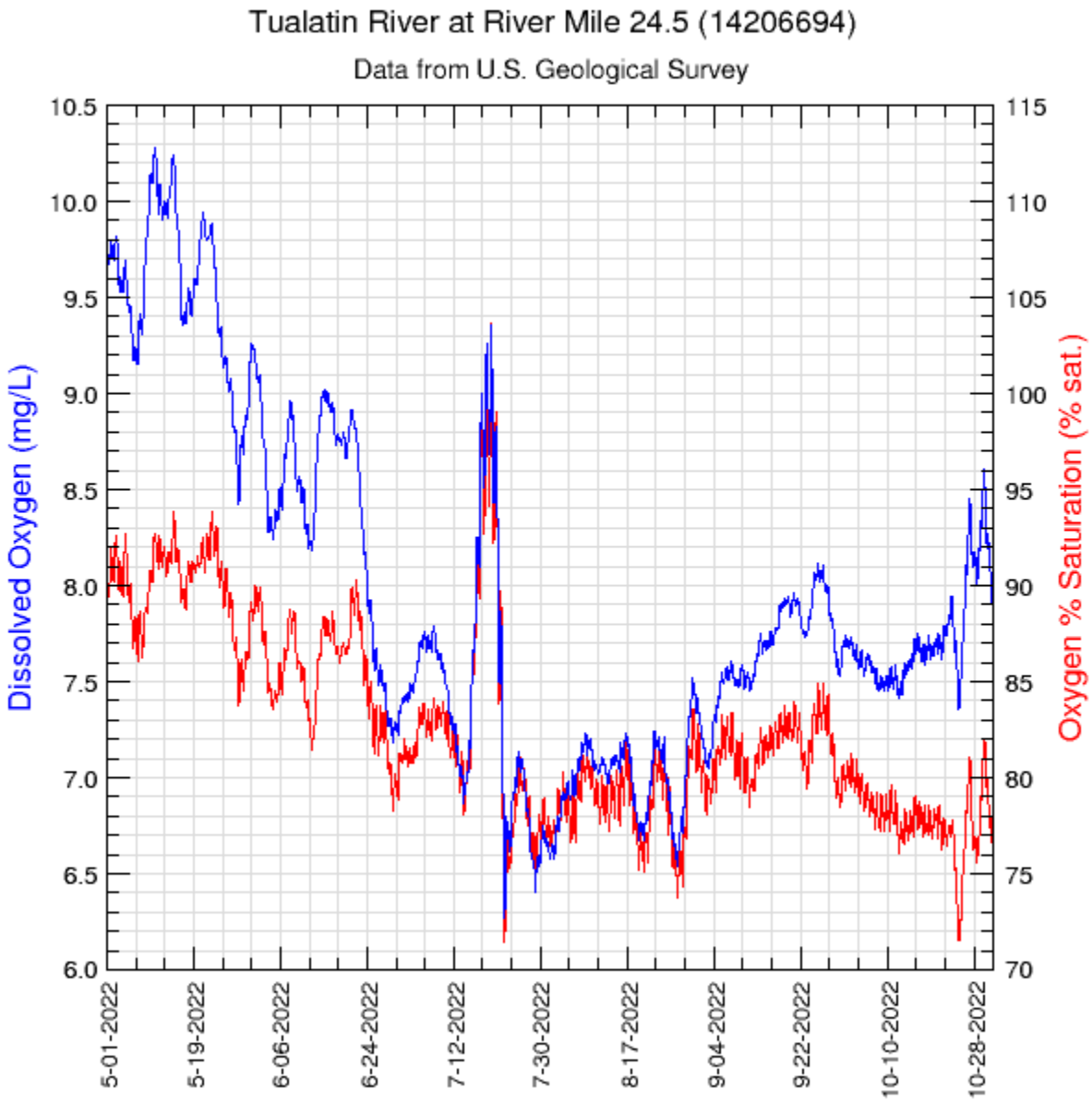
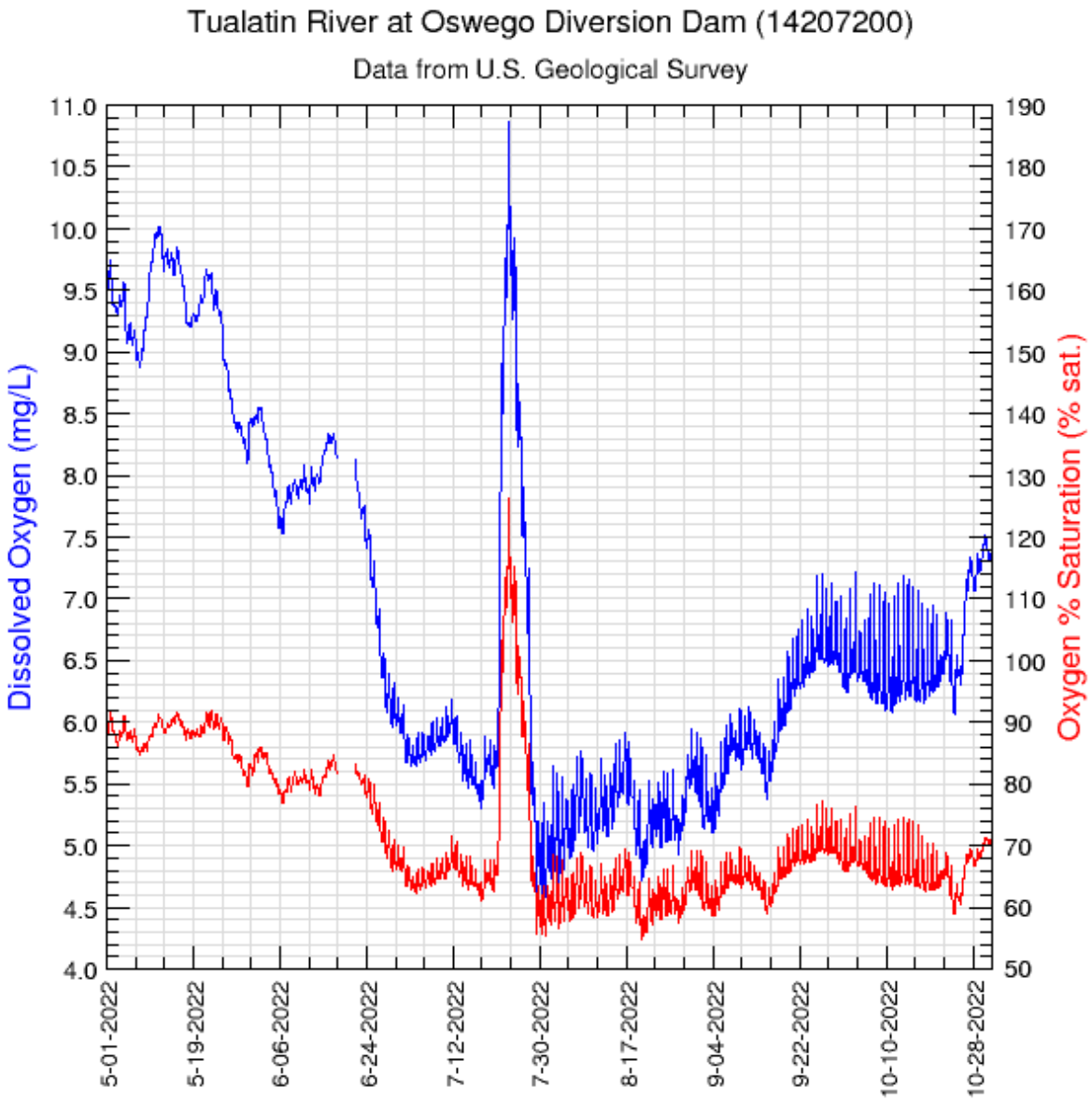

Tualatin River at River Mile 24.5 (14206694)
Data from U.S. Geological Survey
Dissolved Oxygen (mg/L)
Oxygen % Saturation (% sat.)
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
115
110
105
100
95
90
85
80
75
70
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-2


Tualatin River at Oswego Diversion Dam (14207200)
Data from U.S. Geological Survey
Dissolved Oxygen (mg/L)
Oxygen % Saturation (% sat.)
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Tributary Dissolved Oxygen TMDL

The 2001 Tualatin TMDL contained requirements for reductions in settleable volatile solids loads to reduce tributary sediment oxygen demand and achieve dissolved oxygen criteria in the tributaries. Figures D-3 to D-6 show the summer dissolved oxygen levels in the tributaries. Some stream segments in the Tualatin Basin are subject to the cold water habitat dissolved oxygen criteria given above, and some are subject to the following cold water habitat dissolved oxygen criteria:

- Grab samples: > 8.0 mg/L
- Continuous monitoring:
  - 30-day average of daily means > 8.0 mg/L
  - 7-day average of daily minimums > 6.5 mg/L
  - Daily minimum > 6.0 mg/L

