Annual Compliance Report No. 23

Fiscal Year 2017 – 2018

(July 1, 2017 to June 30, 2018)

National Pollutant Discharge Elimination System (NPDES)
Municipal Separate Storm Sewer System (MS4)
Discharge Permit No. 101314

Prepared for:

Oregon Dept. of Environmental Quality

Submitted by:

City of Portland

Port of Portland

Date:

November 1, 2018

Portland, Oregon
National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System Discharge Permit
Permit Number: 101314

ANNUAL COMPLIANCE REPORT
Fiscal Year 2017-18
(July 1, 2017 – June 30, 2018)

We, the undersigned hereby submit this annual compliance report for the Municipal Separate Storm Sewer System Discharge Permit No. 101314, in accordance with Schedule B, Section 5 of that permit. We certify, as required by 40 CFR Section 122.22, under penalty of law, that this document was prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Michael Jordan
Director, Bureau of Environmental Services
City of Portland

10/11/18
Date

Vincent Granato
Chief Operating Officer
Port of Portland

10/12/18
Date

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ANNUAL COMPLIANCE REPORT NO. 23

Fiscal Year 2017-2018

(July 1, 2017 – June 30, 2018)

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Executive Summary

Introduction

This 23rd *Annual Compliance Report* is submitted to the Oregon Department of Environmental Quality (DEQ) to fulfill reporting requirements for the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit # 101314 (hereinafter referred to as the MS4 permit or permit) issued to the City of Portland and the Port of Portland (the co-permittees) by DEQ on January 31, 2011. The report provides information about activities that have been accomplished in accordance with the co-permittees' *Stormwater Management Plans* (SWMPs) during fiscal year (FY) 2017-18 (July 1, 2017 through June 30, 2018). It also includes a monitoring report that summarizes sampling and monitoring activities conducted during FY 2017-18.

Notable Accomplishments

The **City of Portland's** information is provided in **Part I** of the report. Notable accomplishments this year for the City included the following:

- ✓ Conducted various public involvement and education activities, which comprised a significant element of the City's Stormwater Program. Key activities included providing water quality education, outreach, and curriculum resources for approximately 22,600 K-12 students; awarding 11 community stewardship grants amounting to over $89,800; involving over 16,000 participants and 3,400 volunteers in community events/activities; and providing educational materials and outreach through the City's website, newsletter, bill inserts, Facebook page, and green blogs.
- ✓ Conducted ongoing assessment, inspection, repair and maintenance activities of MS4 components, including the cleaning of 5,590 green street facilities, 10,942 catch basins and inlets, 46,939 lineal feet of ditches, and 5,259 lineal feet of pipes and culverts. Also swept major arterials four to six times during the year and continued to sweep residential streets approximately once per year.
- ✓ Administered 229 Industrial Stormwater NPDES Discharge Permits with requirements to maintain BMPs for stormwater runoff. Conducted 228 site inspections on Industrial Stormwater NPDES permitted sites. The discrepancy between the number of permits administered and inspected is due to the fact that one permit was issued June 29, 2018, and therefore was unable to be inspected during the 2017-18 fiscal year.
- ✓ Conducted 283 technical assistance site visits to Portland businesses to promote pollution prevention and environmental sustainability. Provided BMP information to aid businesses when conducting pollutant-generating activities, such as painting, catch basin maintenance, dewatering, material loading and unloading, and storage and waste disposal.
- ✓ Issued 58 enforcement actions against 52 responsible parties for prohibited discharges to the MS4, and conducted 156 inspections at 133 outfalls to identify illicit discharges.

- ✓ Managed 178 active public construction projects (citywide) with erosion control components. Conducted 3,784 erosion control-related inspections of private construction sites, and issued 1,169 associated enforcement actions, which included stop work orders, correction notices, and notices of violation.
- ✓ Conducted 5,406 stormwater management permit reviews reflecting 1,411 projects with private stormwater management facilities and an additional 1,469 pollution source control measures at commercial and industrial properties.
- ✓ Conducted operations and maintenance inspections at 759 properties (containing 1,305 associated private stormwater management facilities) for compliance with operations and maintenance requirements.
- ✓ Completed construction of various public water quality retrofit and green street projects treating a total drainage area of 8.2 acres.
- ✓ Supported 66 private property retrofit projects associated with the City's Private Property Retrofit Program, treating 2.4 acres of impervious area.
- ✓ Provided technical assistance, incentives, and grants as part of programs to encourage onsite retrofits and water quality improvements for existing private development. Under the Clean River Rewards utility discount program, the City received 62 new commercial site registrations and 1,498 new residential site registrations.
- ✓ Acquired 13 acres of land and planted 19,332 trees and 32,745 shrubs along 22,311 linear feet of streambank covering 47.6 acres. Also, with Friends of Trees and other community planting partners, planted 2,743 street trees and yard trees in City of Portland rights-of-way, on school properties, and in private yards.

The **Port of Portland's** information is presented in **Part II** of the report. Notable accomplishments this year for the Port included the following:

- ✓ The Port continues to conduct annual maintenance of the storm sewer system components and structural controls and conducts regular sweeping on specific Port-managed properties.
  - These efforts included maintaining over 1,136 catch basins, inspecting and maintaining Port-owned water quality treatment facilities, cleaning 1,940 feet of storm line, and conducting 3,774 hours of street sweeping. Together, these tasks diverted 372 tons of potential pollutants from Port receiving waters.
- ✓ Port staff continued to implement the Illicit Discharge Detection and Elimination Program. The program involves field screening of priority outfalls and investigation of potential illicit discharges.
  - Dry-weather field screening inspections were conducted at 68 outfalls Port-wide. No potential illicit discharges were observed.
- ✓ Port staff continued to implement the Industrial Facility Inspection Program, inspecting a total of 23 priority industrial facilities Port-wide in FY 2017-18. Staff provided technical assistance during these visits, while also setting timelines for correction of any deficiencies where appropriate.

- ✓ Port operating area staff received training on a variety of stormwater-related subjects, including pesticide application (14 staff), stormwater pollution prevention and spill response (179 staff), and erosion prevention (22 staff). In addition, 43 new employees were trained on the importance of preventing pollutants from entering stormwater in the Port's new employee orientation program.
- ✓ The Port continued its support of organizations that work to promote watershed health, including the Columbia Slough Watershed Council, SOLVE, the Lower Columbia Estuary Partnership, The Intertwine Alliance, and the Willamette Partnership. Other participation includes financial sponsorship, membership, volunteer assistance at events, and in-kind services for the following stakeholder groups: Oregon Environmental Council, Oregon Association of Clean Water Agencies, Clackamas River Basin Council, Northwest Steelheaders, PDX Community Advisory Committee, and KOIN 6 Water … Do Your Part Clean Water Partners.
- ✓ The Port continues to coordinate with the City of Portland on monitoring and compliance with MS4 deliverables in addition to the annual report.
- ✓ The Port continues to implement the *Design Standards Manual* and ensure that treatment for post-construction stormwater runoff complies with requirements of the *Manual*.

A Monitoring Report that summarizes monitoring activities conducted through the year is provided in Part III of the report. The monitoring data is provided in Appendix B of Part III and will also be provided to DEQ electronically.

Permit Areas

The permit areas for the co-permittees are as follows:

City of Portland: Approximately 15,214 acres within the City of Portland's urban services boundary drain to the City's MS4.

Port of Portland: The Port owns approximately 5,487 acres within the City of Portland's urban services boundary. Much of this property drains to the Port's municipal separate storm sewer system and is regulated by the MS4 permit. This acreage includes Portland International Airport (PDX), four marine terminals, several industrial parks occupied by commercial tenants, mitigation sites, and undeveloped land.

Permit History

DEQ issued the first MS4 permit to the City and other co-permittees within the Portland urban services boundary on September 7, 1995. DEQ renewed the permit for a second permit term in March 2004 and subsequently revised and reissued that permit on July 27, 2005. The co-permittees submitted a permit renewal package to DEQ on September 2, 2008, and DEQ subsequently issued the third-term permit on January 31, 2011. The co-permittees submitted a renewal package to DEQ on July 31, 2015, for the fourth permit-term. The 2011 permit expired on January 30th, 2016 and has been administratively extended since that time.

Program Coordination

The City and Port share information about program development and implementation, best management practice (BMP) effectiveness, monitoring, and other issues related to the MS4 permit. This coordination avoids duplication and promotes cost-effective use of resources. To further ensure ongoing collaboration and efficiency, the City and Port have an intergovernmental agreement that allocates responsibilities and resources.

The City and Port also coordinate and address stormwater permit implementation issues with other jurisdictions in the state through the Oregon Association of Clean Water Agencies (ACWA). City and Port representatives participate in ACWA's water quality, stormwater, and groundwater committees.

Document Organization

The following table (Table E.1) outlines the organization of this annual report document, with respect to the annual reporting requirements per Schedule B(5) of the City and Port's NPDES MS4 permit.

Table E.1: Annual Reporting Requirements for Permit Year 23 (FY 2017-18)

	Location in Document (section #- page #)	
	City of Portland	**Port of Portland**
a) Status of implementing SWMP elements, including progress in meeting measurable goals.	I-2 through I-13	II-7.1.1 through 7.1.8
b) Status of any public education effectiveness evaluation conducted during the reporting year, and a summary of how results were used in adaptive management.	--[a]	--[a]
c) Summary of the adaptive management process implementation during the reporting year, including new BMPs.	I-1	II-8.0
d) Any proposed changes to SWMP program elements to reduce TMDL pollutants to the MEP.	NA	II-8.0
e) A summary of total stormwater program expenditures and funding sources over the reporting fiscal year, and those anticipated in the next fiscal year.	I-1	II-4.0
f) A summary of monitoring program results, including monitoring data that is accumulated throughout the reporting year.	III	III
g) Any proposed modifications to the monitoring plan necessary to ensure that adequate data and information are collected to conduct stormwater program assessments.	I-1.2 and III	I-1.2 and III
h) A summary describing the number and nature of enforcement actions, inspections, and public education programs.	--[b]	--[c]
i) An overview, as related to MS4 discharges, of concept planning, land use changes, and new development activities that occurred within the UGB expansion areas during the previous year, and those forecast for the following year. Includes the construction permits issued and an estimate of the total new and replaced impervious area related to new and redevelopment projects.	I-1 and I-10	I-1 and I-10
j) Additional submittals listed in Schedule B.5.j due November 1, 2014	--[a]	--[a]

a. These requirements were fulfilled in Permit Year 19 and are addressed in the Permit Year 19 annual report.

b. Enforcement actions, inspections, and public education programs are included in the City's SWMP as BMPs and are reported along with the status of implementing all components of the SWMP in Sections II-2 through II-13.

c. Enforcement actions, inspections, and public education programs are included in the Port's SWMP as BMPs, and are reported along with the status of implementing all components of the SWMP in Sections II-7.1.1 through 7.1.8).

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Part I
CITY OF PORTLAND

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Abbreviations & Acronyms

ac	acre(s)
ACWA	(Oregon) Association of Clean Water Agencies
BES	Bureau of Environmental Services
BMP	best management practice
BPS	Bureau of Planning and Sustainability
City	City of Portland
CSO	Combined Sewer Overflow
CSWC	Columbia Slough Watershed Council
DEQ	(Oregon) Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FOT	Friends of Trees
GIS	geographic information system
IDDE	Illicit Discharge Detection & Elimination
LA	load allocation
MIP	Maintenance Inspection Program
MS4	municipal separate storm sewer system
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
ODOT	Oregon Department of Transportation
O&M	operations and maintenance
OLCA	Oregon Landscape Contractors Association
OMF	Office of Management and Finance
PBOT	Portland Bureau of Transportation
PCB	polychlorinated biphenyl
PLRE	pollutant load reduction evaluation
PPRP	Private Property Retrofit Program
PP&R	Portland Parks and Recreation Department
PWB	Portland Water Bureau
SDCs	system development charges
SMF	stormwater management facility
SWMM	stormwater management manual
SWMP	stormwater management plan
SWNI	Southwest Neighborhoods, Inc.
TB-PAC	Tualatin Basin Public Awareness Committee
TMDL	total maximum daily load
UIC	underground injection control
WLA	waste load allocation
WRC	Watershed Resource Center

Section 1 Introduction

This annual report fulfills reporting requirements of the City of Portland's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314. The City's NPDES MS4 Permit expired January 30, 2016, and has been administratively extended until a new permit is issued. Under the extended permit, the City is continuing with regular Stormwater Management Plan (SWMP) implementation, monitoring plan implementation, and annual report preparation. This annual report reflects activities conducted during the 23rd fiscal year (July 1, 2017, through June 30, 2018) of the permit program.

Annual reporting requirements related to program authority, adaptive management, urban growth expansion, and stormwater expenditures/funding sources are described in Section 1. Program activities per the City's 2011 SWMP are detailed by each of the individual best management practice (BMP) categories in Sections 2 through 13. For each BMP category, the City's SWMP includes measurable goals. Measurable goals are actions the permittee has committed to undertake to implement the BMPs and include, where appropriate, the frequency, timeline, and/or locations where BMP actions will occur. For purposes of this annual report, the status of meeting measurable goals during Permit Year 23 is collectively summarized for all BMPs in Section 13 Program Management (PM-1).

Monitoring activities relevant to the City's NPDES MS4 Permit are reported in Part 3 of this report. Many of the strategies and BMPs outlined in the SWMP are also conducted to fulfill obligations under the City's Total Maximum Daily Load (TMDL) Implementation Plan for the Willamette River and its tributaries. A separate annual report is typically submitted to the Oregon Department of Environmental Quality (DEQ) for TMDL compliance. However, this year, a 5-year evaluation survey will be completed to summarize the City's implementation of TMDLs.