Figure D-3

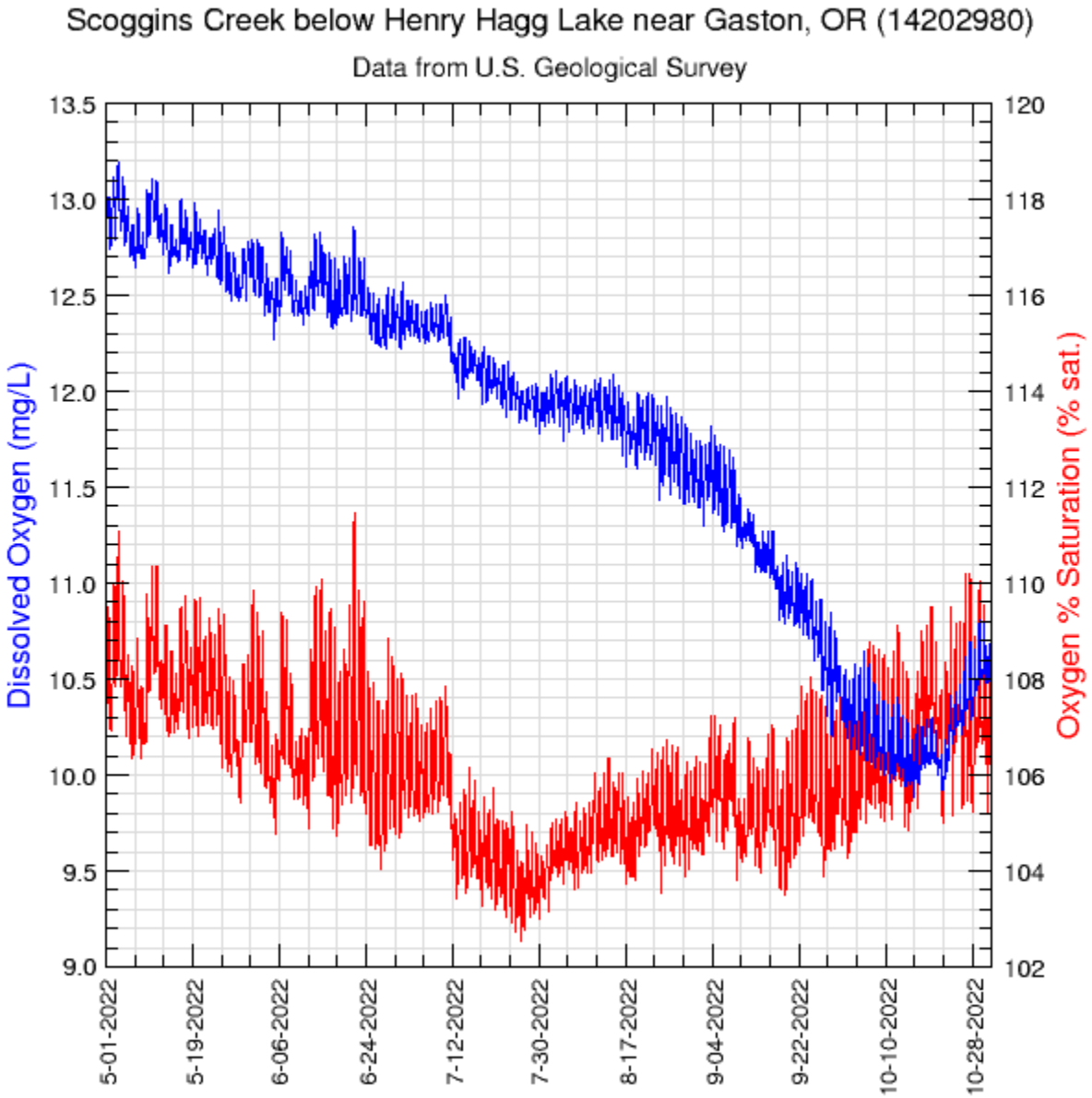

Scoggins Creek below Henry Hagg Lake near Gaston, OR (14202980)
Data from U.S. Geological Survey
Dissolved Oxygen (mg/L)
Oxygen % Saturation (% sat.)
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
120
118
116
114
112
110
108
106
104
102
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-4

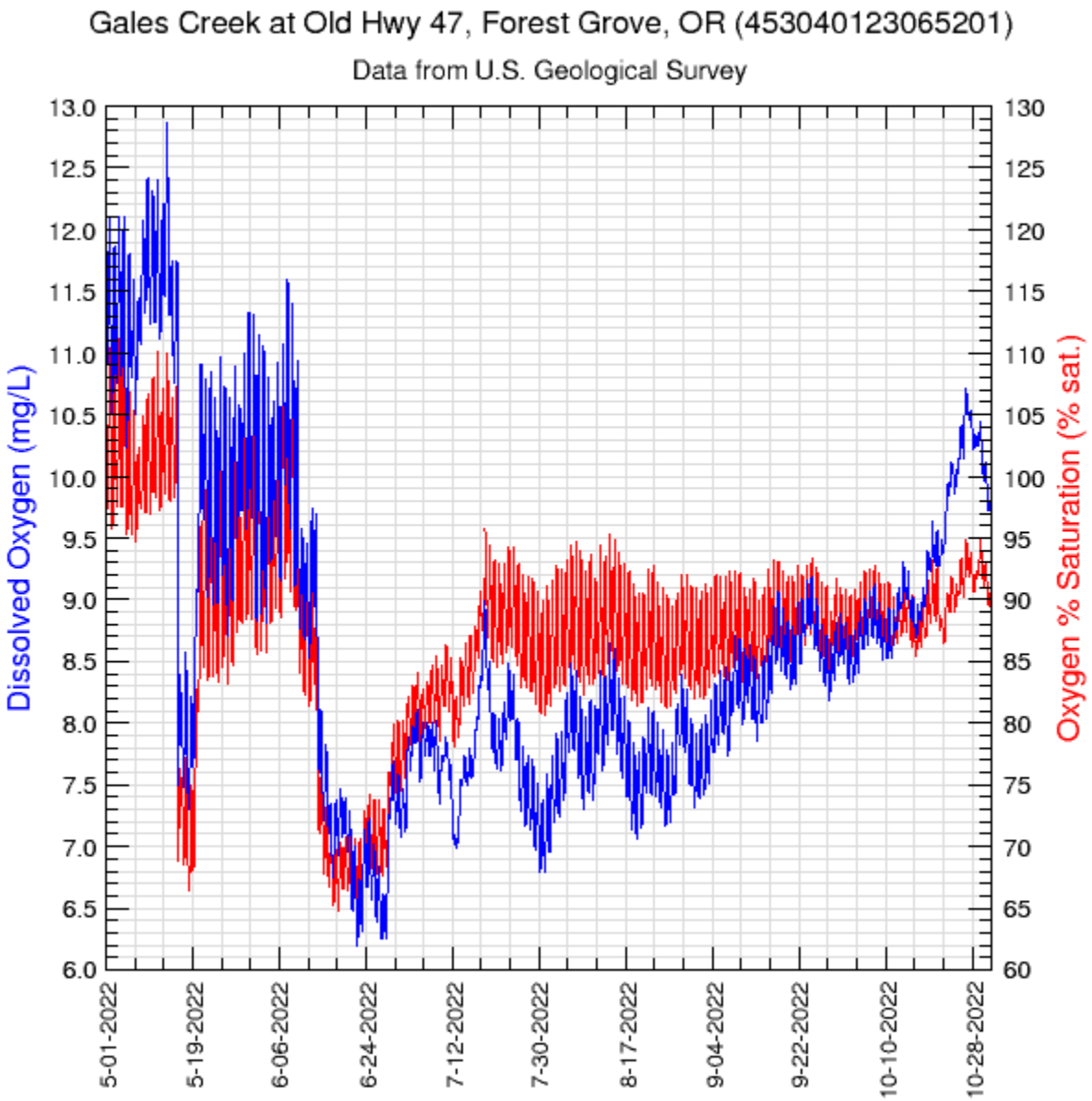

Gales Creek at Old Hwy 47, Forest Grove, OR (453040123065201)
Data from U.S. Geological Survey
Dissolved Oxygen (mg/L)
Oxygen % Saturation (% sat.)
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-5

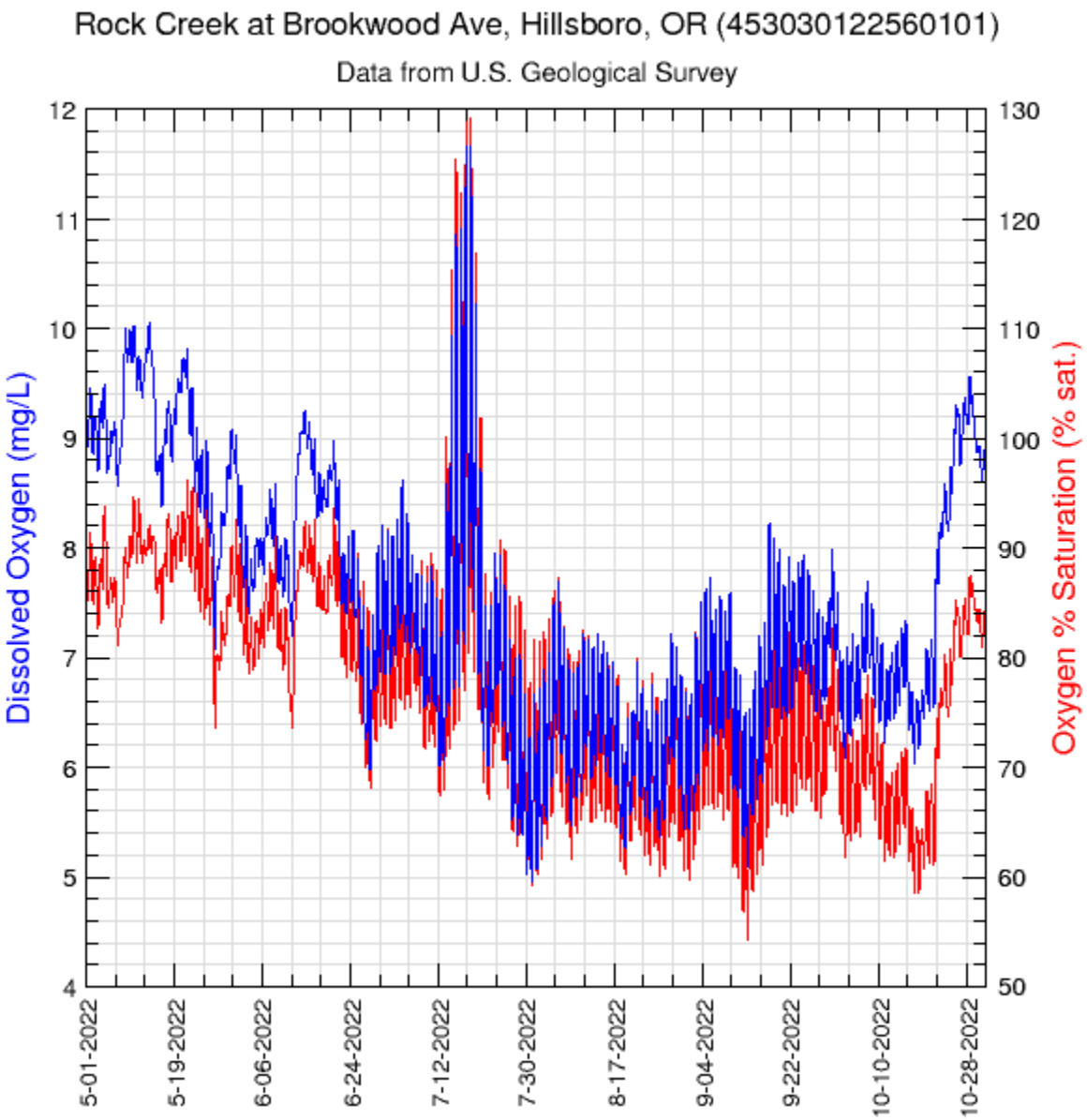
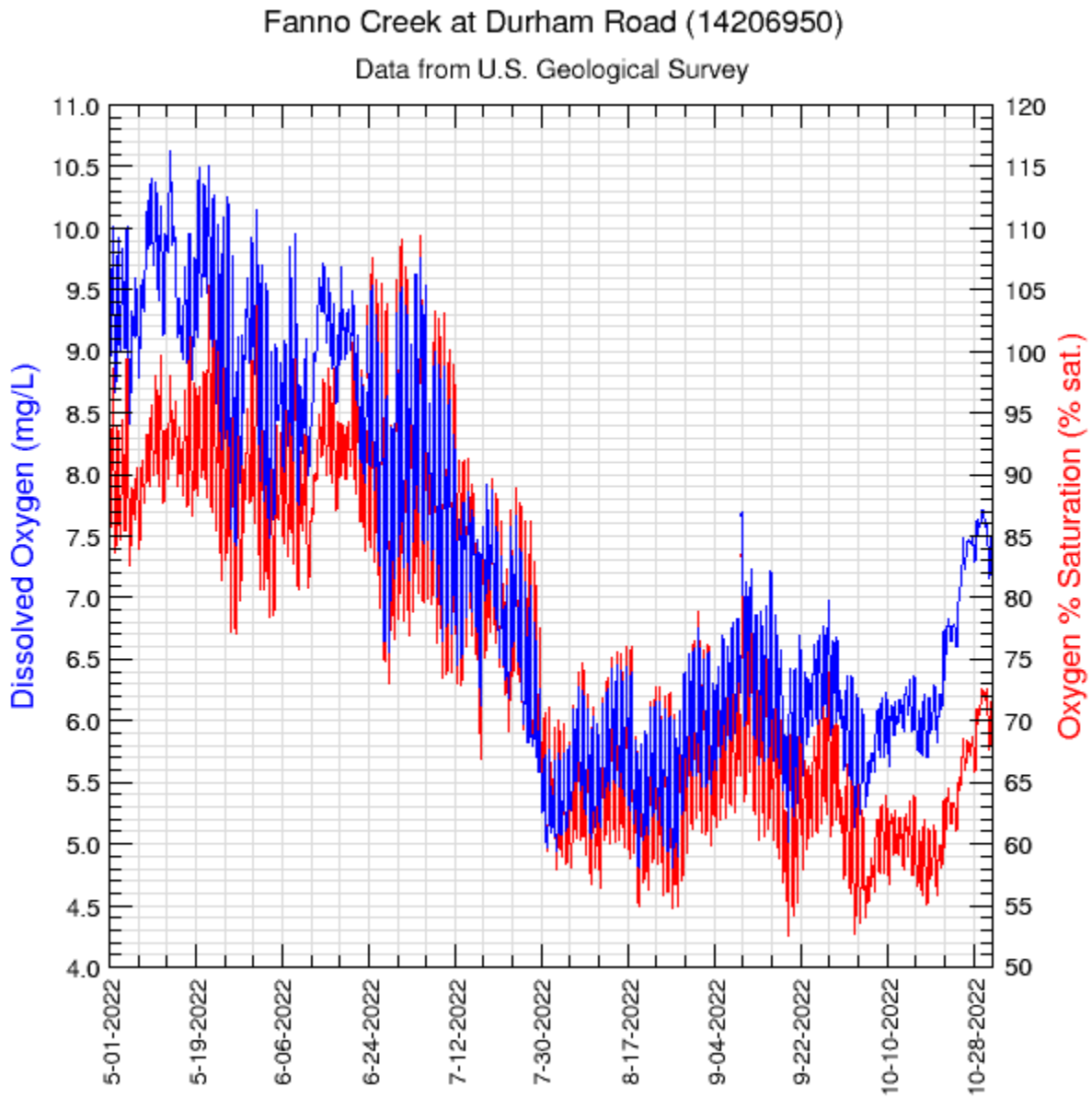

Rock Creek at Brookwood Ave, Hillsboro, OR (453030122560101)
Data from U.S. Geological Survey
Dissolved Oxygen (mg/L)
Oxygen % Saturation (% sat.)
12
11
10
9
8
7
6
5
4
130
120
110
100
90
80
70
60
50
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-6


Fanno Creek at Durham Road (14206950)
Data from U.S. Geological Survey
Dissolved Oxygen (mg/L)
Oxygen % Saturation (% sat.)
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Temperature TMDL

The temperature TMDL applies to both the mainstem and the tributaries. The TMDL is based on percent effective shade with the environmental goal of meeting the water quality temperature criteria. Most of the Tualatin subbasin is subject to the salmonid fish rearing beneficial use, which has the criterion of 18 degrees C throughout the year. The temperature TMDL was developed as a basin-scale TMDL in response to the Water Quality Limited status of selected tributaries and the lower mainstem of the river as indicated by the data from the Farmington Road station. There are sites and times in the upper Tualatin Basin where the applicable beneficial use is salmonid spawning, which has a criterion of 13 degrees C. Figures D-7 to D-12 display graphs of summer temperatures at selected sites.