1.1 Program Authorization

The Portland City Council passed a resolution supporting the City's NPDES MS4 permit application in June 1995. In that resolution, the Council designated the Bureau of Environmental Services (BES) as the lead for the City's implementation of the stormwater program. The City of Portland continues to maintain and update legal authority to implement the programs outlined in the SWMP, as demonstrated in Part 1 of the City's original 1991 NPDES MS4 permit application.

1.2 Adaptive Management

The City submitted its adaptive management approach to DEQ on November 1, 2011. The City's approach includes two elements: 1) an **annual process** to determine if the City's stormwater program is being implemented in accordance with the SWMP, determine if measurable goals are being met or progress is being made towards meeting them (as applicable), and identify whether

any program adjustments are needed; and 2) a more **comprehensive process** to identify proposed program modifications submitted as part of the City's permit renewal package, including the modification, addition, or removal of BMPs incorporated into the SWMP and associated measurable goals. The City provided its Permit Renewal Submittal to DEQ on July 31, 2015, that included a description of the adaptive management process that was conducted to assess the existing MS4 program and develop a proposed SWMP for the next permit term.

The City continues to implement an annual adaptive management process to improve overall implementation of key stormwater programs. No significant programmatic changes were implemented during Permit Year 23 as a result of the annual review process. The permit is also under administrative extension, which prevents the City from making substantive changes to the SWMP and associated programs. However, the City has refined the annual reporting effort to streamline reporting amongst various departments and staff. Key accomplishment tables have been incorporated into the narrative reporting description, and measurable goal compliance is summarized in Section 13 (PM-1). This adaptive management-related improvement is to improve readability and develop more efficient data compilation processes (use of tables and quantitative metrics). Reporting improvements will likely continue in subsequent years.

1.3 Urban Growth Boundary Expansion Areas

There were no changes to the urban growth boundary during the permit year.

1.4 Stormwater Funding Sources

The Portland City Council approves revised stormwater monthly user fees and stormwater system development charges (SDCs) at the start of each fiscal year. Rate adjustments are based upon cost of service principles, thereby ensuring equity by charging ratepayers and developers per the amount of sewer and drainage service they use.

1.4.1 Stormwater Monthly User Fees

Monthly user fees are adjusted to reflect operating, maintenance, and capital costs of the City's sanitary sewer and drainage system. Table 1.1 reports the monthly single-family stormwater management charge and the monthly stormwater rate per 1,000 square feet (sf) of impervious area over the current, administratively extended permit term. Table 1.1 also includes the anticipated monthly stormwater management charge and stormwater rate for the next permit year (2018-19).

1.4.2 Stormwater SDCs

SDCs are assessed for new development and significant redevelopment based on two components: 1) onsite runoff management — the charge for stormwater facilities that handle runoff from individual properties, and 2) public right-of-way (ROW) runoff management — the cost of stormwater facilities that handle runoff from public ROWs. Riparian properties that drain directly to the Columbia Slough, Columbia River, or Willamette River are exempt from the onsite portion of the fee. The ROW portion of the fee is assessed based on the use of the transportation system, using

road frontage and vehicle trips associated with the proposed development. Table 1.1 summarizes the actual and anticipated SDC fees based on both components. Discounts may be granted only for the "onsite" part of the charge for facilities constructed as part of new development. Discounts range from 80 percent for retention of the 100-year event to no discount for control of the 10-year storm.

Table 1.1: Stormwater Management and SDC Charges and Rates Over the Permit Term

Stormwater Management Monthly Charges and Rates	2010-11	2017-18	% Change	Adopted 2018-19*
Single-Family Residential Charge	$21.79	$28.61	31.3%	$29.68
Residential Rate ($/1000 sf impervious area)	$9.08	$11.92	31.3%	$12.36
Non-Residential Rate ($/1000 sf impervious area)	$9.66	$12.48	29.2%	$13.02
SDC Charges & Rates	**2010-11**	**2017-18**	**% Change**	**Adopted 2018-19***
Onsite Portion ($/1,000 sf)	$154.00	$231.00	50.0%	$228.00
ROW Portion ($/linear foot of frontage)	$4.78	$7.12	49.0%	$7.40
ROW Portion ($/vehicle trips)	$2.51	$3.84	53.0%	$4.02

** 2018-19 rates were adopted July 1, 2018.*

1.5 Stormwater Program Expenditures

The City of Portland has invested more than $1.59 billion in stormwater management services and facilities during Permit Years 1 through 23. Table 1.2 reflects the revenue requirements over the current administratively extended permit term. The revenue requirements for Permit Year 23 (2017-18) totaled approximately $128.2 million, allocated as shown in Table 1.2 below.

Table 1.2: Stormwater Program Expenditures

Major Program Category	Revenue Requirements (millions)		% Change
	2010-11	2017-18	
Enforcement and Development Review	$5.8	$12.7	119.0
Watershed Program and Habitat Restoration	$18.3	$21.8	19.1
Facilities Operations and Maintenance	$21.0	$26.9	28.1
Capital Improvements*	$45.8	$66.8	45.9
Total Expenditures	**$90.9**	**$128.2**	**41.0**

** Includes debt service, facilities planning and engineering, construction engineering, and construction contracts.*

In Permit Year 24 (2018-19), the City plans to invest $138.6 million in stormwater management services and facilities. Direct monthly user fees will pay for 88 percent of these investments.

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Section 2
Public Involvement 1 (PI-1)

BMP Summary

Implement public information, education, involvement, and stewardship activities that will raise awareness, foster community stewardship, and promote pollution prevention and stormwater management.

Measurable Goals

- Provide outreach to approximately 15,500 K-12 students annually (classroom programs, education field programs).
- Award at least $50,000 in community stewardship grants annually.
- Involve approximately 10,000 participants in community events, workshops, stewardship projects, and restoration events annually.
- By May 2011, develop and distribute a public education bill insert to over 200,000 water and sewer customers.

2.1 Clean Rivers Education Programs

The City's Clean Rivers Education Program includes a variety of classroom and field study science programs provided free to kindergarten to college students in Portland. Students learn about watershed health, urban ecology, the causes and effects of water pollution, and what they can do to protect rivers, streams, and riparian areas. Examples of our Clean Rivers Education Programs include the following.

***Watershed Awareness* Classroom Presentation.** Students examine a variety of Portland maps and create their own watershed map to help them understand the concept of a watershed. Educators use an EnviroScape® watershed model to demonstrate how water moves over land and how pollution can drain into rivers and streams. As students identify pollution sources, they discuss solutions to keep our rivers healthy.

***Soak It Up* – Green Infrastructure Classroom Presentation**. Working with aerial maps of a model neighborhood, teams of students calculate area, impervious area coverages, and determine quantities of stormwater runoff. Students then redesign their neighborhoods with green infrastructure solutions such as swales, ecoroofs, green streets, and stormwater planters that will soak up water and filter pollution. This lesson integrates math and science topics.

***After the Flush* – The Wastewater Story Classroom Presentation**. Students learn about Portland's combined sewer system and brainstorm "ingredients" as they simulate sewage and stormwater. Students then clean up their wastewater, modeling the steps taken at the City's treatment plant. Students learn how they can help at home, like reducing the use of home and yard chemicals and preventing fats, oils, and grease from clogging sewer pipes. This presentation is sometimes followed by a tour of the Columbia Boulevard Wastewater Treatment Plant.

Green Infrastructure Tours. Students visit bioswales, ecoroofs, stormwater planters, green streets, rain gardens, and creative downspout disconnections. Students learn how these solutions allow stormwater to soak into the ground to reduce volume, while plants and soil filter pollutants and improve water quality. Educators work with schools to develop an itinerary based on their methods of transportation and location.

Water Pollution Control Laboratory Tours. Students tour the City's Water Pollution Control Laboratory to learn about key functions of the lab and careers related to pollution prevention. Students conduct basic water quality tests and learn about the green infrastructure features onsite such as disconnected downspouts, bioswales, and a rain garden.

Watershed Investigation Field Studies. Students apply water quality concepts and new skills gained in the classroom to a field study. Students travel to a local stream, pond, or wetland to investigate water and the nearby habitat. Field study activities may include testing water quality, sampling for aquatic macroinvertebrates as biological indicators, exploring wildlife, and identifying native and non-native plants.

Storm Drain Curb Marking. School and community groups install permanent curb markers that remind residents that stormwater can carry pollutants to rivers and streams. Participants also deliver educational door hangers with pollution prevention messages and clean river tips.

Columbia Slough Watershed Canoe Tours. Students in the Columbia Slough Watershed who participate in Clean Rivers Education programs and complete watershed stewardship projects are invited to a canoe paddle along the Columbia Slough. Students view stormwater outfalls, test water quality, and view restoration projects from the water.

Career Awareness Field Trips. Select middle and high school classes visit sewer construction sites, the Water Pollution Control Laboratory, or a natural area to work alongside BES staff and learn about careers related to infrastructure, pollution prevention, and natural area restoration. Career field trips are preceded by classroom presentations.

Friends of Zenger Farm. In a BES-supported partnership, Zenger Farm provides classroom and field education lessons focused on stormwater management, watershed health, environmental stewardship, and sustainability. Zenger Farm serves thousands of youth and adults every year through classroom, field, and service-learning programs.

Table 2.1: Educational Programs and Student Participation

Education Activity	Programs (#)	Student Contact (#)*
Clean Rivers Education Classroom Programs	266	6,281
Clean Rivers Education Field Programs	158	3,595
Friends of Zenger Farm	63	12,715
Total	**487**	**22,591**

** Some students participate in multiple programs or attend programs for multiple days, which would each be counted as a student contact.*

2.2 Community Stewardship Grants Program

BES's Community Watershed Stewardship Grants Program, in place since 1995, provides up to $10,000 per project to citizens and organizations to encourage watershed protection. Projects must be within the City of Portland, promote citizen involvement in watershed stewardship, and benefit the public.

Table 2.2: Community Stewardship Grants Issued

Grant Name / Description	Watershed	Amount ($)
Mudbone Grown: Resilience, Culture, Conservation	Columbia Slough	$ 8,000
Verde: Cully Rain Gardens	Columbia Slough	$ 7,814
Depave: Big Stormwater Collection at Ascension Catholic Church	Willamette River	$ 10,000
Harmony Montessori Rain Garden	Willamette River	$ 10,000
Rose Community Development: Lents Conservation Partnership	Johnson Creek	$ 9,561
National Indian Parent Information Center: Native American Youth for the Environment	Johnson Creek	$ 4,486
Portland Montessori School: Raindrops to River	Willamette River	$ 8,441
Blueprint Foundation: Constructing Careers Green Building Mentoring-Dharma Rain Zen Garden	Columbia Slough	$ 10,000
Dig In: Trillium Creek Restoration and Environmental Education	Fanno Creek	$ 6,700
Tryon Creek Watershed Council: Tryon Creek Watershed Stewardship Training and Outreach	Tryon Creek	$ 7,094
Hillsdale Neighborhood Assn.: SW 25th Ave Restoration Project	Fanno Creek	$ 7,761
Total		**$89,857**

2.3 Stewardship Activities

The City's stewardship activities vary by watershed and include sponsorship, presentation, partnership, and public participation efforts. The City actively works with and co-sponsors activities with the Columbia Slough Watershed Council, the Johnson Creek Watershed Council, the Tryon Creek Watershed Council, Crystal Springs Partnership, Tualatin Basin Public Awareness Committee, Friends of Trees and more.

Resident outreach is routinely conducted via presentations to neighborhood associations and other community groups, newsletters, open houses, and individual outreach to property owners. Topics include invasive species and riparian restoration, watershed stewardship, green streets and stormwater facility installations, tree planting and community greening, and other pollution prevention efforts. Stewardship activities also include technical data collection and distribution efforts. BES often partners with multiple agencies and jurisdictions on monitoring activities, specifically water quality and macroinvertebrate monitoring.

Table 2.3: Stewardship Activities Conducted (2017-18)

Watershed	Description	Events* (#)	Participants (#)	Volunteers (#)
Columbia Slough	Events were coordinated with the Columbia Slough Watershed Council and include Slough 101, Groundwater 101, Explorando El Columbia Slough, Canoe the Slough, Columbia Slough Regatta, and more.	90	6580	700
Willamette River	Willamette Watershed public involvement activities include the Big Float, Clean Rivers Festival, town halls and public hearings for the Central City 2035 (which includes a proposed ecoroof requirement for Central City and an increased Greenway buffer of 50 feet), outreach for the Willamette WRDA package, outreach for the Oaks Bottom restoration project, Multnomah Days, rain garden workshops, Sunday Parkways, the Stormwater Stars restoration and education event series, meetings with neighborhood associations and community groups, and generalized stormwater education.	24	696	37
Johnson Creek	Events coordinated with the Johnson Creek Watershed Council and community partners include creek cleanup events, Coho spawning surveys, lamprey surveys, dragonfly surveys, Salmon Celebration/Sunday Parkways, student service learning projects, Crystal Springs Partnership planting, and maintenance events.	60	707	1,892
Fanno Creek	Events and activities were conducted in the Fanno Creek Watershed and in partnership with Southwest Neighborhoods, Inc., and the SW Watershed Resource Center. Events and activities include presentations, volunteer opportunities and tabling events, the Stormwater Stars restoration and education event series, generalized stormwater education, and site visits and technical assistance for property owners and residents.	8	187	49
Tryon Creek	Events and activities conducted in the Tryon Creek Watershed, in partnership with Southwest Neighborhoods, Inc., and the SW Watershed Resource Center, include presentations, volunteer opportunities and tabling events, the Stormwater Stars restoration and education event series, generalized stormwater education, and site visits and technical assistance for property owners and residents.	15	722	110
City wide	Storm Drain Curb Marker Program	3	39	4
City wide	Natural area restoration field trips for K-college students in partnership with Portland Parks and Recreation. Activities include invasive removal and native plantings paired with field studies such as water quality monitoring and macroinvertebrate sampling.	76	1894	253

Watershed	Description	Events* (#)	Participants (#)	Volunteers (#)
City wide	Green Street Steward Program recruit residents, businesses, and non-profit organizations to become volunteers and look after our green infrastructure. The Program also provides education, training, and tours to low-income groups and communities of color.	42	928	65
City wide	Tree Program Community Events	39	4,430	354
Total		**357**	**16,183**	**3,464**

2.4 Public Outreach

The City uses the BES annual newsletter *RiverViews*, bill inserts, BES websites, and various social media platforms to distribute information directly to the public regarding stormwater and water quality/water resources management. Outreach materials typically include information and suggestions on practices that citizens can do at home to improve or prevent pollution of waterways and protect natural resources.

Table 2.4: Public Outreach (2017-18)

Mailings and Bill Inserts	Materials Distributed (#)
RiverViews, the BES Annual Newsletter – Theme: Our Willamette River	301,308
Fall 2017 Bill Insert: Salmon in our city	190,000
Winter 2017/18 Bill Insert: Winter rains are on the way	190,000
Spring 2018 Bill Insert: What not to flush	190,000
Summer 2018 Bill Insert: Big Pipe, Big Difference and weekly summer testing results	190,000
BES Website Activities, Top Hits	**Page Views (#)**
Stormwater Discount Program https://www.portlandoregon.gov/bes/41976 or www.cleanriverrewards.com	120,639
Green Street Stewards Program https://www.portlandoregon.gov/bes/52501 or www.portlandoregon.gov/bes/GreenStreetStewards	36,743
Treebate Incentives for Planting Yard Trees https://www.portlandoregon.gov/bes/51399 or www.portlandoregon.gov/bes/treebate	52,283
BES Social Media	**Page Views (#)**
City Green Blog	282,262
BES Facebook Page (reported as reach versus page view)	44,728

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Section 3
Operations and Maintenance 1 (OM-1) City Storm and Drainage System

BMP Summary

Operate and maintain components of the Municipal Separate Storm Sewer System (MS4) to remove and prevent pollutants in discharges from the MS4.

Measurable Goals

- Develop a training handbook for Portland Bureau of Transportation Maintenance and Operations (PBOT-MO) staff during the permit term.
- Provide the following maintenance actions over the 5-year permit term:
  - Clean 31,000 lineal feet of culverts.
  - Repair 10,000 lineal feet of culverts.
  - Clean 250,000 lineal feet of ditches.
  - Clean 38,000 inlets and catch basins.
  - Repair 1,500 inlets and inlet leads.
  - Clean 135 major stormwater management facilities/pollution reduction facilities.
  - Repair 40 pollution reduction facilities.

3.1 Storm System Inventory

The City manages a highly varied inventory of stormwater assets that includes drainage conveyances, green streets, and other structural and non-structural stormwater features. New features are constructed every year. The City maintains an asset inventory and maintenance database and continues to evaluate and implement improved maintenance practices to protect water quality. Key features of the City's MS4 infrastructure are listed in Table 3.1.

Table 3.1: Asset Inventory – Key Storm Drainage Components as of June 30, 2018.

System Component	# of Assets (as of June 30, 2018)
Storm Sewer Culverts and Pipes (includes storm force mains)	445 (miles)
Stormwater Conveyance Ditches	96 (miles)
Storm Inlets	54,998
Trash Racks	328
Water Quality Facilities*	
Green Streets	2,179
All Other Types**	402

** Water Quality Facilities are not strictly confined to the City's MS4 areas. Some assets are located within the combined sewer area to provide volume reduction benefits, but the City prioritizes assets in MS4 areas for water quality purposes.*

***Includes manufactured stormwater treatment facilities, constructed treatment wetlands, dry ponds, spill ponds, wet ponds, vegetated swales, sand filters and sedimentation boxes.*

3.2 Storm System Operations and Maintenance

The BES Stormwater Operations and Maintenance (O&M) team evaluates maintenance needs of MS4 components and generates work orders to address those needs. The BES *Stormwater O&M Manual* provides guidance to City staff on important maintenance practices and schedules for the variety of infrastructure components. The PBOT Maintenance and Operations workgroup also performs a variety of related maintenance tasks. Most routine maintenance is driven by inspections, condition assessments, and specific action triggers. The PBOT *Maintenance Environmental Handbook* is used as guidance for maintenance procedures, preferred seasonality of work, and materials management.

In general, BES groups stormwater system components into two broad categories: conveyance assets and water quality assets. As with the sanitary sewer, BES uses an asset management approach to storm system maintenance that considers the likelihood and consequences of failure to determine priorities. Water quality assets generally need a more intense inspection and maintenance program to preserve water treatment functionality. As such, those assets are inspected more frequently (annually at a minimum), and maintenance is prescribed based largely on inspection results, with the goal of keeping the assets functioning as designed. Urgent problems and needed repairs are remedied as soon as possible, and routine system maintenance is scheduled to optimize efficiency and facility function.

3.2.1 Inspection Activities

Inspection activities conducted during the permit year are included in Table 3.2.

Table 3.2: Storm System O&M Inspection Activities

System Component	# of Inspections
Storm Sewer Culverts and Pipes	17,718 (feet)
Trash Racks	1,194
Water Quality Facilities	
Green Streets	2,218
All Other Types	403*

** This number includes inspections of individual asset components. Many water quality facilities have multiple "treatment train" components that are inspected for their specific maintenance needs. Therefore, a single water quality feature may be associated with more than one inspection.*

3.2.2 Cleaning Activities

Cleaning activities conducted during the fiscal year are included in Table 3.3.

Table 3.3: Storm System Cleaning Activities

System Component	# of Cleanings
Storm Sewer Culverts and Pipes	5,259 (feet)
Stormwater Conveyance Ditches	46,939 (feet)
Storm Inlets	10,942
Trash Racks	1,194*
Water Quality Facilities	
Green Streets	5,590 cleanings
All Other Types	119**

** Value represents the number of inspections. Trash racks are cleaned and cleared of debris at the time of inspection, if needed. The true cleaning number is likely much lower.*

*** Number of cleaning-related work orders recorded.*

3.2.3 System Repair

Repairs that were made during the permit year are included in Table 3.4.

Table 3.4: Storm System Repairs

System Component	# Repaired
Storm Sewer Culverts and Pipes	614 (feet)
Storm Inlets and Inlet Leads	275
Water Quality Facilities	6

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Section 4
Operations and Maintenance 2 (OM-2) City Roadways

BMP Summary

Operate and maintain components of public ROWs, including streets, to remove and prevent pollutants in discharges from the municipal separate storm sewer system.

Measurable Goals

- Sweep arterials six times per year.
- Develop a training handbook for PBOT-MO staff during the permit term.

4.1 Right-of-Way O&M

The City implements practices in and around rights-of-way (ROWs) to prevent and limit pollutant discharges to the Municipal Separate Storm Sewer System (MS4), including street sweeping, spill control, erosion control, material testing, and other best management practices (BMPs) related to the operation and maintenance (O&M) of city roadways. PBOT is the primary bureau responsible for maintaining the City's roads, sidewalks, and other transportation and maintenance facilities and infrastructure. The PBOT *Maintenance Environmental Handbook* is a guide provided to PBOT-Maintenance and Operations (MO) field crews to ensure they have easily accessible information on the handling of wastes, erosion control measures, spill control and prevention practices, and vehicle washing. The handbook was completed in 2011.

The City's street cleaning program removes dirt and debris from City streets to provide a healthy, safe, and attractive environment for Portland residents and visitors. Regular removal of leaves and debris by members of the public as well as City crews is necessary to prevent stormwater drains from clogging, which can result in street flooding. Street cleaning protects water quality and minimizes the burden on the sewer system from surface debris. The street sweeping program sweeps over 4,000 lane miles of curbed streets in the City each year, including residential streets and major arterial streets. Table 4.1 details street sweeping and debris removal activities.

Table 4.1: Roadway O&M Activities

Street Sweeping – Frequency	**Frequency**
Major Arterials	4-6/year
Residential Streets	1/year
Downtown Core	5x/week
Material Removed from City Roadways	**Amount (tons)**
Sediment and Material Collected from Street Sweeping Activities	4,415
Leaf Material Collected from the Street Leaf Removal Program	7,653*
** Equivalent to 14,983 cubic yards.*	

Additional BMPs that the City uses for roadways include:

- Following the Oregon Department of Transportation (ODOT) *Routine Road Maintenance Water Quality and Habitat Guide.*
- Erosion control during all sediment-disturbing activities.
- Using low-disturbance sign installation methods to avoid or minimize digging.
- Using mild cleaners, with no solvents, to clean signs.
- Monitoring weather conditions during asphalt grinding to avoid runoff.
- Hand-applying asphalt where necessary to prevent these materials from entering the MS4.

The City routinely investigates the potential use of alternative products and practices with the purpose of reducing and preventing pollution associated with ROWs. For example, PBOT is now using a UV-protection and anti-graffiti coating on new street signs that will further reduce the need for chemical cleaners.

The City has a Street Leaf Removal Program to remove leaves from city streets during leaf season for traffic safety and water quality protection. The leaf removal service area includes streets that have high concentrations of mature street trees, where fallen leaves can clog catch basins, cause street flooding, and create slippery road conditions that can be hazardous to the traveling public. PBOT continues to implement the leaf removal program in 30 leaf service areas (areas that have streets lined with large, mature trees). Under the program, PBOT schedules and implements one or two leaf collection days per zone. Table 4.1 details leaf removal activities.

PBOT continues to utilize the Cured-in-Place Pipe technology for rehabilitating existing sewer and stormwater pipe in the ROW. This practice reduces the size and number of asphalt cuts and amount of excavation and spoils to be disposed.

4.2 Deicing Activities

During the 2017-18 fiscal year, the City developed procedures to address the operational and safety challenges that arise from serious snow and ice events. One step the City took to ensure public safety during such events is the use of road salt (sodium chloride, or NaCl) on critical streets to facilitate deicing and passable driving conditions. The City historically used magnesium chloride (MgCl) for anti-icing of roadways, but it was shown to be less effective during extreme winter events that Portland has faced over the past 2 years.[1]

[1] MgCl will continue to be used in a tiered response with NaCl in a manner consistent with established BMPs.

The City strives to ensure that deicing activities are conducted in a manner that prevents or minimizes risk to water quality and that continues compliance with the MS4 Permit. BES and PBOT coordinated to create environmentally responsible practices for City use of road salt. The following details summarize the City's deicing activities during the 2017-18 winter season:

Table 4.2: Roadway Deicing Activities (2017-2018)

Roadway Deicing Activities (by region)	Southwest Portland	Northwest Portland	Southeast Portland	North/Northeast Portland
Total Lane Miles	57.9	31.4	32.6	14.7
Quantity of Salt Applied (tons)	26.4	14.4	14.0	5.5

The City also conducted the following activities related to its new deicing practices:

- **Training**: All crews who use deicer or salt are trained on BMPs of the Pacific NW Snowfighters Association prior to the start of the winter season in October. The use of salt is outlined in the PBOT Winter Weather Salt Plan: https://www.portlandoregon.gov/transportation/article/661465
- **Monitoring**: BES has been conducting water quality monitoring to evaluate the potential risks associated with PBOT's winter storm procedures, including the use of road salts, on a targeted reach of Johnson Creek and one of the City's stormwater facilities. The water quality data collected will provide BES staff with information that can be used to monitor whether the aquatic systems in the Johnson Creek watershed may be at risk and to make adaptive management recommendations to PBOT if warranted. BES will continue to perform instream monitoring to observe trends in local streams and inform practices related to roadway maintenance and storm response where warranted.

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Section 5
Operations and Maintenance 3 (OM-3) City Facilities

BMP Summary

Operate and maintain other City facilities and infrastructure (not included in OM-1 or OM-2) to remove and prevent pollutants in discharges from the Municipal Separate Storm Sewer System (MS4).

Measurable Goals

- Inspect and maintain, as necessary, all stormwater and stormwater containment and pollution prevention facilities in City maintenance yards annually.

5.1 Maintenance Facilities

The City operates several maintenance yards that receive, store, and transport municipal waste collected during routine maintenance activities and support additional City operations such as parks maintenance and fleet services. The City employs a variety of structural stormwater and non-structural source controls at each site. Typical controls include the use of covers, berms, and other containment strategies for waste and recyclables; sweeping and good housekeeping practices; installation of filtration and absorbent inlet inserts in catch basins; and use of oil-water separators and other pollution prevention facilities.

In addition to maintaining the City's roadways and transportation facilities, the Portland Bureau of Transportation (PBOT) operates critical city maintenance facilities[2]. The PBOT Environmental Coordinator evaluates and tracks maintenance procedures, pilot tests new products and techniques, evaluates work processes including spill response, and monitors developments in related fields. PBOT is also a participating bureau in the City's Salmon-Safe Certification. PBOT employs significant management practices and programs that are innovative and consistent with Salmon-Safe Standards. PBOT's maintenance facilities consist of:

- **Albina Yard.** This maintenance facility serves as a centralized hub for storage and maintenance activities, including bulk material storage, dewatering of street sweeping sediments, equipment shops, and parking. The facility is located in the City's combined sewer area.
- **Sunderland Yard.** The City composts more than 5,000 tons of leaves collected through the Street Leaf Removal Program every year at the 20-acre Sunderland facility (see OM-2). The facility also runs a crushing operation for asphalt and concrete that are removed as part of the City's sidewalk and roadway improvement projects. The City continues to implement best

[2] The City is in the process of developing a master plan for City fleet and PBOT maintenance facilities. A contractor was selected in 2016 to support the City in completing this work. Planning is anticipated to be a multi-year process with implementation to follow. Stormwater controls will be included as part of the master plan.

management practices (BMPs) at the Sunderland Yard and maintains the pollution prevention facilities regularly as conditions require.