Figure D-7

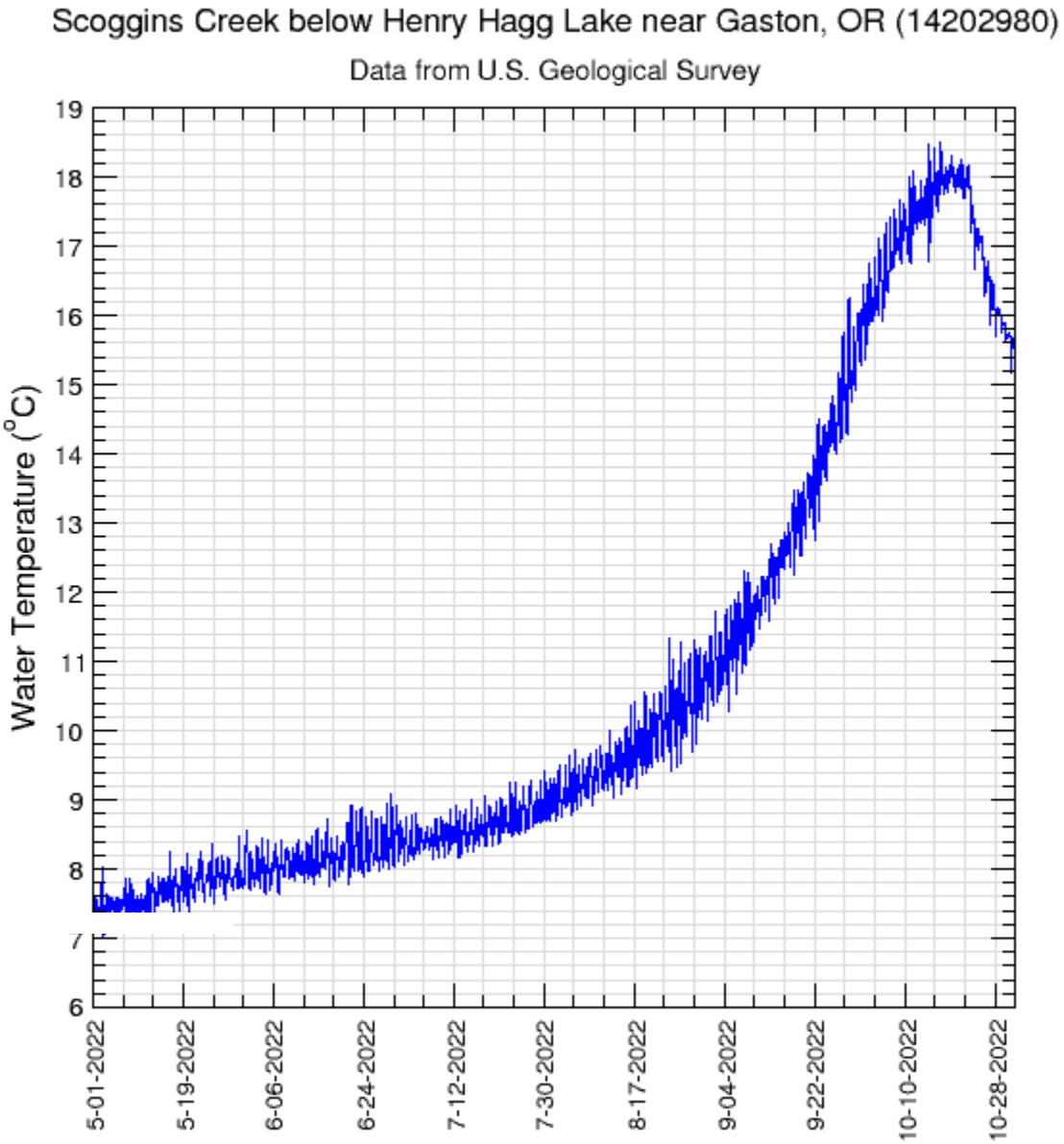


Figure D-8

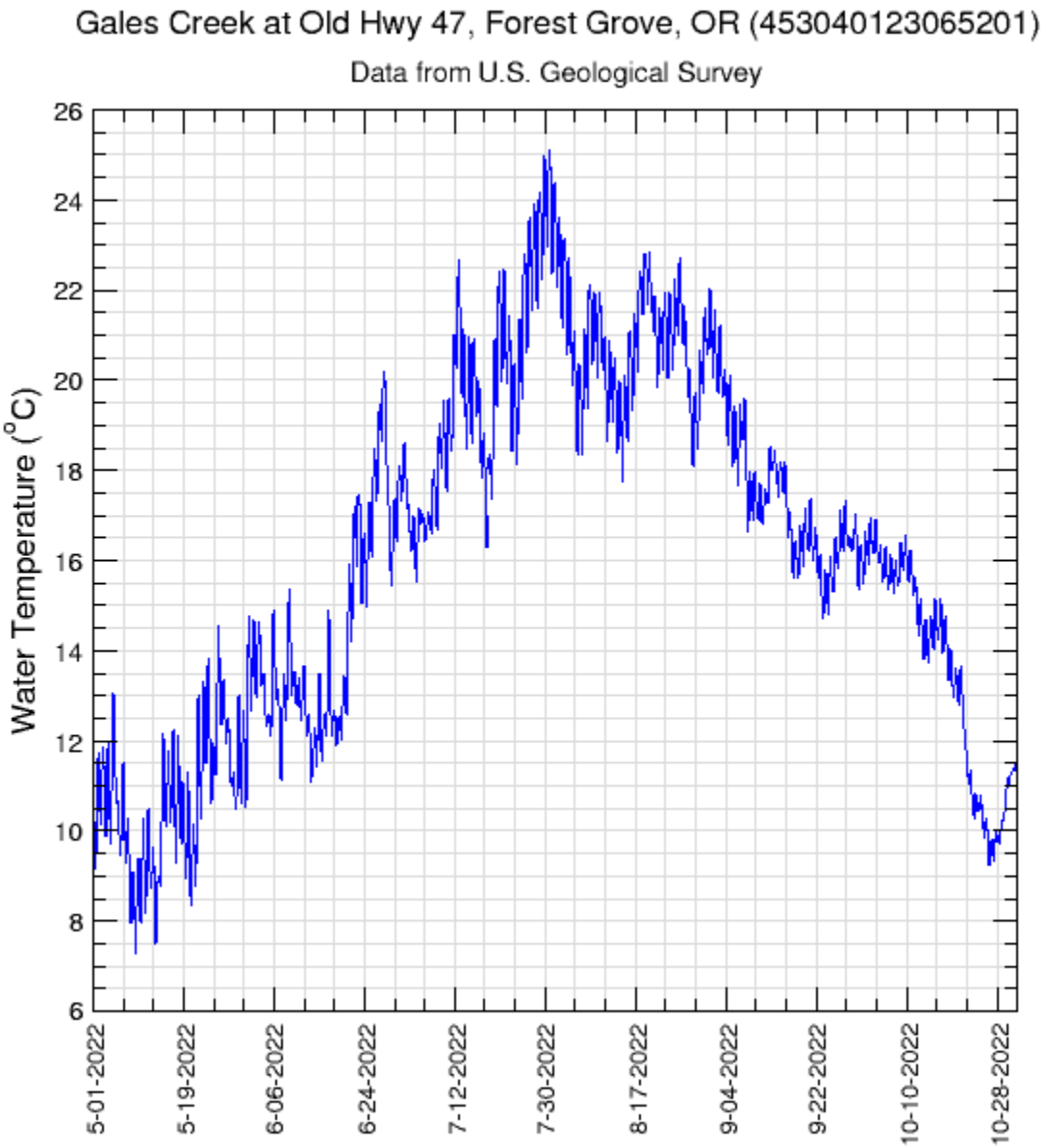

Gales Creek at Old Hwy 47, Forest Grove, OR (453040123065201)
Data from U.S. Geological Survey
Water Temperature (°C)
26
24
22
20
18
16
14
12
10
8
6
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-9

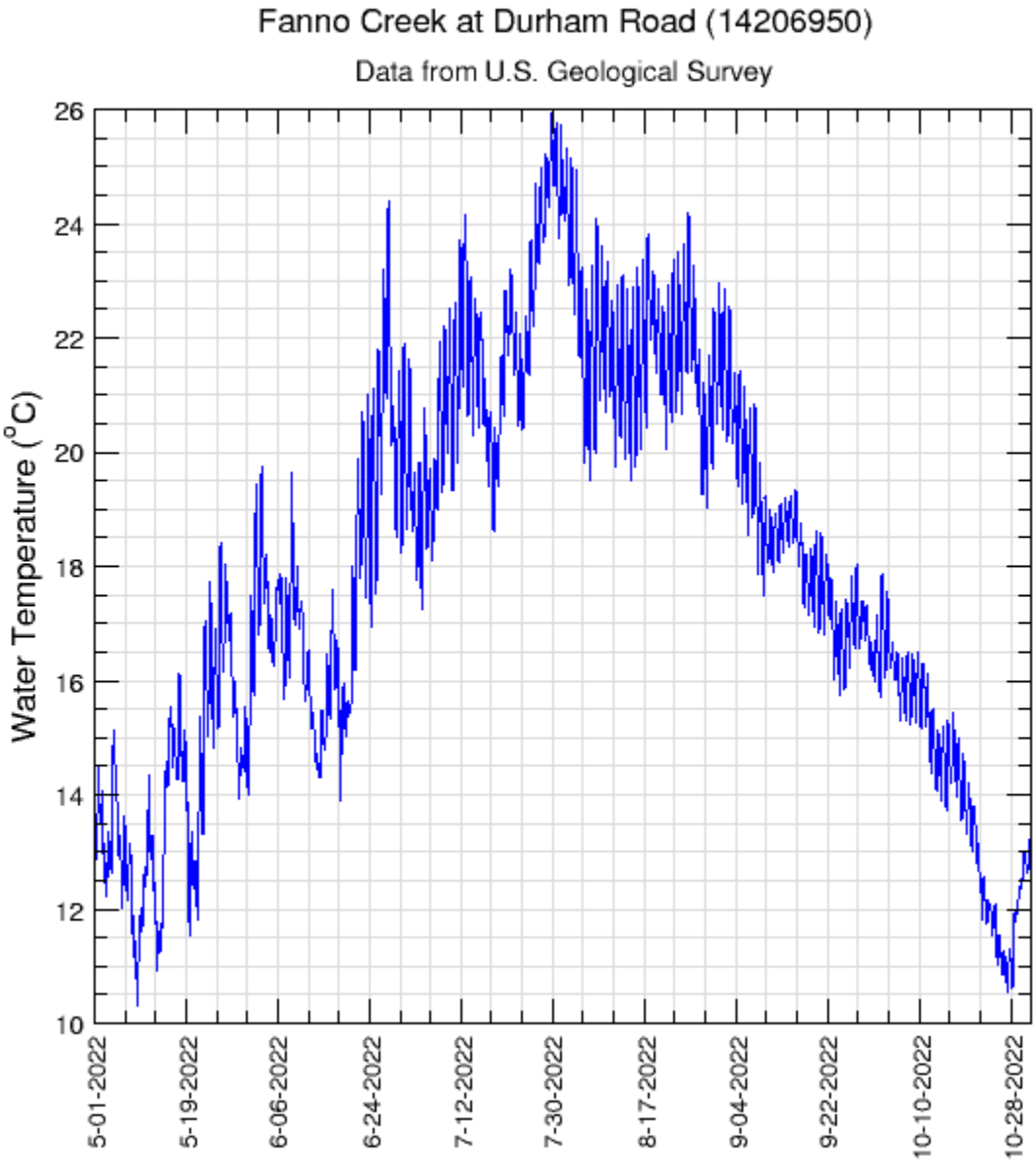

Fanno Creek at Durham Road (14206950)
Data from U.S. Geological Survey
Water Temperature (°C)
26
24
22
20
18
16
14
12
10
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-10

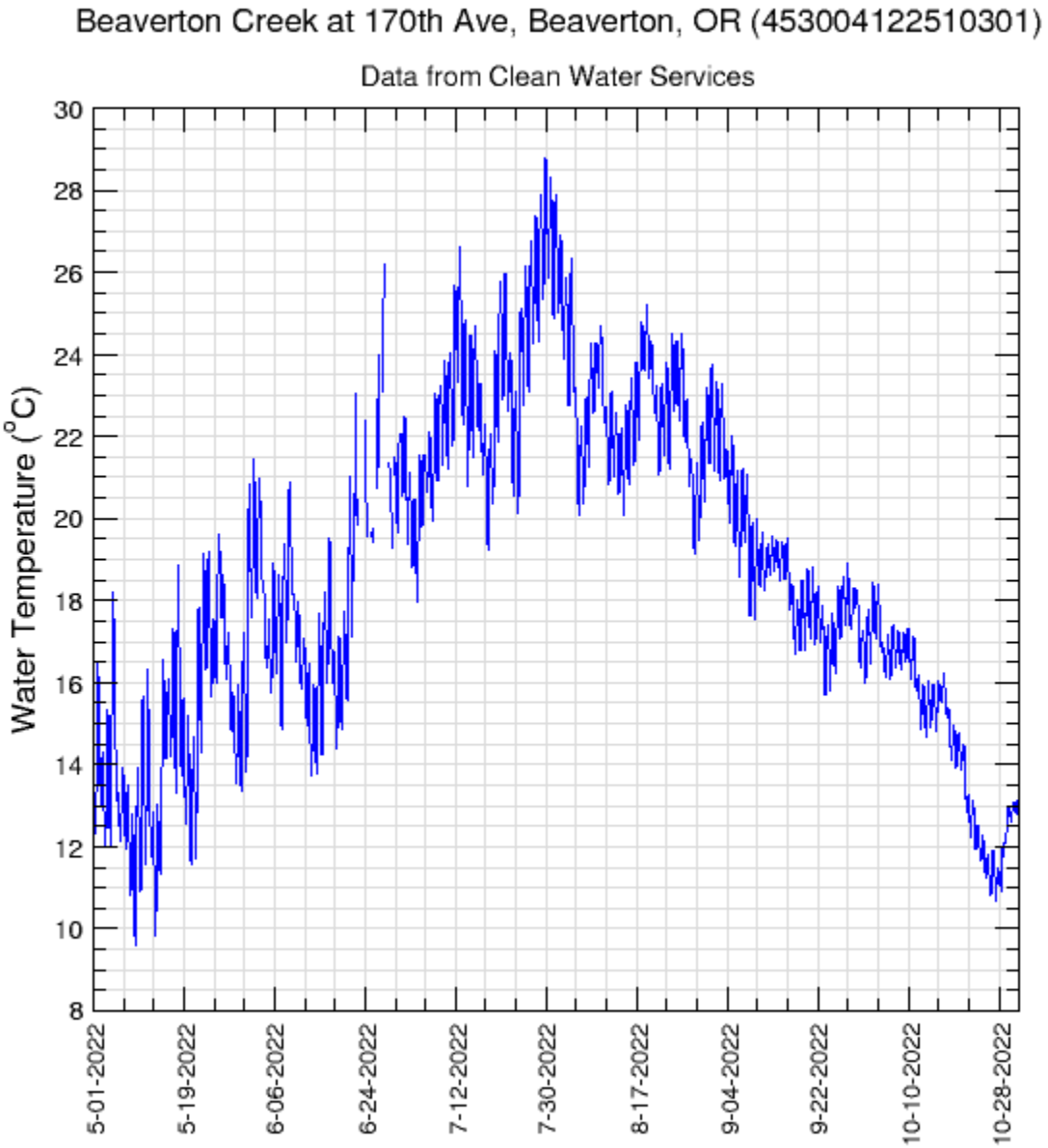

Beaverton Creek at 170th Ave, Beaverton, OR (453004122510301)
Data from Clean Water Services
Water Temperature (°C)
30
28
26
24
22
20
18
16
14
12
10
8
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-11