  - Stormwater from the composting operation at Sunderland Yard is collected and treated before entering a detention pond, which discharges to the sanitary sewer.
  - Stormwater from the crushing operation at Sunderland Yard is collected in a sediment control and vault system that is discharged to a constructed wetland that has an overflow to the Columbia Slough. This facility was formerly covered by a General NPDES 1200-COLS Industrial Stormwater Discharge Permit, but the permit was terminated by the DEQ in 2012 because there is no stormwater discharge from the site's activity areas.

- **Stanton Yard.** This facility serves as the primary office location for PBOT employees but also includes some maintenance activities, such as small equipment repair, shops, and parking. Fueling of vehicles and equipment also occurs at this location under the City's fleet services operations. Stanton Yard is in the combined sewer area.

Portland Parks & Recreation (PP&R) consolidates its activities and materials from parks maintenance operations to prevent pollution and reduce impacts to the MS4.

- **Mount Tabor Yard.** This facility is located within the City's combined sewer area and functions as the central location for PP&R's equipment and vehicle washing. Recyclable and recoverable waste products are moved to the site, stored appropriately, and hauled offsite by specialized vendors and contract services. Used transportation maintenance wastes (oil, antifreeze, solvents, tires, dry cell batteries), paper and cardboard, scrap wood and metal, excess paint, and fluorescent lamps are managed at the site.

5.2 Parks Operations

PP&R oversees and maintains developed and natural area parks, public golf courses, and a variety of sports and athletic fields throughout the City. At the end of 2017, PP&R's portfolio of parks facilities included 146 developed parks (3,539 acres including developed parks, golf courses, and Portland International Raceway), 7,921 acres of natural areas, and 252 undeveloped acres.[3]

The bureau's strategic plan emphasizes development of an asset management program that integrates with operations, financial planning, and performance management. PP&R implements many BMPs that prevent or minimize the potential for pollutants in stormwater runoff from the City's diverse parks system. PP&R became the City's first bureau to achieve Salmon-Safe Certification in 2004. The certification was renewed in 2012 and again in 2018.

5.2.1 Integrated Pest Management

The mission of the PP&R Integrated Pest Management (IPM) program is to manage pests that are harmful to the health, function, or aesthetic value of park landscapes in an efficient, effective, and

[3] https://www.portlandoregon.gov/parks/article/422533

environmentally responsible manner, while paying careful attention to public and employee safety. A few examples of the City's IPM activities include:

- Utilizing plants with natural resistance to pests.
- Proper mowing and irrigation of park turf to increase vigor and reduce weed populations.
- Mulching of planting beds to reduce establishment of weeds.
- Application of selected herbicides to control invasive weeds and prevent their spread.
- Release of natural biological control insects to control invasive weed infestations.

The City's IPM efforts also include reducing water and fertilizer inputs on park properties, restoring riparian and upland habitats, and using alternatives to pesticides. PP&R continued to follow IPM practices during the 2017-18 fiscal year, tracked herbicide and pesticide uses, and is in the process of developing related metrics.

5.2.2 Water Usage and Irrigation Management

PP&R implements responsible irrigation management principles to conserve water, minimize runoff and increase infiltration, and optimize fertilizer use. Over the past several years, PP&R has also been installing computerized equipment to monitor irrigation flow. Water usage BMPs used in the City's park system include:

- Aerating and overseeding athletic fields to reduce the need for fertilizers.
- Computerizing irrigation systems to reduce water usage.
- Prioritizing park areas that receive irrigation based on frequency and volumes.
- Reviewing park designs to minimize the amount of "open turf" acreage.

PP&R continued to follow these BMPs throughout the 2017-18 fiscal year.

5.3 Non-Stormwater Discharge Management

Authorized non-stormwater discharges from facilities to the MS4 include discharges of potable water from hydrants, mains, and tank and reservoir drains. The Portland Water Bureau continues to submit requests to BES for such discharges. Discharges are approved on a case-by-case basis with a letter of authorization that requires appropriate BMPs to manage flow and water quality and adherence to Oregon Department of Environmental Quality guidelines for chlorinated discharges. A report is required for each discharge event to track volume and respond to any complaints.

Table 5.3: Discharge Authorizations to MS4

Discharge Authorization Type	Number Issued (#)
Hydrant Flows	35
Tank and Reservoir Drain Flows	20
Water Main Discharges	2
Uni-Directional Flushing	6
Total	**63**

5.4 Fire-Fighting Practices

Portland Fire & Rescue (PF&R) is Oregon's largest fire and emergency services provider that operates and maintains a network of fire station facilities and associated equipment to fulfill its mission. PF&R practices that are relevant to MS4 management involve equipment repair and washing, equipment maintenance, and training-related discharges.

- **Equipment Washing**. Equipment washing is generally conducted at all 31 fire stations. Per PF&R policy, all washing occurs inside station apparatus bays where the water is discharged to the sanitary sewer, typically through an oil/water separator. Fire stations were retrofitted between 1998 and 2008 during a large upgrade project that also facilitated environmental improvements.
- **Equipment Maintenance and Repair**. Equipment maintenance and repair is performed at PF&R's Logistics facility, located at 1135 SE Powell Blvd., which is in the combined sewer area. BMPs are followed, and the facility drains discharge to the sanitary sewer.
- **Training**. Fire-fighting training activities are conducted at PF&R's training facility located at 4800 NE 122nd Ave. Discharges from non-emergency fire training activities are permanently routed to the sanitary sewer system.

5.5 Salmon-Safe Certification

During the 2016-17 permit year, the City of Portland became the first city in the world to achieve Salmon-Safe Certification for its work to improve water quality and restore salmon habitat. In 2016, Portland City Council formally adopted the findings of Salmon-Safe's assessment, which was the culmination of a years-long process. Portland's designation means that city operations have conditionally passed the organization's comprehensive science-based evaluation of land and water management practices. Salmon-Safe Certification affects day-to-day city operations that potentially impact downstream water quality as well as the construction and maintenance of City-managed properties, including City-owned buildings and the City's fleet of vehicles and bureau maintenance yards.

There are several participating bureaus that are specifically tasked with carrying out elements of the Salmon-Safe Certification: PP&R (certified since 2003), BES, PBOT, Portland Water Bureau, PF&R, Office of Management and Finance, and Bureau of Planning and Sustainability. Facility managers are committing to additional actions to limit water pollution, conserve water use, and

restore habitat over the next 5 years, at which time City operations will be inspected for Salmon-Safe recertification.

BES is required to meet four cross-bureau conditions, as well as eight bureau-specific conditions to maintain certification. Progress toward the completion of each condition must be documented in an annual report to Salmon Safe, due in October each year. The 2018 progress report will document the completion of two of the seven remaining bureau-specific conditions, and two of the three remaining cross-bureau conditions.

5.6 Sustainable Procurement Program

The City engages in green purchasing efforts to spend public funds on goods and services that minimize negative impacts on human health and the environment. The City's Sustainable Procurement Policy directs City bureaus to include environmentally preferable product and service specifications in City solicitations and contracts. Stormwater pollution prevention is addressed in construction and architectural/engineering design services, for example. Specifications reference BMPs such as zero-sediment runoff at construction sites, onsite stormwater management (ecoroofs, rain gardens, etc.), restrictions on zinc- or copper-containing exterior materials, and the use of untreated wood for boardwalks and similar exterior wood features.

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Section 6
Industrial Stormwater Management 1 (IND-1)

BMP Summary

Implement the Industrial Stormwater Management Program to control the discharge of pollutants from industrial and commercial facilities (both existing and those undergoing changes in operations) to the Municipal Separate Storm Sewer System (MS4).

Measurable Goals

- Inspect all permitted (1200Z, 1200COLS) facilities once per year.
- Review each permitted facility's monitoring and annual report each year.
- Survey 100 percent of newly identified facilities to determine the need for NPDES permits.
- Every 5 years, inspect industries (individual sites) previously identified as having no exposure and not required to obtain a permit.
- Complete revision of City Code Title 17.39 by 2012.

6.1 Industrial Stormwater Permitting

The Industrial Stormwater Program (ISW) administers General National Pollutant Discharge Elimination System Industrial Stormwater Discharge Permits in Portland through an intergovernmental agreement with the Department of Environmental Quality. Program staff conduct annual compliance inspections of permitted sites, provide technical assistance on BMP implementation, and issue enforcement referrals for instances of non-compliance. ISW also performs inspections of non-permitted sites to assess the need for permit coverage, evaluates sites with No Exposure Certifications (NECs) to verify that the permit exemption is valid and locates and maps private outfalls located throughout riparian areas that discharge directly to receiving streams and identifies the sources that drain to these outfalls.

During the 2017-2018 fiscal year, ISW issued 20 new General Industrial Stormwater Discharge Permits, 16 of which were in the Portland Harbor and issued due to language in the new General Permit (effective in 2017), which expands permit coverage based on exposure of certain industrial activities.

ISW activities are detailed in Table 6.1.

Table 6.1: Industrial Stormwater Program Activities

Permitted Site Activities	**Number (#)**
Permits Administered*	229
Permitted Site Inspections*	228
Enforcement Actions Issued **	232
Non-Permitted Site Activities	**Number (#)**
Non-Permitted Site Inspections	57
Expiring NECs	31
NECs Re-issued***	22
New NECs Issued	14

** Administered permits include those that were issued and terminated midway through the permit year. One permit was issued June 29, 2018, and therefore was not inspected during the 2017-2018 fiscal year.*

*** Includes City code enforcement to permitted facilities.*

**** NECs may not be renewed for a variety of reasons. Some businesses are no longer in operation and others are required to obtain permit coverage due to increased exposure.*

Section 7
Industrial Stormwater Management 2 (IND-2)

BMP Summary

Provide educational programs and materials and technical assistance to reduce industrial and commercial pollutant discharges to the Municipal Separate Storm Sewer System (MS4).

Measurable Goals

- Under the Eco-Logical Business Program, certify 10 additional auto shops and 20 additional landscape firms that provide services within the City of Portland by 2015.
- Evaluate one new business sector for implementation of the Eco-Logical Business Program.

7.1 Commercial and Industrial Web Outreach

Twenty best management practice (BMP) fact sheets are posted on BES's Industrial Stormwater Program website, which provides technical assistance information to the public, specifically targeting commercial and industrial site operators. The most-viewed BMP materials during Fiscal Year 2017-18 are listed in Table 7.1. Other BMP materials include information on dewatering activities, loading and unloading materials, and outside container storage and waste disposal.

Table 7.1: Commercial and Industrial Web Outreach

BES Website Activities, Top Hits	Page Views (#)
Sand-Blasting and Painting Operations	371
Catch Basin Maintenance	675
Preparing Emergency Response and Spill Cleanup Plans	237

7.2 P2O Team and EcoBiz Outreach

The City is a member of the Regional Pollution Prevention Outreach Team (P2O Team) and the Eco-Logical Business Program (EcoBiz) to reduce pollutant discharges to the MS4 from commercial business operations. EcoBiz Program members certify automotive and landscaping businesses in the Portland metropolitan region to ensure sustainable and environmental practices. Additionally, the EcoBiz Team has partnered with the Department of Environmental Quality (DEQ) to create a certification program for green dry cleaners. The criteria to be an EcoBiz dry cleaner is awaiting approval by DEQ and the Regional P2O Team, and implementation is anticipated to begin in September 2018.

The City did not perform EcoBiz site visits or provide certifications/recertifications this fiscal year, while it evaluated the effectiveness of the EcoBiz Program in meeting pollutant prevention goals. Results of this evaluation indicated that the EcoBiz program provides a positive community benefit. Subsequently, the City has resourced the program for the next fiscal year with the initial goals of re-certifying expired businesses and expanding the landscaping program. Table 7.2 summarizes the current number of certified landscapers and automotive businesses.

Table 7.2: EcoBiz Activities

Category	Site Visits	Re-Certifications	New Certifications	Current Total (#)
Landscapers	N/A	N/A	N/A	9
Automotive*	N/A	N/A	N/A	23
Total				**32**

** Includes repair service and car washing facilities. The EcoBiz program is voluntary. The number of participating businesses varies from year to year. Barriers to obtaining certification or re-certification include business closure, ownership changes, financial impediments, and unsuitable site conditions.*

7.3 Sustainability at Work

The City's Sustainability at Work (SAW) program continued to assist Portland businesses with resources and information to promote pollution prevention and environmental sustainability. The program is administered by the City's Bureau of Planning and Sustainability in partnership with the Portland Water Bureau, Metro, and Energy Trust of Oregon. As part of SAW, the City conducts site visits to assist businesses on a broad range of topics, including water conservation, stormwater management, hazardous waste, energy efficiency, renewable power, alternative transportation, and waste prevention. The City also distributes monthly newsletters to over 4,000 customers and administers a certification program recognizing businesses that have taken measurable steps to conserve resources and reduce greenhouse gas emissions.

Table 7.3: Sustainability at Work (SAW) Program Activities

Activity	Number (#)
Technical Assistance Site Visits	283
New SAW Certifications and Renewals	161
Total Number of SAW Certified Business to Date	**368**

7.4 Columbia South Shore Well Field Wellhead Protection

The City provides outreach and technical assistance to businesses and residents in the Columbia South Shore Well Field Wellhead Protection Area to help them comply with local drinking water source protection regulations, which are designed to prevent contamination of groundwater used as the drinking water source. Because much of the area is in the City's MS4 area, these activities are beneficial to protecting local surface water as well. Businesses in the area are required to implement structural and operational BMPs to manage harmful chemicals, reduce the occurrence of spills, and minimize spill impacts. Activities in fiscal year 2017-18 included the following:

- Made over 2,300 individual outreach contacts.
- Provided technical assistance to 24 businesses.
- Published newsletter articles on the protection program.
- Distributed free spill kits, required signs, and secondary containment pallets.
- Maintained the Columbia Corridor Association and City of Portland webpages on the Groundwater Protection Program with information for businesses and residents.
- Conducted 174 site inspections for compliance with the City's Wellhead Protection Area Reference Manual.

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Section 8
Illicit Discharges (ILL-1)

BMP Summary

Identify, investigate, control, and/or eliminate illicit discharges (illicit connections, illegal dumping, and spills) to the Municipal Separate Storm Sewer System (MS4). Evaluate and, if appropriate, control non-stormwater discharges to the MS4.

Measurable Goals

- Conduct dry weather sampling at all major City-owned outfalls at least once annually.
- Inspect the priority outfalls a minimum of three times per year.
- Expand the Illicit Discharge Detection and Elimination (IDDE, formerly IDEP) program to include the combined sewer overflow system below diversion structures, where the outfalls discharge only stormwater and should have no dry-weather flows. Currently, the program addresses all of the westside outfalls and 25 percent of the eastside outfalls. Expand the program to all eastside outfalls by December 2013.
- Maintain the spill response hotline 24 hours a day.

8.1 Illicit Discharge Detection and Elimination Activities

The City implements several programs to address illicit discharges and spills to the MS4. BES's IDDE Program performs inspections of MS4 outfalls and priority locations to identify and eliminate illicit discharges or cross-connections to the system. The City's Spill Response Program operates a 24-hour spill response hotline and investigates pollution complaints that have the potential to impact the MS4.

The Industrial Stormwater Program (discussed in the IND-1 section of this report) ensures that BMPs relating to spill prevention and reporting are properly implemented at industrial facilities covered by a General NPDES Industrial Stormwater Discharge Permit. During the reporting year, the program administered 229 permits with requirements to maintain spill prevention and response procedures.

The City also implements curbside collection services (residential garbage, recycling, yard debris, and food scrap collection) to help prevent illegal dumping. The City has a partnership with the Neighborhood Coalition Offices and Metro to administer community collection events. During the year, 50 Community Collection Events took place throughout the city. BPS continued to support the implementation of Keep It Pretty Rose City, an anti-litter toolkit to help community groups organize litter pickup activities. More than 4,500 households removed bulky household waste from their homes with the assistance of over 1,000 community volunteers who helped at the citywide events.

8.1.1 Dry-Weather Field Screening

BES inspects major outfalls during dry weather to identify and eliminate illicit or non-stormwater discharges of concern. Related activities during the 2017 summer season and are provided in Table 8.1 below.

Table 8.1: 2017 Dry-Weather Field Screening Activities

Dry-Weather Field Screening Activities	Number (#)
IDDE Outfalls Inspected	128
Inspections Performed	242
Outfalls with Flow Observed*	82
Illicit Discharges Identified	1

** Many City outfalls convey flow from background sources, such as hillside streams. Any presence of flow is accounted for here, including flow levels that are too low to perform field screening. Conditions where no determination can be made from the surface, when conditions are back-watered or outfalls are submerged, are excluded from the count.*

Illicit Discharge Description and Actions

One illicit discharge was identified during dry weather field screening efforts. Outfall 68 had high *E. coli* counts. No single source was discovered. City staff investigated for a possible cross connections or sewage release, but no structural defects were identified. Upon repeat sampling, the high *E. coli* numbers dropped to normal levels, indicating a single incident/spill and not a chronic problem. A number of streets in this basin had reports of RV camping/homeless activity, and the temporary high *E. coli* might have been associated with that. BES is partnering with other City bureaus/programs that focus on mitigating the impacts of homelessness activities to develop programmatic approaches and communication to reduce future risks of similar activities.

8.1.2 Pollution Complaint Response

The City's Spill Protection and Citizen Response (SPCR) Program investigates pollution complaints that have the potential to impact the MS4 and enforces prohibited discharge violations of Portland City Code 17.39. SPCR operates a 24-hour spill response hotline and administers a duty officer program that responds to pollution complaints 365 days a year. During the 2017-18 permit year, SPCR received and responded to roughly 1,975 calls regarding pollution complaints, spills, sewer overflows, dye tests, and other pollution-related inquiries.

SPCR also facilitates training related to spill response and participates on the Regional Spill Response Committee. The Regional Spill Response Committee includes representatives from different City bureaus and the Department of Environmental Quality, U.S. Coast Guard, Clackamas Water Environment Services, Port of Portland, and City of Gresham. In 2016-17, the City initiated a "re-boot" of this effort to re-focus activities, solicit input about new participants and meeting topics, and increase coordination with emergency responders and planners. This re-boot produced a significant amount of material, information, and suggestions that the team is analyzing to determine next steps. Additional staff resources were identified as necessary to better coordinate and facilitate the Regional Spill Response Committee. One new position (one FTE) was approved for funding for the 2018-19 fiscal year.

8.1.3 Investigation and Enforcement

The IDDE Program, the SPCR Program, and the Industrial Stormwater Program all inspect and investigate possible prohibited discharges to the MS4. If an inspection or an investigation determines that a prohibited discharge took place, and a responsible party can be determined, BES will pursue an enforcement action. See Table 8.2 for enforcement actions that were undertaken due to inspections and investigations.

In addition to the enforcement actions detailed in Table 8.2, two sanitary cross connections from private property to the City's storm system were discovered by field staff and corrected through enforcement actions.

Table 8.2: Illicit Discharge Enforcement Actions

Enforcement Type	Enforcements Issued (#)	Responsible Parties (#)	Penalties and Costs ($)
Notice of Violation	48	42	$36,750
Notice of Assessment of Costs*	6	6	$16,966
Warning Notice	1	1	0
Compliance Order	3	3	0
Total	**58**	**52**	**$53,716**

** These notices are related to an underlying violation and are used to recover costs the City incurred to clean, repair, or respond to an illicit discharge.*

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Section 9
New Development Standards 1 (ND-1)

BMP Summary

Control erosion, sediment, and pollutant discharges from active construction sites.

Measurable Goals

- Evaluate the *Erosion and Sediment Control Manual* and update as needed (at least once during the 2011-2016 permit cycle); conduct public involvement on updates.
- Inspect public sites with erosion control permits daily during construction.
- Inspect 100 percent of active private development construction sites subject to erosion control requirements. At a minimum, inspections will occur 1) after initial, temporary erosion control measures are installed, and 2) near completion of development after permanent erosion control measures are in place. Conduct interim checks as part of routine building permit inspections.

9.1 Erosion Control Activities

The City has an erosion control program that applies to both public and private construction projects. Portland City Code Title 10 and the City's *Erosion and Sediment Control Manual* outlines requirements and provides technical guidance for temporary and permanent erosion prevention, sediment control, and control of other site development activities that can cause pollution during the construction process. The City's erosion control requirements apply to all ground-disturbing activities, regardless of whether a development permit is required, unless such activities are otherwise exempted by Portland City Code.

The Bureau of Development Services (BDS) administers and enforces erosion control requirements for private development sites. Sites with qualifying ground disturbance areas are inspected for temporary and permanent erosion control measures at the beginning and near or at completion of the project. Interim checks are conducted during regular building inspections or as needed for problem and complaint-related sites. City inspectors note deficiencies related to best management practice (BMP) implementation and require site operators to implement corrective action when needed.

The public works bureaus (Water, Environmental Services, Transportation, and Parks) manage erosion, sediment, and pollutant control activities and BMPs for their respective City infrastructure projects that involve public works permits. In general, public works projects are inspected daily during construction.

Table 9.1: Erosion Control Activities

Private Sites	**Number (#)**
Permits Issued with "Ground Disturbing Activities"	3300
Site Inspections	3784
Enforcement Actions and Correction Notifications Issued*	1169
Complaints Received	23
Public (City) Sites	**Number (#)**
Portland Bureau of Transportation Projects	13
Bureau of Environmental Services Projects	82
Portland Water Bureau Projects	66
Portland Parks & Recreation Projects	17
Total Active Public Construction Projects with Erosion Control	**178**
**Stop-work orders, correction notices, and notices of violation.*	

Additional erosion control activities and accomplishments include the following:

- Provided annual construction inspector training to BES inspection staff on November 28, 2017.
- Conducted monthly erosion control program meetings with BDS and BES.
- Provided erosion control program and compliance guidance to permittees at 14 BDS Pre-construction Conferences.
- The Erosion Control Technical Advisory Committee (BES and BDS) continued meeting throughout 2017-2018. The committee's work includes assessing existing program resource needs, identifying program needs, and creating prioritized goals for management review. On May 4, 2018, the committee presented a prioritized list of 35 items for management's consideration, with an emphasis on 10 items listed as high priority. The committee continues meeting to track program improvements as well as shortcomings.
- In June 2018, BDS promulgated new regulations (PCC 24.55.205), which address asbestos and lead discharges from demolition activity. Inspection and enforcement of this program is overseen by site development inspectors and linked directly by administrative rule to air quality erosion, sediment, and stormwater protection.
- Three new full-time inspector positions were approved in May 2018 and filled in July 2018. This brings the erosion and sediment control program up to a total of five inspectors for the upcoming permit year. Two of the newly hired inspectors are a Certified Inspector of Sediment and Erosion Control inspector and Certified Erosion, Sediment, and Stormwater Inspector (CESSWI).
- Trainings and certifications: In August 2017, BDS Senior Erosion Control Inspector attended the annual STORMCON conference in Bellevue and received continuing education on topics related to erosion control and stormwater management. In February 2018, the BDS Senior Erosion

Control Inspector attended the annual IECA conference in Long Beach, California, and received continuing education on topics related to erosion control and stormwater management. Site Development Inspector completed a Certified Erosion and Sediment Control Lead certification training and was approved to apply for CESSWI certification in 2018. All five inspectors have received AHERA asbestos certifications and lead-based paint certifications.

- The BDS Site Development Environmental Soils work group added one temporary inspector position to perform erosion and sediment control inspections for larger development sites (1 acre or greater).
- On June 21, 2018, the BDS Senior Erosion Control Inspector gave a presentation at the annual NEBC Conference in Salem, Oregon, titled “Fundamentals of Erosion and Sediment Control.”
- Provided erosion control program compliance and reporting at pre-construction conferences for 13 PBOT capital improvement projects.

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Section 10
New Development Standards 2 (ND-2)

BMP Summary

Implement and refine stormwater management requirements for new development and re-development projects to minimize pollutant discharges and erosive stormwater flows.

Measurable Goals

- Inspect 1,500 private stormwater facilities or 450 properties annually. Use education and enforcement tools to ensure that stormwater management operations and maintenance plans are followed.
- Revise the Stormwater Management Manual (SWMM) during the 2011-2016 permit term.
- Track number, type, size, drainage area[4], and location of private facilities constructed annually.

10.1 Stormwater Management Manual Developments

The SWMM provides policy and design requirements for stormwater management throughout the City of Portland. The requirements in the manual apply to all development, redevelopment, and improvement projects within the City of Portland on private and public property and in the public right-of-way. Projects with 500 square feet or more of impervious area trigger stormwater management requirements, including volume and flow control and water quality control using specified treatment and green infrastructure facilities.

BES revises the SWMM to meet current regulatory requirements and to provide current technical standards. The City is currently implementing the 2016 SWMM, which became effective in August 2016. The latest update reinforced the stormwater management hierarchy, updated the user interface for the Presumptive Approach Calculator used to size best management practices (BMPs), separated source control requirements into a new stand-alone manual, and shifted from citywide flow control and pollution reduction requirements to system-specific (i.e., MS4, UIC, or CSO) requirements.

10.1.1 Monitoring and Evaluation

BES conducts monitoring, research, and evaluation projects related to the SWMM to continually adapt and improve the technical and policy specifications within the manual. During the 2017-18 fiscal year, BES conducted the following SWMM monitoring and evaluation activities:

- Continued monitoring of green streets and ecoroofs. The evaluated facilities are located throughout the City and represent a variety of facility types, configurations, ages, and land uses.
- Continued implementation and evaluation of soil media specifications for green street facilities to improve and promote better plant health and drought tolerance.

[4] Drainage area is tracked for all private stormwater management facilities subject to Chapter 3 of the SWMM (O&M plan).

- Continued monitoring of modified drain systems in stormwater planters (including orifices) for improved performance.
- Continued implementation and evaluation of soil blends using slightly more fines to improve water retention and plant health in vegetated stormwater management facilities and improve performance in lined facilities.
- Continued implementation of a multi-year monitoring project focused on performance of mature lined green streets.
- Completed design and construction documents for a group of green streets to test a modified underdrain system and different soil media blend. These facilities will be monitored for water quality, plant health, soil moisture and infiltration performance.
- Pursued partnerships with projects to incorporate monitoring access during the design phase.

10.2 Stormwater Management Manual Implementation

BES has several teams tasked with implementation of the SWMM, which includes reviewing development plans for public and private projects, providing technical assistance to developers early in the design process, inspecting the design and installation of stormwater management facilities (SMFs), and enforcing operations and maintenance requirements for SMFs in the long term.