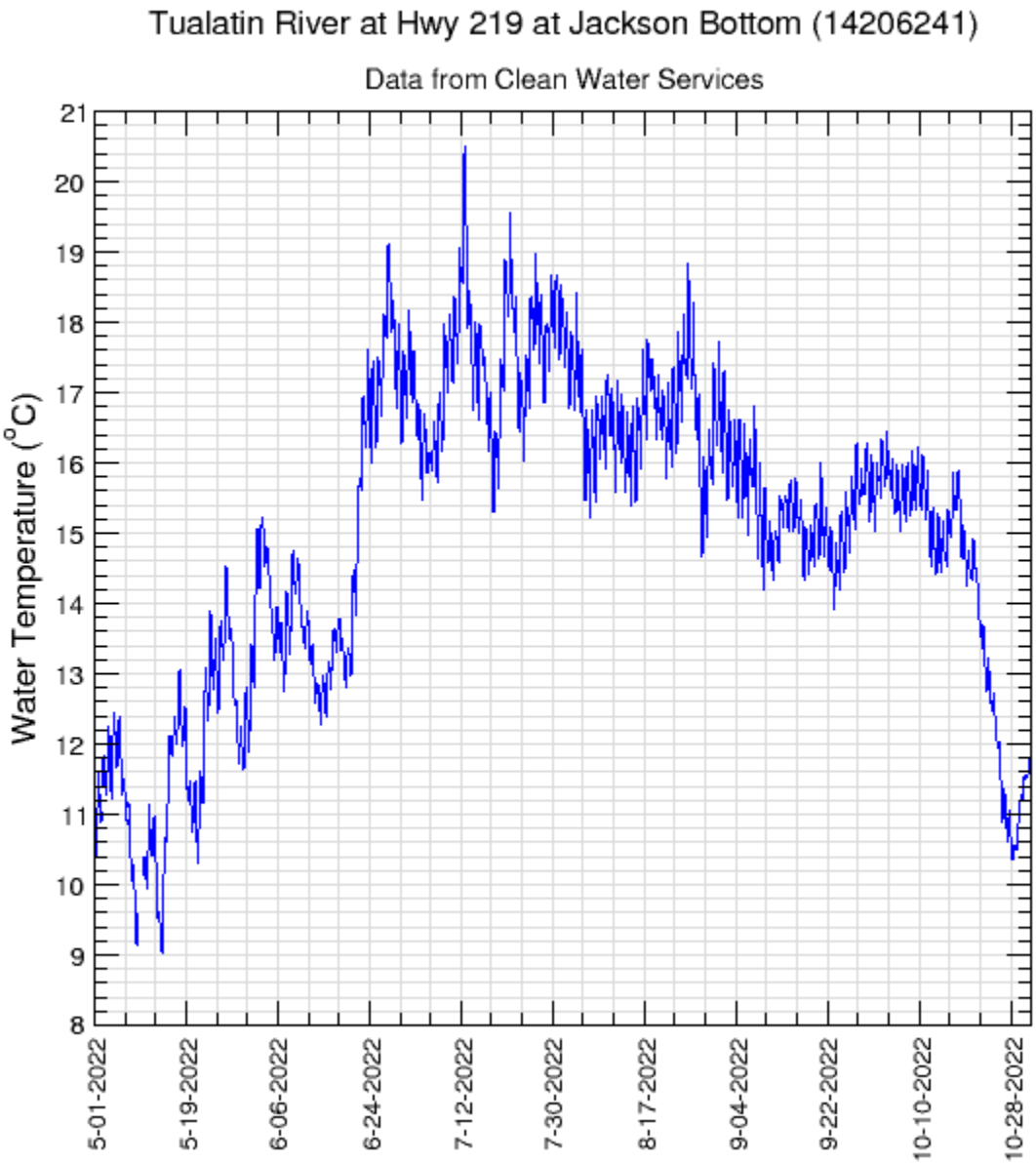
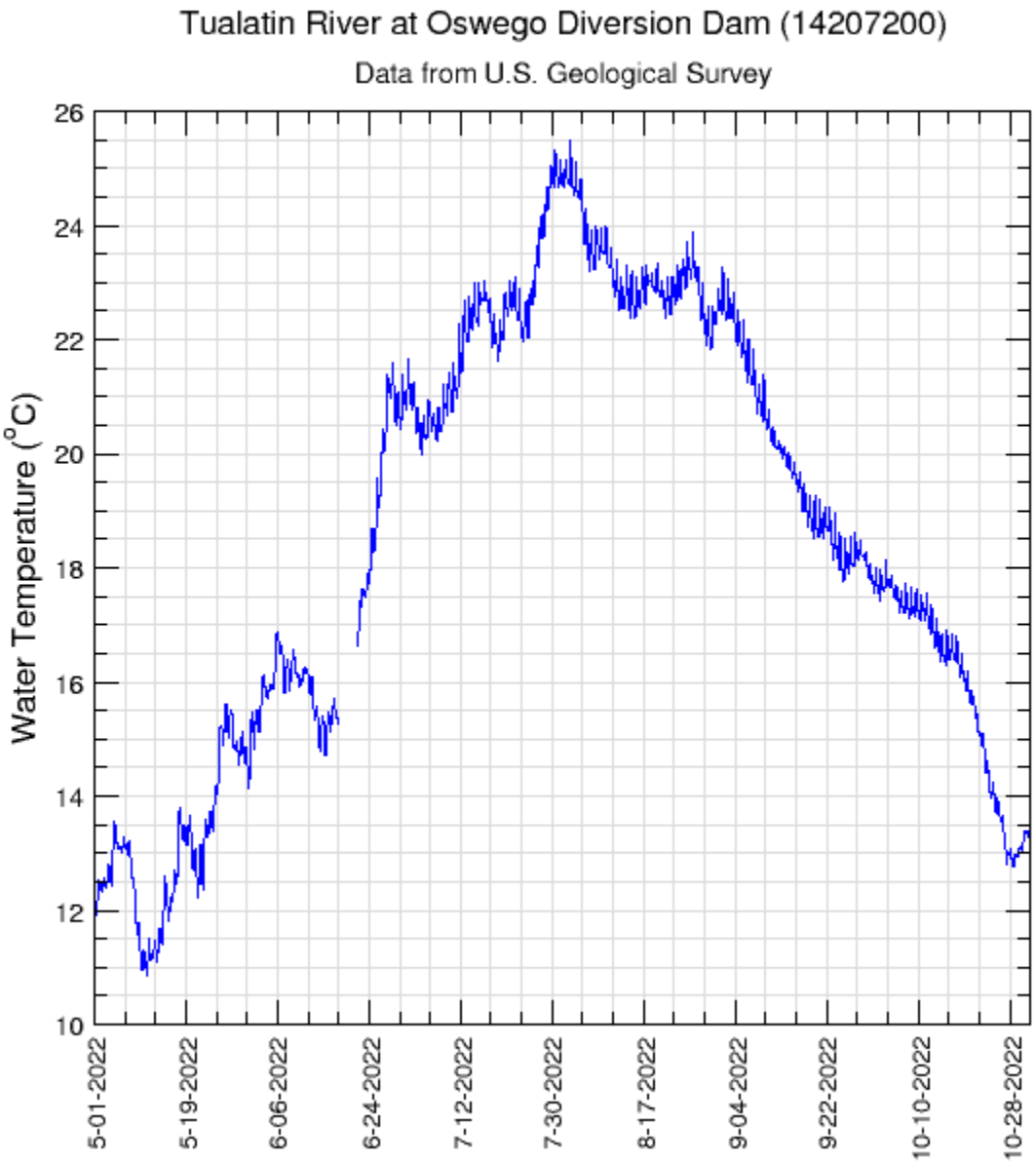

Tualatin River at Hwy 219 at Jackson Bottom (14206241)
Data from Clean Water Services
Water Temperature (°C)
21
20
19
18
17
16
15
14
13
12
11
10
9
8
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Figure D-12


Tualatin River at Oswego Diversion Dam (14207200)
Data from U.S. Geological Survey
Water Temperature (°C)
26
24
22
20
18
16
14
12
10
5-01-2022
5-19-2022
6-06-2022
6-24-2022
7-12-2022
7-30-2022
8-17-2022
9-04-2022
9-22-2022
10-10-2022
10-28-2022

Bacteria TMDL

The bacteria TMDL is designed to protect the designated use of water contact recreation. This TMDL applies to both the Tualatin River and its tributaries. Unlike the other TMDLs on the Tualatin, it has both a summer and a winter component. The bacteria test used is Standard Methods 9223B (Most Probable Number/100 mL).

CWS conducts several activities to reduce the bacteria levels in the Tualatin River and tributaries. At CWS' water resource recovery facilities, the effluent is disinfected before discharge to the river. To reduce the amount of bacteria entering streams via stormwater, CWS employs BMPs designed to help prevent contamination of stormwater by bacteria and other pollutants. These BMPs include addressing and preventing illicit discharges such as cross connections; implementing proper operations and maintenance by detecting cross connections and preventing overflows; and public education and outreach, including education to prevent bacterial contamination from pet and wildlife waste.

CWS has implemented a robust monitoring program to track the concentration of bacteria in the Tualatin River and tributaries. The graph below (Figure D-13) displays the data from monitoring locations on the river and on the major tributaries near their confluences with the river.