Table 10.1: SWMM Implementation Activities

Stormwater Early Assistance*	**Number (#)**
Land Use Reviews Conducted	489
Early Assistance Request Responses and Pre-app Conferences	455
Development Review & Construction	**Number (#)**
Public Works Project Permit Approvals	39
SWMM Permit Reviews	5406
Projects with Stormwater Management Facilities (SMFs) Constructed**	1411
Impervious Area Managed by Constructed SMFs	425.3 (acres)
Operations & Maintenance (O&M)	**Number (#)**
O&M Agreements Recorded	419
SMFs Covered by O&M Agreements	886
Properties Covered by O&M Agreements	478
Impervious Area Managed under O&M Agreements	143.1 (acres)
Properties Inspected for O&M Requirements	759
SMFs Inspected for O&M Requirements	1305
Enforcement Actions Issued***	19

** Land Use Reviews and Early Assistance counts per SWMM Implementation are inclusive of cases reported in Table 10.2.*
*** Some permit projects have multiple SMFs constructed.*
**** Warning Notices, Notices of Violations, and Voluntary Compliance Agreements.*

10.3 Pollution Prevention and Source Control

BES's Pollution Prevention Plan Review team conducts early assistance activities and land use and pollution source control reviews associated with commercial and industrial properties subject to requirements in the City's Source Control Manual (SCM). In 2016, BES separated Chapter 4 out of the SWMM and made it the stand-alone SCM. The SCM specifies pollution control requirements for development and post-development activities considered to be "high-risk" or pollutant-generating. The manual identifies structural, operational, and treatment BMPs designed to prevent or control conventional and toxic pollutants in stormwater, groundwater, and wastewater.

Table 10.2: Source Control Manual Activities

Case Reviews*	**Number (#)**
Land-Use Reviews Conducted	82
Early Assistance Request Responses and Pre-Application Conferences	426
Contaminated Site Reviews	327
Total	**835**
Pollution Source Control Measures Required and Installed (by activity area)	**Number (#)**
Trash and Recycling Areas	772
Loading Docks	121
Fueling Stations	64
Boilers and Chillers	65
High-risk Vehicle and Equipment Areas	4
Water Reclaim/Reuse	2
Wash Racks	13
Liquid Storage Areas	79
Dewatering/Subgrade Structures	269
Covered Parking	59
Water Features	11
Exterior Bulk Storage	7
Tank Farms	3
Total	**1469**
** Land Use Reviews and Early Assistance counts per SCM Implementation are included in cases reported in Table 10.1.*	

Section 11
Structural Controls (STR-1)

BMP Summary

Structurally modify components of the storm drainage system to reduce pollutant discharges. Implement structural improvements on existing development to reduce pollutants in discharges from the Municipal Separate Storm Sewer System (MS4).

Measurable Goals

- Construct the following public facilities to provide treatment for stormwater runoff from approximately 336 acres.
  - Construct the NE 148th Avenue stormwater management facility by FY 14-15.
  - Construct stormwater management facilities in the NE 122nd Avenue subbasin by December 2012.
  - Convert 5,000 linear feet of roadside ditches to swales or porous shoulder during the permit term.
  - Construct stormwater management facilities along SW Beaverton-Hillsdale Highway and SW Barbur Blvd. and in commercial and multi-family residential areas during the permit term.
- Track the number, type, drainage area, and location of public facilities constructed annually.

11.1 Stormwater System Plan

The BES *Stormwater System Plan* is a comprehensive asset management approach that identifies major infrastructure improvement needs for the City's storm system and natural drainage operations. Development of the *Stormwater System Plan* is a multi-year process that includes a risk assessment and review of stormwater system capacity, condition, service needs, water quality and stream impacts. Activities conducted over Permit Year 2017-18 include the following:

- Development of a citywide overlay for all stormwater service categories using the best available data, to inform the next stages of system planning and risk assessment. Service categories assessed include:
  - Stormwater system deficiencies that impede community development
  - In-stream erosion due to development activities
  - Habitat degradation
  - Landslide hazards
  - Localized nuisance flooding
  - Risks to surface water from existing sanitary sewer infrastructure
  - Water quality degradation
- Utilized the preliminary overlay risk map to identify how and when multiple risks occur. This information was shared internally to inform the development of future stormwater risk reduction projects.
- Formed partnerships with Portland Bureau of Transportation (PBOT) Active Transportation and Grade and Gravel programs to identify overlapping priority projects, where BES would prioritize water quality treatment and flow control as well as other stormwater risks.

- Gathered information and data to evaluate risk and opportunities associated with the existing stormwater system located within the project area for the proposed Southwest Corridor Light Rail project, in coordination with the SW Corridor Team, Trimet, and Oregon Department of Transportation.
- Continued design and community outreach to finalize retrofit options for Capitol Highway in Southwest Portland, in partnership with the Westside Watershed Team and Portland Bureau of Transportation (PBOT).

11.2 Tracking and Mapping of Structural Storm System Facilities

The City maps and tracks structural MS4 components on an ongoing basis using a robust asset management system called Hansen. For structural controls and City BMP facilities, this includes tracking the location, type, drainage and other system components and maintenance details. This structural asset information is then used on an as-needed basis in a more complex modeling process to generate information and estimates related to treated acreage, pollutant loading benchmarks, and so forth. The City continued this asset inventorying through the permit year as new structural components were designed and constructed.

11.3 Technical Assistance, Incentives, and Grants Programs for Property Retrofits

The City provides technical assistance, incentives, and grants as part of programs to encourage onsite retrofits and water quality improvements for existing development. Outreach is focused on private property and management of stormwater onsite to mitigate stormwater flow, pollutant discharge, and runoff volume. Key programs include the Green Building and Development Program, Private Property Retrofit Program, the Sustainable Stormwater Management program, the Clean River Rewards Program, and the Backyard Habitat Certification Program. These efforts are summarized in Table 11.1. The City's Community Watershed Stewardship Program is referenced in Section 2 under PI-1.

- **Green Building and Development Program.** Since 2000, the BPS Green Building and Development Program has worked with residents, businesses, and community partners to advance sustainable building practices, including stormwater management for new construction on private property. By request, Bureau of Planning and Sustainability (BPS) staff advise construction projects and provide green building presentations. If stormwater management-related questions are asked, BPS refers the public to relevant BES programs and incentives.
- **Stormwater System Program.** The former Sustainable Stormwater Management Program (now integrated into the Stormwater System Division and referenced as the Stormwater System Program) fields public requests for information and provides technical assistance on a variety of stormwater projects, programs, and policy including green streets, ecoroofs, watersheds, the urban tree canopy program, and more.

- **Private Property Retrofits.** BES's Private Property Retrofit Program works with private property owners to manage stormwater on-site by aiding with the installation of rain gardens, stormwater planters, swales, ecoroofs, and pervious pavement on sites that meet program criteria. The City provides substantial financial and technical assistance for project construction in targeted neighborhoods. Participation is voluntary, and the stormwater facilities installed are on private property and are privately maintained long-term under the administration of the Maintenance Inspection Program (see ND-2). Currently most of the program's work is focused in the City's combined sewer areas to address system capacity issues, but BES is in the process of expanding the program to targeted MS4 areas.

- **Clean River Rewards.** Clean River Rewards is Portland's stormwater utility discount program. With Clean River Rewards, Portland ratepayers can save money and work for clean rivers and healthy watersheds at the same time. Properties that manage stormwater on-site qualify for up to a 100 percent discount on their on-site stormwater management charges. The program rewards private property owners who conduct stormwater retrofits and help protect rivers, streams, and groundwater.

- **Backyard Habitat Certification Program.** As part of the City's invasive species program, the City provided a $10,000 grant to Columbia Land Trust to operate the Backyard Habitat Certification Program within the City limits. The Program focuses on removing impervious area and invasive species and restoring small native vegetation for improved stormwater management and wildlife and pollinator habitat. Program support will increase to $15,000 in 2019.

Table 11.1: Technical Assistance, Incentives, and Grants Programs for Private Retrofits

Green Building and Development Program	**Number (#)**
Projects/Building Construction	8
Outreach (Presentations and Tours)	17
Stormwater System Program	**Number (#)**
Requests for Green Streets and Other Projects	6
Outreach (Presentations, Conferences and Tours)	12
Clean River Rewards	**Number (#)**
New Registrations – Commercial Sites	62
New Registrations – Residential Sites	1,498
Total Impervious Area covered by CRR program to-date	**4,804 (acres)**
Private Property Retrofit Program (BES)	**Number (#)**
Number of Private Property Retrofit Projects Through PPRP Partnerships	66
Acres of Impervious Area Managed in These Projects	2.4 (acres)
Total Impervious Area Managed Through Program To Date	**10.5 (acres)**
Backyard Habitat Certification Program	**Number (#)**
Number of (New) Households Receiving Funding	528
Acreage (New) Managed	165
# of Plants Provided	8,486

11.4 Storm System Retrofits and Green Streets

The City continues to implement retrofit projects to roadways and the existing storm drainage system to address water quality and stream health. These retrofits include construction of stand-alone treatment facilities or the conversion of existing drainage infrastructure to facilities that promote watershed health and treatment and/or infiltration of runoff (e.g., roadside ditches to swales or porous shoulders). One method of system retrofitting is the construction of green streets. The City maintains an active program to identify potential green street opportunities and install green street features (e.g., roadside planters, curb bump outs), either as part of a subsequent utility improvement or roadway and sidewalk improvement project. Retrofit projects that were in design or construction phases during Fiscal Year 2017-18 are listed in Table 11.2.

Table 11.2: Storm System Retrofits and Green Street Projects (2017-18)

Watershed	Retrofit/Facility Type	Project Description	Project Location	Project Status	Job #	Area Treated (acres)	MS4 Outfall
Columbia Slough	TBD	Project to provide stormwater treatment for City rights-of-way.	North/Northeast Portland	Pre-Design	E10626	TBD	60, 62, 62A, 73A
Columbia Slough	TBD	Project to provide stormwater treatment for City rights-of-way.	North Portland	Pre-Design	E10690	TBD	58, 59, 61, 61A
Columbia Slough	TBD	Project to provide stormwater treatment for City rights-of-way.	Northeast Portland	Pre-Design	E10700	TBD	63, 64, 65, 65A
Columbia Slough	Green Streets, UICs, Catch Basin Filters, and a Filter Vault	Combination of green streets and subsurface stormwater treatment facilities to treat stormwater runoff from City rights-of-way.	Portsmouth Neighborhood	Design - 30%	E10918	82	57
Columbia Slough	UIC and Green Streets	Subsurface stormwater treatment facilities and green streets to treat stormwater runoff from City right-of-way.	Parkrose Neighborhood	Design - 30%	E10689	15	100
Columbia Slough	Green Streets	Over 50 green street facilities to treat stormwater runoff from roughly 30 acres of City rights-of-way.	South of NE Sandy Blvd, between NE 122nd and NE 138th, Argay Neighborhood	Construction - 50%	E10625	200	104B
Columbia Slough	Green Streets	Five green streets to manage 25,900 sf of NE 185th built by a private developer to meet development requirements.	NE 185th Dr. & Riverside Pkwy	Construction - Complete	EP244	0.6	AAW440
Fanno Creek	Stormwater Conveyance and Regional Detention	Partner with PBOT and PWB on a project to enhance transportation infrastructure on the corridor, replace aging water pipes and enhance stormwater management in the corridor and in adjacent stormwater drainage basins. Note the project area extends to the Tryon Creek watershed.	SW Capitol Hwy between Multnomah Village and SW Barbur Blvd	Design - 60%	E10939	102	Various
Fanno Creek	Stream Restoration	Stream enhancement and pipe/pump house removal near Dickinson Park.	SW 57th Place and SW Huddleson St	Construction - 10%	E10781	N.A.	ADF652
Fanno Creek	Catch Basin Storm Filters and Green Streets	Construction is underway on a project to improve stormwater management for water quality and stream health.	SW Shattuck @ SW Beaverton-Hillsdale Highway	Construction - 10%	E08675	4	ANJ675 ACG027
Fanno Creek	Stream Daylighting	Constructed a stream day-lighting projects at Albert Kelly Park to slow stormwater and reduce erosion to Restoration Creek.	Albert Kelly Park (SW Dosch @ SW Mitchell)	Construction - Complete	E10824	N.A.	Near ADG234
Fanno Creek	Culvert Replacement	Replace an undersized culvert on Fanno Creek at SW 45th to alleviate flooding risk and enhance fish passage.	SW 45th and Beaverton-Hillsdale Highway	Construction - Complete	E08676	N.A.	ACG533 APN707
Johnson Creek	Stormwater improvements	Stormwater basin and road improvements to treat 1.2 acres of impervious area that drains to a wetland adjacent to Johnson Creek.	SE Harney Street Between SE 45th and Johnson Creek	Design - Final	E08406	1.2	TBD
Johnson Creek	Green Street	Three green streets to manage 6,300 sf of SE 162nd Ave and one regional swale to manage 72,800 sf of SE 160th Ave, SE Spokane Ct., and SE Tenino Ct. Built by a private developer to meet development requirements.	SE 162nd Ave & SE Spokane Ct	Construction - Complete	EP118	1.8	ACV532
Johnson Creek	Stormwater Improvements – UICs and Green Street	Combination of UICs and vegetated stormwater facilities to treat runoff from 1.2 miles of (currently gravel and proposed to be paved) streets.	Errol Heights Neighborhood	Design – 60%	E10917	2.8	ACZ290
Johnson Creek	Stream Restoration	Repair eroding streambed and banks of Johnson Creek that were damaged following a FEMA-declared disaster flood event (December 2015).	S of SE Luther Road, E of SE 72nd	Design – 60%	E10854	N.A.	N.A
Johnson Creek	Stream Restoration	Installation of large wood to stabilize an actively eroding bank of Johnson Creek.	SE 44th Ave & SE Umatilla	Construction - Complete	E10996	N.A.	N.A
Tryon Creek	Culvert Replacement/Bridge Construction	Remove an undersized culvert and replace with a bridge to improve fish passage.	SW Boones Ferry Road at Arnold St (confluence of Arnold and Tryon creeks)	Design – 90%	E08682	0.6	near ANT403
Tryon Creek	Stormwater Facility and Green Street	Along with PBOT, constructed a green street and stormwater facility to address water quality from unimproved roadway.	SW 19th Avenue @ Taylors Ferry	Construction - Complete	E10672	3.7	ADD172
Willamette River	Stream Enhancement	Three projects at the Stephens Creek Headwaters to manage stormwater flows and enhance water quality and habitat.	SW 26th and Texas St; Custer Park; Stephens Nature Park	Design - 30%	E10911; E10912; E10596	TBD	ACS140 (Custer)
Willamette River	Green Street and Roadside Ditch Revegetation	One green street and revegetation of roadside swale to treat 3,590 sf of roadway runoff prior to discharge in the headwaters of channel in Riverview Natural Area.	SW Palatine Hill @ Lewis and Clark	Construction - Complete	E10769	0.08	ADH777

Watershed	Retrofit/Facility Type	Project Description	Project Location	Project Status	Job #	Area Treated (acres)	MS4 Outfall
Willamette River	Stormwater Facility	Constructed Centennial Oaks Stormwater Project to treat parking lot and roadway runoff.	Willamette Park	Construction - Complete	E10153	1.4	OF01
Willamette River	Culvert Replacement	Restoration of failing culverts along Leif Erikson Drive in Forest Park to address hydrology, scouring and sediment in runoff.	Leif Erikson Drive, Forest Park, mile 6.61, 7.71, 9.89	Construction - Complete	E10710	N.A.	OFs 22C & 22D
Willamette River	Outfall Repair	Repair three outfalls in the Stephens Creek sub-watershed	SW 2nd and Taylors Ferry; SW Custer and Canby	Design - Final	E10579	N.A.	ACT031 ACY349 (completed) ACY374, ACY378
Willamette River	Green Street	Two green streets to manage 24,150 sf of NW Front built by a private developer to meet development requirements.	NW Front Ave & NW 16th Ave	Construction - Complete	EP209	0.6	OF13
Willamette River	Green Street	One green street to treat roadway runoff prior to discharge in the headwaters of channel in Riverview Natural Area.	SW Palatine Hill @ Corbett Lane	On Indefinite Hold	E10634	1.3	ADD991

Section 12
Natural Systems (NS-1)

BMP Summary

Protect and enhance natural areas and vegetation that help prevent pollutants from entering into the Municipal Separate Storm Sewer System (MS4).

Measurable Goals

- Plant 20,000 trees and initiate revegetation work on 70 acres by the end of the permit cycle.
- Acquire 50 acres of land by the end of the permit cycle.
- Update the Portland Plan (an update to the City's Comprehensive Plan) by December 2013.

12.1 Land Acquisition and Protection

The City pursues opportunities for land acquisition to protect and restore watershed functions such as stormwater filtration, groundwater recharge, storage and retention of flood waters, sediment delivery, and nutrient recharge. Programs in place to acquire land include the Johnson Creek Willing Seller Program, the Grey to Green Land Acquisition Program, and other acquisition and management efforts in conjunction with Portland Parks & Recreation (PP&R) and BES. Table 12.1 lists land acquisition by watershed.

Table 12.1: Land Acquisition and Protection

Watershed	Acquisition Area (acres)
Johnson Creek	8.0
Fanno Creek	0.5
Tryon Creek	4.9
Total	**13.4**

12.2 Land Use Planning and Zoning Tools

The City develops and maintains various planning documents, codes, and ordinances related to the protection of natural resources. Comprehensive guidelines related to natural resource conservation and protection are addressed in the recently adopted 2035 Comprehensive Plan and the Central City 2035 Plan, which sets a 20-year vision for the central City that includes a range of policies related to climate change resilience, sustainable development, and management of the Willamette River and its adjacent uses. Both plans reflect significant public input and a future vision of planning and policies.

The City also implements and enforces tree and zoning codes (e.g., Title 11, Trees) and overlay zones (e.g., environmental protection and environmental conservation overlay zones), which further protect high-value natural resources and limit natural resource area disturbances.

Developers are required to adhere to setbacks from stream, wetlands, and overlay zones and limit tree removal in conjunction with development.

The City continued planning processes that include goals and policies focusing on watershed health and environmental quality. Work in FY 2017-18 included the following:

- Continued work on the Central City 2035 Plan, which sets a 20-year vision for the Central City and is a culmination of over 5 years of planning and public involvement. The plan includes a range of policies related to the climate change resilience, sustainable development, and management of the Willamette River and its adjacent uses. Among the strategies included in the plan are establishment of a new Willamette River overlay zone (to replace Greenway regulations in the central City), an ecoroof requirement in the central City, an expanded river setback requirement (from 25 feet to 50 feet), new bird-safe building guidelines and tree canopy targets, and others.

- Launched an update to the City's Willamette Greenway Plan focused on the South Reach of the Willamette River. The River Plan/South Reach Plan will update existing policies and codes for the area, establish a new urban design framework, include natural resources and scenic resources protection plans, and identify future strategies, actions and potential investments for improving and increasing habitat. Building on the Central Reach changes in the Central City 2035 Plan, the River Plan/South Reach Plan will apply the new Willamette River overlay zones to properties within the Willamette Greenway.

- Initiated a project to modify the existing environmental overlay zones to match the findings of the new Natural Resources Inventory (NRI), adopted as a part of the 2035 Comprehensive Plan. The existing environmental overlay zones, which have been applied over the past 30 years, do not always match the newly mapped resources in the NRI. This project will "true up" the environmental overlay zones to ensure the city's streams, wetlands, flood areas, steep slopes, forests, and wildlife habitat are protected moving forward. This effort is part of bringing the zoning code into compliance with the new 2035 Comprehensive Plan.

- Continued evaluation of existing policies and development regulations in the floodplain in preparation for potential changes in the Federal Emergency Management Agency National Flood Insurance Program (NFIP) criteria resulting from the National Marine Fisheries Service Biological Opinion on the NFIP in Oregon. Initiated preliminary due diligence on establishing citywide mitigation banks to address multiple environmental impacts from private development including water quality.

- Continued implementation of Title 11 (Trees), which includes tree preservation and planting requirements on development sites and standardization of the City's tree removal permit system. These regulations help to preserve, expand, regenerate, and improve the quality of Portland's tree canopy. Expanding tree canopy will improve stormwater management throughout the City.

- The City of Portland became the first Salmon-Safe city in the country in October 2016. Certification was received for five bureaus that own or manage property, programs, and activities that could positively impact salmon. To support certification, Salmon-Safe Science Team assessments were conducted on each bureau's relevant facilities, operations, and

activities. Implementation of actions to reduce impacts on salmon are ongoing throughout the bureaus.

- BES is finalizing a two-year Ecosystem Diagnosis and Treatment assessment of all restoration projects since 2000 in the City's salmon-bearing streams. Efforts included assessing water quality improvements, and is evaluating potential benefits near term future projects, including stormwater. Results of the assessment identified high-priority reaches for protection and restoration in Johnson Creek, Tryon Creek, and the Columbia Slough. In addition, the analysis evaluated the local impacts of climate change, primarily temperature, on streams and its effect on wild salmon populations.

12.2.1 Climate Change Planning

In 2015, Portland City Council adopted the 2015 Climate Action Plan, Portland's updated climate plan focused on reducing local carbon emissions and building resilience to the projected impacts of climate change. The Climate Action Plan provides a roadmap for the community to achieve an 80 percent reduction in carbon emissions by 2050, with an interim goal of a 40 percent reduction by 2030.

The City implements actions outlined in the Climate Change Preparation Strategy (adopted in 2014). The Strategy recognizes the critical role of the urban forest and natural systems in making the City more resilient to potential climate-related changes in summer air and water temperatures, urban heat islands, storm intensity and flooding patterns, and frequency of landslides and wildfires.

Work in FY 2017-18 included the following:

- BES continued development of a resiliency master plan for wastewater and stormwater infrastructure to better prepare City infrastructure for climate change impacts. Efforts included performing a stress-test analysis pilot study, which included precipitation analyses and system capacity modeling for a selected pilot basin to evaluate impacts and assess the sensitivity of those impacts to potential changes in design storms under potential future scenarios (increased volume of precipitation and increased rainfall intensity).

- In partnership with the National Science Foundation (Urban Resilience to Extremes Sustainability Research Network), Portland was one of 10 cities selected for a grant to evaluate and respond to potential climate change impacts. As part of that project, Portland will be doing a scenarios workshop with community members in 2019 to create a vision for a more resilient Portland in the face of extreme events, including flooding and landslides, exacerbated by climate change.

- BPS completed a collaborative project with Portland State University to evaluate potential flooding along the Willamette River under different climate change scenarios. Research efforts included how climate change might shift the duration and frequency of storm types that historically have caused challenges for the stormwater management system.

- The City participated in a flood risk analysis by the U.S. Army Corps of Engineers and U.S. Geological Survey for the Columbia, Willamette, and Columbia Slough under the Levee Ready Oregon Solutions project.

- The City's infrastructure bureaus (BES, Water, Portland Bureau of Transportation, and PP&R) came together for 2 full days of workshops to identify risks, vulnerabilities, and interdependencies of the City's infrastructure systems to extreme natural hazard events. Called RIPE (Resilient Infrastructure Planning Exercise), the workshops resulted in a summary report of findings, as well as the beginnings of a cross-departmental work plan to advance resiliency and recovery planning work going forward.
- The PP&R Urban Forestry department is focusing efforts towards increasing tree canopy in areas of elevated urban heat island effects as well as neighborhoods with low-income residents and under-represented communities, including communities of color. Increased tree canopy will help alleviate some potential impacts of climate change.
- The City is conducting ongoing work with Portland State University to further understand the implications of green infrastructure on temperature.

12.3 Watershed Revegetation Program

The Watershed Revegetation Program, along with public agencies, businesses, and landowners, participates in and helps fund revegetation projects on properties (see Table 12.2). The program works to improve water quality and native habitats by removing non-native invasive plants, reintroducing native vegetation, creating habitats, and reducing erosion and pollutant transport.

Table 12.2: Watershed Revegetation Program Activities*

Watershed	Trees Planted		Shrubs Planted	Streambank (linear ft)	Acreage
	Deciduous	Coniferous			
Willamette River	572	12,500	11,775	2,895	1.2
Columbia Slough	3,730	125	10,100	13,190	0.0
Johnson Creek	740	425	5,720	2,280	43.6
Tryon Creek	250	650	4,200	1,694	1.8
Fanno Creek	290	50	950	2,252	1.0
Total	**5,582**	**13,750**	**32,745**	**22,311**	**47.6**

** Data represent only the current permit year's plant installations and new streambank and acreage additions to the Revegetation Program. Data in Table 12.2 do not represent the cumulative work of the program.*

12.4 Partnership Stream and Natural Area Restoration Activities

Through partnerships with non-profits, community groups, and schools, the City actively enhances natural areas using volunteer support. Activities include invasive plant species removal, native plant installation, and community education. A number of these partnership planting and restoration activities (Table 12.3) are consistent with the volunteer outreach reported under PI-1.

Table 12.3: Partnership Restoration Activities

Program/Watershed	Events (#)	Streambank Restored (linear ft)	Trees Planted (#)	Other/Natives Planted (#)	Acres (#)	
					Invasives Removed	Restored
SW Watershed Resource Center Partnership	39	NR	NR	343	0.17	0.17
Johnson Creek Watershed Restoration Event	58	2,100	630	9,445	5.00	20.60
Community Watershed Stewardship Program and Native Mini Grants	55	NR	515	4,405	4.40	5.04
Total	**152**	**2,100**	**1,145**	**14,193**	**9.57**	**25.81**

Results presented should be considered estimates only, due to varying tracking methods between program coordinators.
NR = Not reported or tracked.

12.5 Partnership Upland Tree-Planting Activities

Through partnerships with non-profits, community members, businesses, and schools, the City actively enhances watershed health by planting trees in the upland, built environment using community engagement and volunteer support. Table 12.4 displays the number of trees planted through these partnerships. These upland trees expand the urban forest canopy, managing stormwater locally while improving habitat connectivity in the urban matrix between natural areas.

Table 12.4: Partnership Upland Tree-Planting Activities

Program	Trees Planted (#)
Friends of Trees Partnership	2,743
Treebate Program Incentives	50
Community Partner Planting with Contractors	620
Total	**3,413**

12.6 PP&R Natural Area Activities

The Natural Areas Stewardship program in PP&R works with volunteers to help restore our natural areas to encourage native species regeneration, provide habitat to wildlife and insects, and provide safe trails to park visitors. PP&R does this through various volunteer projects such as invasive species removal, native planting and plant maintenance, fence building, and trail work. PP&R hosts monthly volunteer events in our natural areas throughout Portland.

PP&R's new Ecologically Sustainable Landscapes Program supports a multi-benefit approach to healthy urban nature. Nature Patch projects implemented through this program retrofit developed parks with natural landscapes to restore ecosystem services in the urban core. These spaces foster habitat, increase native plant diversity, enhance ecological value, capture stormwater and reduce irrigation, as well as provide environmental education and stewardship opportunities to the public.

Table 12.5 provides a summary of the planting activities that PP&R implemented in both natural area parks and developed parks.