Figure D-13

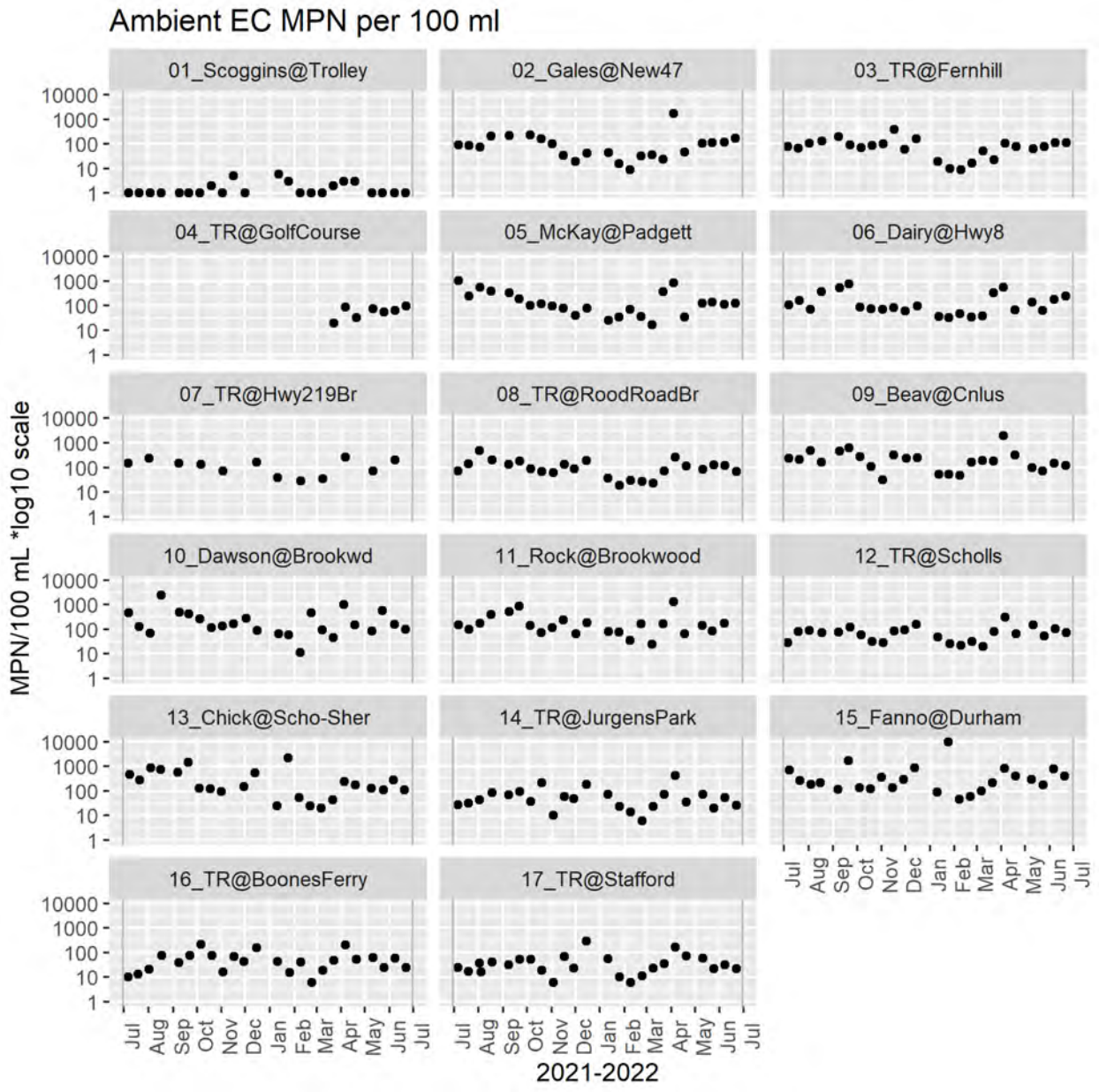

Ambient EC MPN per 100 ml
01_Scoggins@Trolley
02_Gales@New47
03_TR@Fernhill
04_TR@GolfCourse
05_McKay@Padgett
06_Dairy@Hwy8
07_TR@Hwy219Br
08_TR@RoodRoadBr
09_Beav@Cnlus
10_Dawson@Brookwd
11_Rock@Brookwood
12_TR@Scholls
13_Chick@Scho-Sher
14_TR@JurgensPark
15_Fanno@Durham
16_TR@BoonesFerry
17_TR@Stafford
MPN/100 mL *log10 scale
10000
1000
100
10
1
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
2021-2022

Table D-2 presents monitoring locations in the Tualatin River and the corresponding river miles.

Table D-2: Tualatin Basin Sample Locations		
ID	*Location*	*River Mile**
01	Scoggins Creek below Hagg Lake at Trolley	
02	Gales Creek at New Highway 47	
03	Tualatin River at Fernhill Road	56.9
04	Tualatin River at Golf Course Road	52.8
05	McKay Creek at Padgett Rd	
06	Dairy Creek at Highway 8	
07	Tualatin River at Hwy 219 Bridge	45.0
08	Tualatin River at Rood Bridge Road	39.1
09	Beaverton Creek at Cornelius near Orenco	
10	Dawson Creek at Brookwood	
11	Rock Creek at Brookwood	
12	Tualatin River at Hwy 210 Bridge	27.1
13	Chicken Creek on Scholls-Sherwood	
14	Tualatin River at Jurgens Park	10.6
15	Fanno Creek at Durham	
16	Tualatin River at Boones Ferry Road	8.7
17	Tualatin River at Stafford Road	5.0

*River miles are shown for the Tualatin River only

Willamette Basin Mercury TMDL

On February 4, 2021, EPA issued a Willamette Basin mercury TMDL. The TMDL notes that the primary source of mercury in the basin is from atmospheric deposition. The mercury in air originates from national and global sources. Once it's deposited on the landscape, the major pathways to streams are erosion of sediment-bound mercury and surface runoff. The TMDL notes that management practices on various land uses (forestry, agriculture, and urban) influence the amount of mercury that reaches streams and rivers in the Willamette Basin.

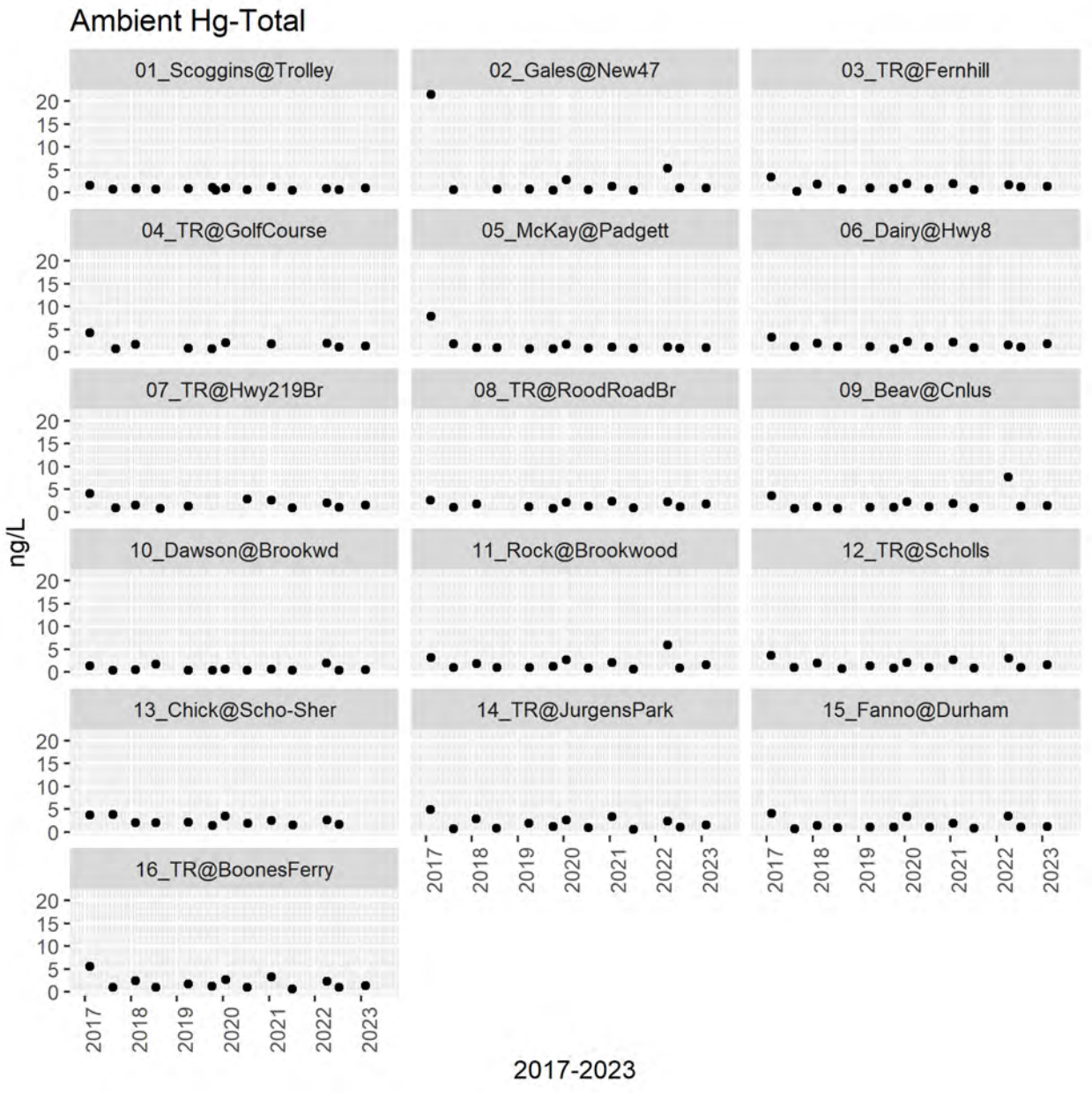
The TMDL includes measures that are to be undertaken by point source discharges, and nonpoint sources to reduce mercury levels. TMDL provisions for point source discharges will be implemented through the NPDES permit. On March 3, 2021, DEQ notified Designated Management Agencies, including CWS and the cities in Washington County, of their obligations under the TMDL. Designated Management Agencies are required to submit a TMDL implementation plan by September 3, 2022. CWS has a history of implementing mercury reduction activities dating to the early 2000s. More recently under its 2016 NPDES permit, CWS developed a Mercury Minimization Plan (MMP), which identifies programs and activities that CWS implements to reduce the levels of mercury conveyed to water resource recovery facilities. Key elements of CWS' MMP include screening significant industrial users for mercury; requiring specific industrial users to develop mercury minimization plans; implementing a dental amalgam program to control mercury discharges from dental offices; and targeting outreach to medical establishments, schools, and commercial laboratories.

CWS and co-implementers conduct a comprehensive stormwater management program (the MS4 program) in urban Washington County. The management practices implemented by CWS and co-implementers are effective in reducing sediment discharges to receiving streams. Since the major pathway of mercury delivery to streams is through erosion of sediment-bound mercury and surface runoff, these management practices are also effective at reducing mercury discharges. Management practices and programs that are effective at reducing sediment discharges — and thereby mercury — include the Illicit Discharge Detection and Elimination Program, Industrial and Commercial Stormwater Program, construction site runoff control, Public Education and Outreach Program, Post Construction Site Runoff Program, pollution prevention for municipal operations, stormwater management facilities operation and maintenance activities, and Retrofit Program.

CWS is planning to develop a single, comprehensive TMDL implementation plan and include the cities as co-implementers. The scope of the TMDL implementation plan will include the work being done in the MS4 program and in natural areas in the Tualatin River watershed.

CWS implements an extensive mercury monitoring program. Figure D-17 presents total mercury at 16 sampling sites based on data from 2017-2023. The elevated February 2017 total mercury result at Gales Creek coincided with the rising limb of a high flow event and correlated with an elevated TSS concentration.

Figure D-17


Ambient Hg-Total
01_Scoggins@Trolley
02_Gales@New47
03_TR@Fernhill
04_TR@GolfCourse
05_McKay@Padgett
06_Dairy@Hwy8
07_TR@Hwy219Br
08_TR@RoodRoadBr
09_Beav@Cnlus
10_Dawson@Brookwd
11_Rock@Brookwood
12_TR@Scholls
13_Chick@Scho-Sher
14_TR@JurgensPark
15_Fanno@Durham
16_TR@BoonesFerry
ng/L
0
5
10
15
20
2017
2018
2019
2020
2021
2022
2023
2017-2023

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Appendix E: Planning and Land Use Changes

CWS is responsible for providing sanitary sewer service and stormwater management throughout urban Washington County. CWS meets these responsibilities by, among other things, reviewing and issuing permits for construction and modification of, or connection to, the public sanitary and stormwater management systems and for erosion control.

The co-implementers other than CWS are responsible for adopting local land use regulations that implement statewide planning and land use goals to protect water quality and fish and wildlife habitat. Land use planning is the responsibility of Metro, an elected regional government serving more than 1.5 million residents in Clackamas, Multnomah, and Washington counties. By working in partnership with Metro, Clackamas, Multnomah, and Washington counties, CWS can anticipate where growth may or may not occur under existing plans. CWS and co-implementers coordinate their water quality, quantity, and habitat management efforts via intergovernmental agreements and day-to-day cooperation.

Work on several ongoing concept plans aimed at planning development patterns either was continued or completed as noted in Table E-1. Figure E-1 shows CWS' service area with the applicable zoning.

Table E-1: Co-Implementer Long-Range Planning Activities for Expansion Areas

Lead Co-Implementer	*Referenced Plan*	*Status*	*Plan Type*
Sherwood	Sherwood West	▪ Updating previous concept plan. ▪ The plan was completed in calendar year 2023 but after the current reporting year ended. If Sherwood chooses to move forward, it will submit the plan to Metro for consideration in 2024.	▪ Concept
Tigard	River Terrace South and West	▪ The plan was completed and the boundary expansion was adopted in February 2023. ▪ CWS is providing planning support for sanitary sewer and stormwater for the area.	▪ Concept
King City	Kingston Terrace Master Plan	▪ King City began the land-use, transportation, and utilities planning for the Kingston Terrace expansion area. ▪ The master plan was adopted by council after the reporting year ended in July 2023. ▪ CWS is providing planning services and support for sanitary sewer and stormwater for the area.	▪ Comprehensive planning
Beaverton	Cooper Mountain	▪ During this reporting year, Beaverton began the land-use and utility master planning processes for the Cooper Mountain expansion area. ▪ Planning is expected to be completed in the next reporting year. ▪ CWS is providing planning support related to resilient streams.	▪ Comprehensive planning ▪ Master utility planning

No other significant land use changes or expansion of the Urban Growth Boundary occurred during this reporting period. Figure E-2 shows CWS' service area with urban reserves. Figure E-3 shows properties annexed to CWS and deannexed in Fiscal Year 2021-22.

A number of areas were annexed to the CWS service area from within the Urban Growth Boundary. These are now served by the urban sanitary sewer and stormwater management system. Details are provided in Table E-2 and in Figure E-3.

Table E-2: Details of Clean Water Services Annexations

Metro Proposal Number	*Location*	*Annexation Date*	*Area Annexed, acres*
WA0223	The property north of West Union Road and west of Cornelius Pass Road.	1/6/2023	4.9
WA0423	The properties under consideration are located north of NE Evergreen Road, south of NE Huffman Street, east of NE 30th Avenue, and west of NE Starr Boulevard.	44935	129
WA0623	The properties are located north of NE Huffman Street, south of Sunset Highway (State Highway 26), east of NE Sewell Road, and west of NE Starr Boulevard.	1/9/2023	140.2
WA1023	The property is located north of David Hill Road and east of Highway 47.	1/30/2023	42.8
WA1423	The property is located north of NE Schaaf Street, south of NE Pubols Street, east of NE Helvetia Road, and west of NE Century Boulevard.	3/1/2023	52.0
WA1623	The properties are located north of SW Rosedale Road, south of SE Mcinnis Street, east of SE Century Boulevard, and west of SE 77th Avenue.	3/23/2023	57.1
WA1823	The property is located north of NE Evergreen Road, south of NE Huffman Street, west of NE 30th Avenue, and east of NE Sewell Avenue.	3/28/2023	3.5
WA2023	The property is located north of SE Cabbage Lane, south of SE Alexander Street, east of SE 64th Avenue, and west of SE 67th Avenue.	3/29/2023	6.6
WA2222	The properties are located east of SW Roy Rogers Road and south of River Terrace East.	8/30/2022	40.0
WA2223	The property is located at 9300 SW Norwood Avenue.	3/30/2023	1.0
WA2422	The property is located on the east side of SW Miller Hill Road, and 250 feet south of SW Gassner Road.	9/7/2022	1.1
WA2623	The property is generally located north of NE Huffman Street, south of NE Constable Street, east of NE 30th Avenue, and west of NE Starr Boulevard.	5/23/2023	0.7

WA2722	The property is generally located north of NE Evergreen Road, south of Huffman Street, east of NE Sewell Street, and west of NE 30th Avenue.	9/20/2022	11.1
WA2923	The property is located North of NE Evergreen Road, south and East of NE Sewell Avenue, and west of NE 30th Avenue	6/16/2023	20.3
WA3223	The property is located north of SE Mcinnis Street, south of SE Kinnaman Street, west of SE Cornelius Pass Road, and east of SE Century Boulevard.	6/16/2023	10.7
WA3322	The properties are located north of NE Evergreen Road, south of NE Huffman Street, east of NE 30th Avenue, and West of NE Starr Boulevard.	12/12/2022	23.7
Total			**428.4**

In Fiscal Year 2021-22, there were no deannexations from the CWS service area. Details are provided in Figure E-3.

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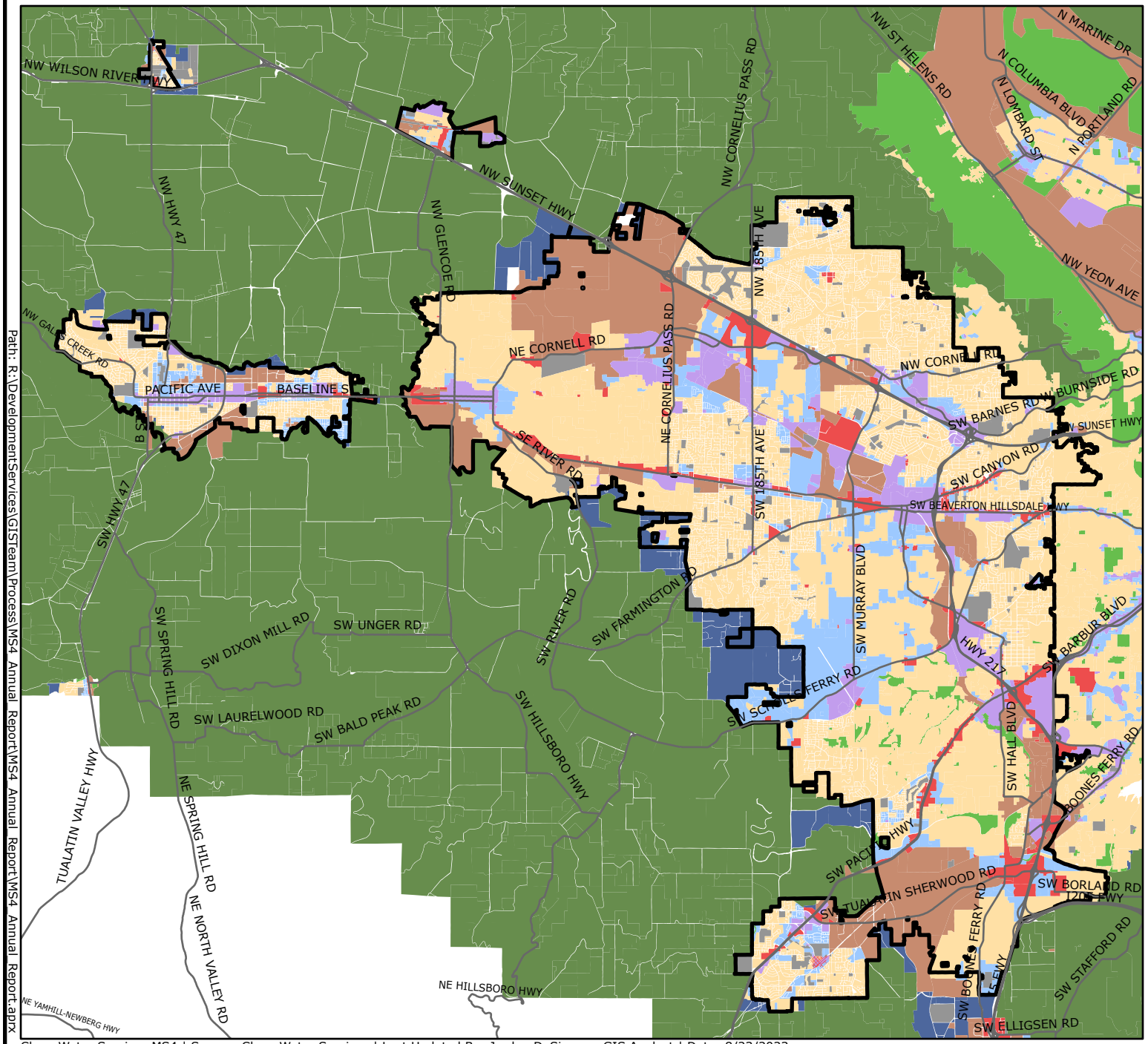
Figure E-1

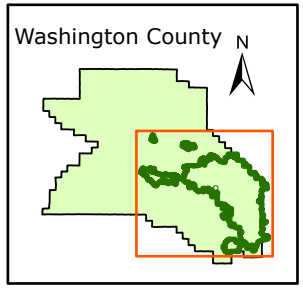
Clean Water Services MS4 Boundary with Zoning



CWS MS4 Service Area

Zoning

- Commercial
- Future Urban Dev.
- Industrial
- Multi Family
- Mixed Use Res.
- Public Facilities
- Parks / Open Spaces
- Rural
- Single Family



Clean Water Services

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Clean Water Services MS4 | Source: Clean Water Services | Last Updated By: Jordan DeSimone, GIS Analyst | Date: 8/23/2023

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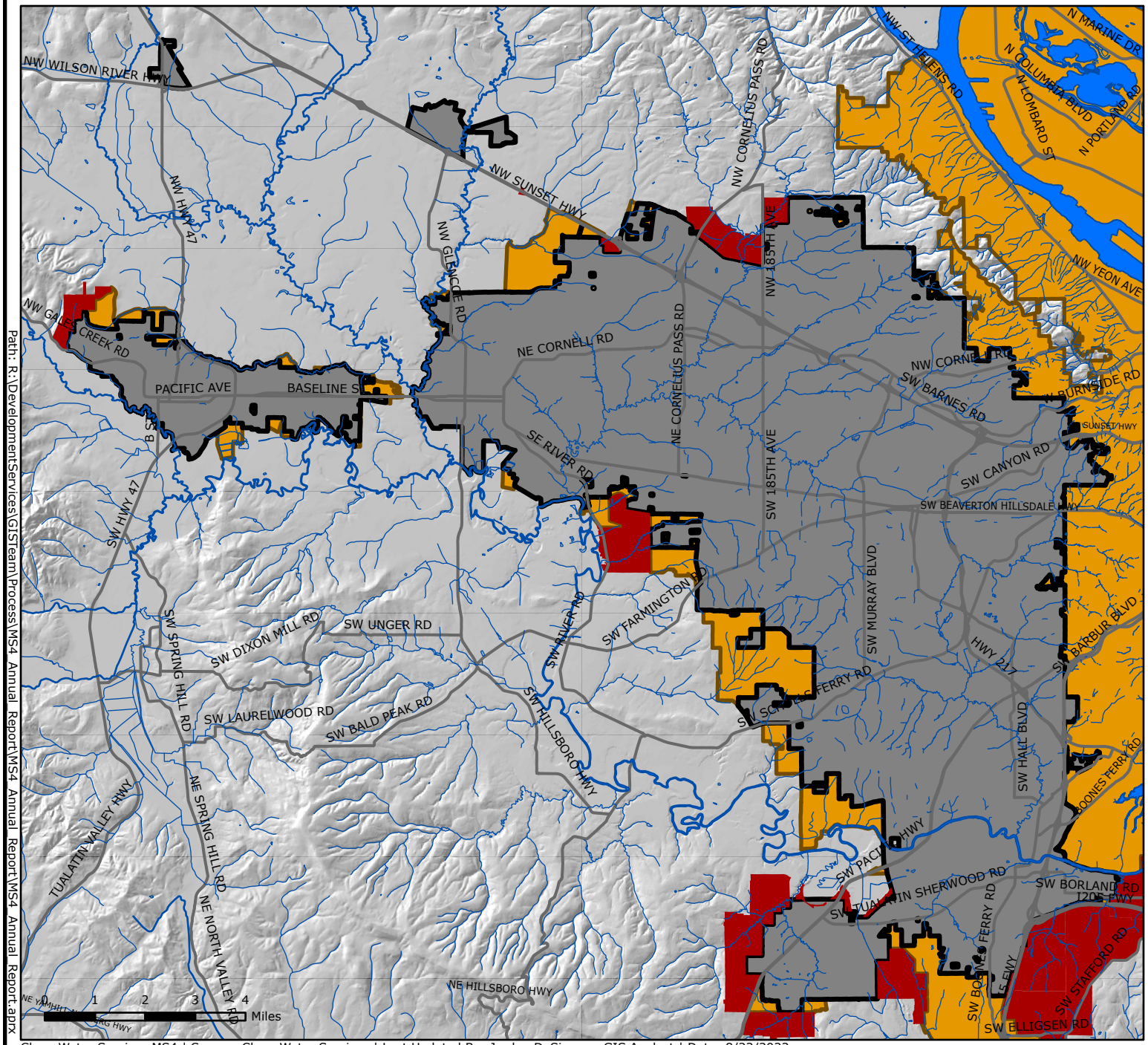
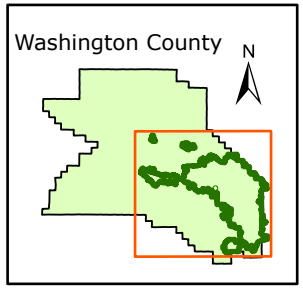


Figure E-2

Clean Water Services
MS4 Boundary
Urban Reserves
UGB Expansion

- Urban Reserves
- CWS MS4 Service
- Current UGB End of Reporting Period

Note: Areas that are not within the CWS MS4 Service boundary but are within the UGB boundary are areas yet to be annexed into CWS Service area.



Clean Water Services

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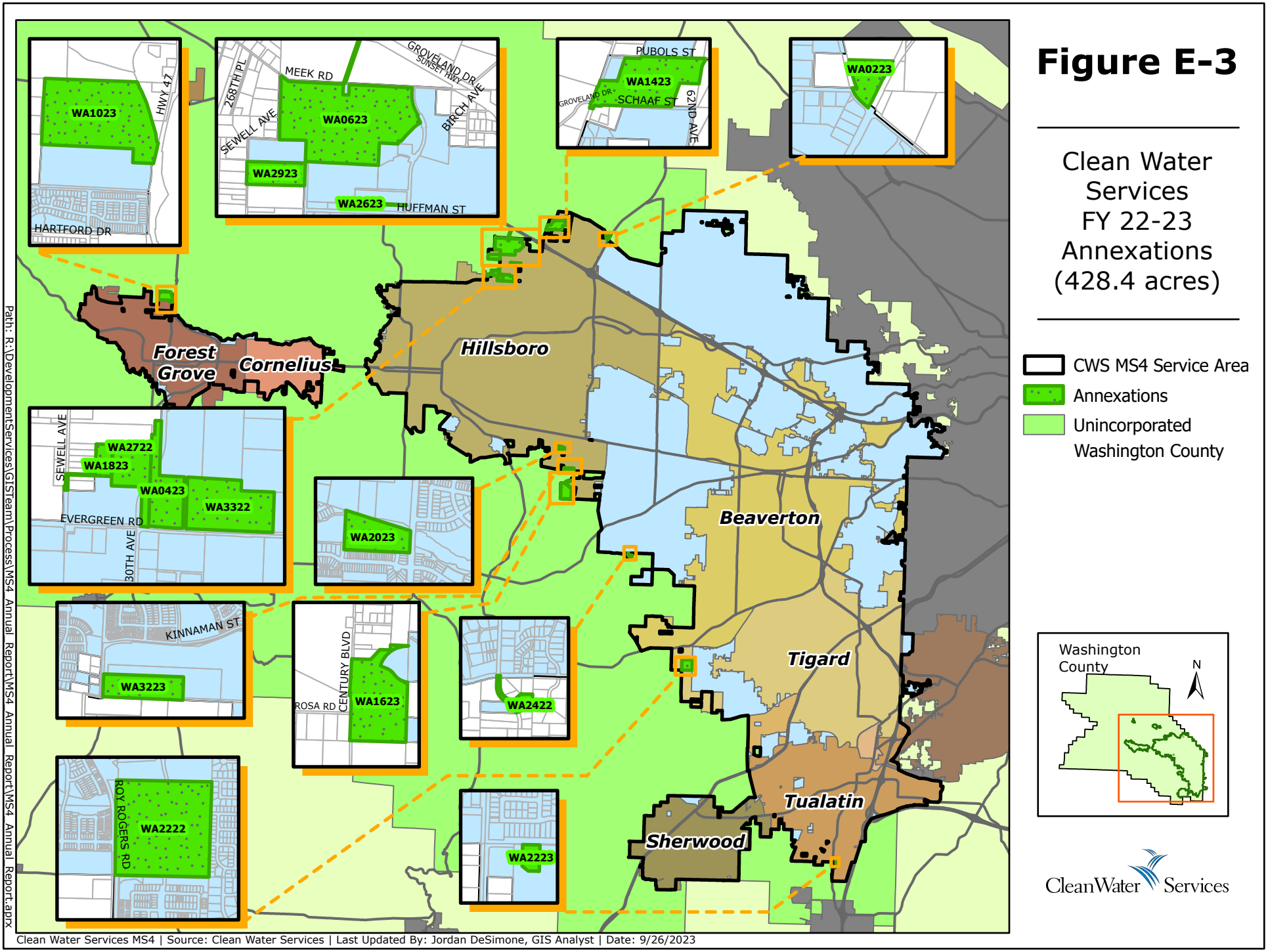
Figure E-3
Clean Water Services FY 22-23 Annexations (428.4 acres)
CWS MS4 Service Area
Annexations
Unincorporated Washington County
Washington County
N
Clean Water Services
WA1023
HWY 47
HARTFORD DR
WA0623
WA2923
WA2623
MEEK RD
268TH PL
SEWELL AVE
GROVELAND DR
SUNSET HWY
BIRCH AVE
HUFFMAN ST
WA1423
PUBOLS ST
SCHAAF ST
62ND AVE
WA0223
Forest Grove
Cornelius
Hillsboro
Beaverton
Tigard
Tualatin
Sherwood
WA2722
WA1823
WA0423
WA3322
WA2023
EVERGREEN RD
30TH AVE
WA3223
KINNAMAN ST
WA1623
CENTURY BLVD
ROSA RD
WA2422
WA2222
ROY ROGERS RD
WA2223
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Clean Water Services MS4 | Source: Clean Water Services | Last Updated By: Jordan DeSimone, GIS Analyst | Date: 9/26/2023

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