Table 12.5: Portland Parks & Recreation Planting Activities

Number of Plantings	Natural Area Parks	Urban/Developed Parks
Native	47,511 trees/shrubs/other	12,243 trees/shrubs/other
Non-Native	None reported	7,270 trees/shrubs/other
Total	**47,511**	**19,513**

12.7 Invasive Plant Species Removal

BES and PP&R implement programs to target and remove invasive species to restore hydrologic and ecological functions to riparian and upland areas. Portland's Early Detection/Rapid Response Program focuses on controlling invasive plant infestations while their distribution is limited and patches are small. This approach increases the possibility of eradication and is much less expensive than trying to control well-established invasive species. PP&R addresses removal of invasive plants in natural areas through their Land Stewardship Division with annual work plans that specify locations and areas for treatment.

Table 12.6: Invasive Plant Species Removal

Program	Area Treated (acres)
Early Detection/Rapid Response (BES)	180
Land Stewardship – Natural Areas(Parks)	786
Total	**966**

Section 13
Program Management (PM-1)

BMP Summary

Conduct program management, coordination, and reporting activities.

Measurable Goals

- Submit annual reports by November 1 of each year.

The City's MS4 Program Manager is responsible for overall project management, compliance reporting, policy development, and coordination within the City of Portland, as well as for co-permittee coordination. BES section managers and staff members serve as leads for the BMPs contained in the Stormwater Management Plan (SWMP). Because the permit is citywide, many City staff members outside BES are also involved with stormwater program development, implementation, and reporting.

13.1 Measurable Goals

As defined in the MS4 permit, measurable goals are BMP objectives or targets used to identify progress of SWMP implementation. Table 13.1 provides the status of meeting the City's measurable goals for the 2017-18 fiscal year.

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Table 13.1: MS4 Program Measurable Goals Evaluation & Summary

BMP	Measurable Goal	Description	Permit Year Status
PI-1	Provide outreach to approximately 15,500 K-12 students annually (classroom programs, education field programs).	Provided or supported outreach to approximately 22,591 students.	✓
	Award at least $50,000 in community stewardship grants annually.	Awarded 11 stewardship grants totaling $89,857.	✓
	Involve approximately 10,000 participants in community events, workshops, stewardship projects, and restoration events annually.	Involved approximately 16,183 participants in 357 events citywide.	✓
	By May 2011, develop and distribute a public education bill insert to over 200,000 water and sewer customers.	Completed as reported in FY 2010-11. In FY 2017-18, the City distributed four separate inserts in quarterly water/sewer bills to more than 190,000 ratepayer properties.	N.A.
OM-1	Develop a training handbook for PBOT-MO staff during the permit term.	Completed the PBOT Maintenance Environmental Handbook in 2011. It includes guidance for maintenance procedures, preferred seasonality of work and materials management.	N.A.
	Provide the following maintenance actions over the 5-year permit cycle: • Clean 31,000 lineal feet of culverts. • Repair 10,000 lineal feet of culverts. • Clean 250,000 lineal feet of ditches. • Clean 38,000 inlets and catch basins. • Repair 1,500 inlets and inlet leads. • Clean 135 major stormwater management facilities/pollution reduction facilities. • Repair 40 pollution reduction facilities.	Maintenance actions completed for FY 2017-18: • Cleaned 827 lineal feet of culverts. Total to date over permit term: 141,853 feet. • Repaired 177 lineal feet of culverts. Total to date over permit term: 10,970 feet. • Cleaned 46,939 lineal feet of ditches. Total to date over permit term: 398,200 feet. • Cleaned 10,942 inlets and catch basins. Total to date over permit term: 98,366 assets. • Repaired 275 inlets and inlet leads. Total to date over permit term: 1,932 assets. • Cleaned 119 major stormwater management facilities/pollution reduction facilities. Total to date over permit term: 909 facilities. • Repaired 6 pollution reduction facilities. Total to date over permit term: 69 facilities.	✓
OM-2	Sweep arterials six times/year.	Swept arterials four to six times/year. The City strives to sweep larger arterial streets six times per year, but there are some circumstances that occasionally prevent crews from meeting that frequency, such as inclement weather, roadway conditions and urgent street-cleaning issues that divert resources to higher priority areas. The City also sweeps residential streets approximately once per year and sweeps higher trafficked areas, such as the downtown core, with a much higher frequency. The City also targets roadway areas with debris and trash build-up more frequently in the interest of water quality and bike safety. Given the City's level of effort on arterial and other roadways and the prioritization of areas that pose a greater threat to safety and water quality, this measurable goal is considered met and no adaptive management changes are needed.	✓
	Develop a training handbook for PBOT-MO staff during the permit term.	Completed the PBOT Maintenance Environmental Handbook in 2011. It includes guidance for maintenance procedures, preferred seasonality of work, and materials management.	N.A.
OM-3	Inspect and maintain, as necessary, all stormwater and stormwater containment and pollution prevention facilities in City maintenance yards annually.	Completed.	✓
IND-1	Inspect all permitted (1200Z, 1200COLS) facilities once per year.	Completed.	✓
	Review each permitted facility's monitoring and annual reports each year.	Completed.	✓
	Survey 100 percent of newly identified facilities to determine the need for NPDES permits.	Completed.	✓
	Every 5 years, inspect industries (individual sites) previously identified as having no exposure and not required to obtain a permit.	Completed.	✓
	Complete revision of City Code Title 17.39 by 2012.	Completed. City Council adopted code revisions in September 2011.	N.A.
IND-2	Under the Eco-Logical Business Program, certify 10 additional auto shops and 20 additional landscape firms that provide services within the City of Portland by 2015.	During fiscal year 2017-18, the City evaluated the effectiveness of the EcoBiz Program in meeting pollutant prevention goals. Results of this evaluation indicated that the EcoBiz program provides a positive community benefit. Subsequently, the City has resourced the program for the next fiscal year with the initial goals of re-certifying expired businesses and expanding the landscaping program. Documentation of measurable goal status was described in FY 2016-17.	N.A.
	Evaluate one new business sector for implementation of the Eco-Logical Business Program.	Completed. Expanded the program to the car washing sector as reported in FY 2010-11.	N.A.

BMP	Measurable Goal	Description	Permit Year Status
ILL-1	Conduct dry weather sampling at all major City-owned outfalls at least once annually.	Completed.	✓
	Inspect the priority outfalls a minimum of three times a year.	Completed.	✓
	Expand the IDDE (formerly IDEP) program to include the CSO system below diversion structures, where the outfalls discharge stormwater only and should have no dry-weather flows. Currently, the program addresses all westside outfalls and 25 percent of the eastside outfalls. Expand the program to all eastside outfalls by December 2013.	Completed as reported in FY 2013-14.	N.A.
	Maintain the spill response hotline 24 hours a day.	Completed.	✓
ND-1	Evaluate the *Erosion and Sediment Control Manual* and update as needed (at least once during the 2011-2016 permit cycle); conduct public involvement on updates.	Evaluated and determined that no update was necessary. Revisions to the manual are being considered for the next permit cycle.	N.A.
	Inspect public sites with erosion control permits daily during construction.	Completed.	✓
	Inspect 100 percent of active private development construction sites subject to erosion control requirements. At a minimum, inspections will occur (1) after initial temporary erosion control measures are installed, and (2) near completion of development after permanent erosion control measures are in place. Conduct interim checks as part of routine building permit inspections.	100 percent of requested erosion control inspections for active private development construction sites were performed. Sites were inspected for temporary and permanent erosion control measures at the beginning and near completion of the project(s). Interim checks were conducted during regular building inspections.	✓
ND-2	Inspect 1,500 private stormwater facilities or 450 properties annually. Use education and enforcement tools to ensure that stormwater management operations and maintenance plans are followed.	Under the Maintenance Inspection Program (MIP), inspected 1,305 private stormwater facilities associated with 759 properties. Provided technical assistance, education and enforcement to ensure facilities are sufficiently operated and maintained.	✓
	Revise the SWMM during the 2011-2016 permit term.	Revision and adoption of the updated SWMM occurred in both 2014 and again in 2016.	N.A.
	Track number, type, size, drainage area, and location of private facilities constructed annually.	This information is tracked for all private stormwater management facilities subject to the SWMM under an O&M agreement.	✓
STR-1	Construct the following public facilities to provide treatment for stormwater runoff from approximately 336 acres: • Construct the NE 148th Avenue stormwater management facility by FY 14/15. • Construct stormwater management facilities in the NE 122nd Ave subbasin by December 2012 (Columbia Slough Watershed). • Convert 5,000 linear feet of roadside ditches to swales or porous shoulder (Tryon Creek and Fanno Creek watersheds) during the permit term. • Construct stormwater management facilities along SW Beaverton-Hillsdale Highway and SW Barber Blvd. and in commercial and multi-family residential areas (Tryon Creek and Fanno Creek watersheds) during the permit term.	Completed as reported in FY 2015-16.	N.A.
	Track the number, type, drainage area, and location of public facilities constructed annually.	Completed.	✓
NS-1	Plant 20,000 trees and initiate revegetation work on 70 acres by the end of the permit cycle.	During fiscal year 2017-18, the City planted 19,332 trees (5,582 deciduous and 13,750 coniferous) on 47.6 acres. Total to date during this extended permit term: Planted 220,742 trees (157,342 deciduous and 63,400 coniferous) on 1,285.1 acres.	N.A.
	Acquire 50 acres of land by the end of the permit cycle.	Acquired 13.4 acres of land this permit year. The total amount of land acquired to date during this extended permit term is 653.1 acres.	N.A.
	Update the Portland Plan (an update to the City's Comprehensive Plan) by December 2013.	Completed. City Council adopted the Portland Plan on April 25, 2012.	N.A.
PM-1	Submit annual reports by November 1 of each year.	Submitted the FY 2016-17 report on October 31, 2017. Anticipate submittal of FY 2017-18 report on or by November 1, 2018.	✓

Part II
PORT OF PORTLAND

PORT OF PORTLAND

National Pollutant Discharge Elimination System (NPDES)
Municipal Separate Storm Sewer System Permit
Permit Number 101314

ANNUAL REPORT NO. TWENTY-THREE

July 1, 2017 – June 30, 2018

Prepared for:
Oregon Department of Environmental Quality

November 1, 2018

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ACRONYMS

BMP – Best Management Practice
DEQ – Department of Environmental Quality
EMS – Environmental Management System
FOG – Fats, Oil, and Grease
HAZWOPER – Hazardous Waste Operations and Emergency Response
IDDE – Illicit Discharge Detection and Elimination
IGA – Intergovernmental Agreement
IPM – Integrated Pest Management
MEP – Maximum Extent Practicable
MFM – Marine Facilities Maintenance (Marine's general maintenance group)
MS4 – Municipal Separate Storm Sewer System
NOAA – National Oceanic and Atmospheric Administration
NPDES – National Pollutant Discharge Elimination System
PDX – Portland International Airport
PIC – Portland International Center
SPCC – Spill Prevention Control and Countermeasure
SWMP – Stormwater Management Plan
SWPCP – Stormwater Pollution Control Plan
TMDL – Total Maximum Daily Load
USB – Urban Services Boundary
USCG – United States Coast Guard

1.0 INTRODUCTION

The Oregon Department of Environmental Quality (DEQ) regulates stormwater runoff from Port of Portland (Port) property through the Municipal Separate Storm Sewer System Discharge Permit No. 101314 (MS4 permit) and other National Pollutant Discharge Elimination System (NPDES) stormwater permits, including the 1200-Z, 1200-CA and Individual permits. This annual report describes activities specifically related to implementation of the Port's MS4 permit.

The Port and City of Portland are co-permittees on MS4 permit #101314. As required under Schedule B.5 of the permit, each co-permittee must submit an annual report. This report documents activity from July 1, 2017 to June 30, 2018 related to the Port's stormwater management efforts under the permit and associated December 28, 2012 Stormwater Management Plan (SWMP). The report emphasizes efforts and activities associated with individual best management practices (BMPs) from the Port's SWMP (as summarized in Section 7.0). Schedule B.5.a-i of the permit states the specific annual reporting requirements. These requirements are addressed within the report as follows:

1. **Status of SWMP implementation:** Section 7.1.1 through 7.1.8
2. **Status of the public education evaluation:** Section 7.1.4
3. **Summary of the adaptive management process:** Section 8
4. **Proposed changes to the SWMP:** Section 8
5. **Summary of stormwater program expenditures:** Section 4.0
6. **Summary of monitoring results:** *See Section IV Monitoring Compliance Report of the combined report. Section 6.1 of this document explains the Port's monitoring coordination with the City.
7. **Proposed changes to the monitoring plan:** *See Section IV Monitoring Compliance Report of the combined report. Section 6.1 of this report explains the Port's monitoring coordination with the City.
8. **Summary describing Port's Illicit Discharge Program:** Section 7.1.1
9. **Overview of planning, land use changes, and new development:** Section 2.1

2.0 PORT OF PORTLAND PERMIT AREA AND RESPONSIBILITIES

The Port of Portland owns approximately 5,487 acres within the City of Portland (City) Urban Services Boundary (USB). Port property is divided into three primary Business Lines under the Operations Division: 1) Aviation, 2) Marine, and 3) Industrial Development. Within the City USB, the Aviation Business Line consists of Portland International Airport (PDX), the Marine Business Line includes Marine Terminals 2, 4, 5 and 6, and the Industrial Development Business Line consists of the following industrial parks: Swan Island, Mocks Landing, Rivergate, Cascade Station, and Portland International Center (PIC). Figure 1 below shows the Port's permit area, breaking out leased property and facilities with Industrial Stormwater General Permits.

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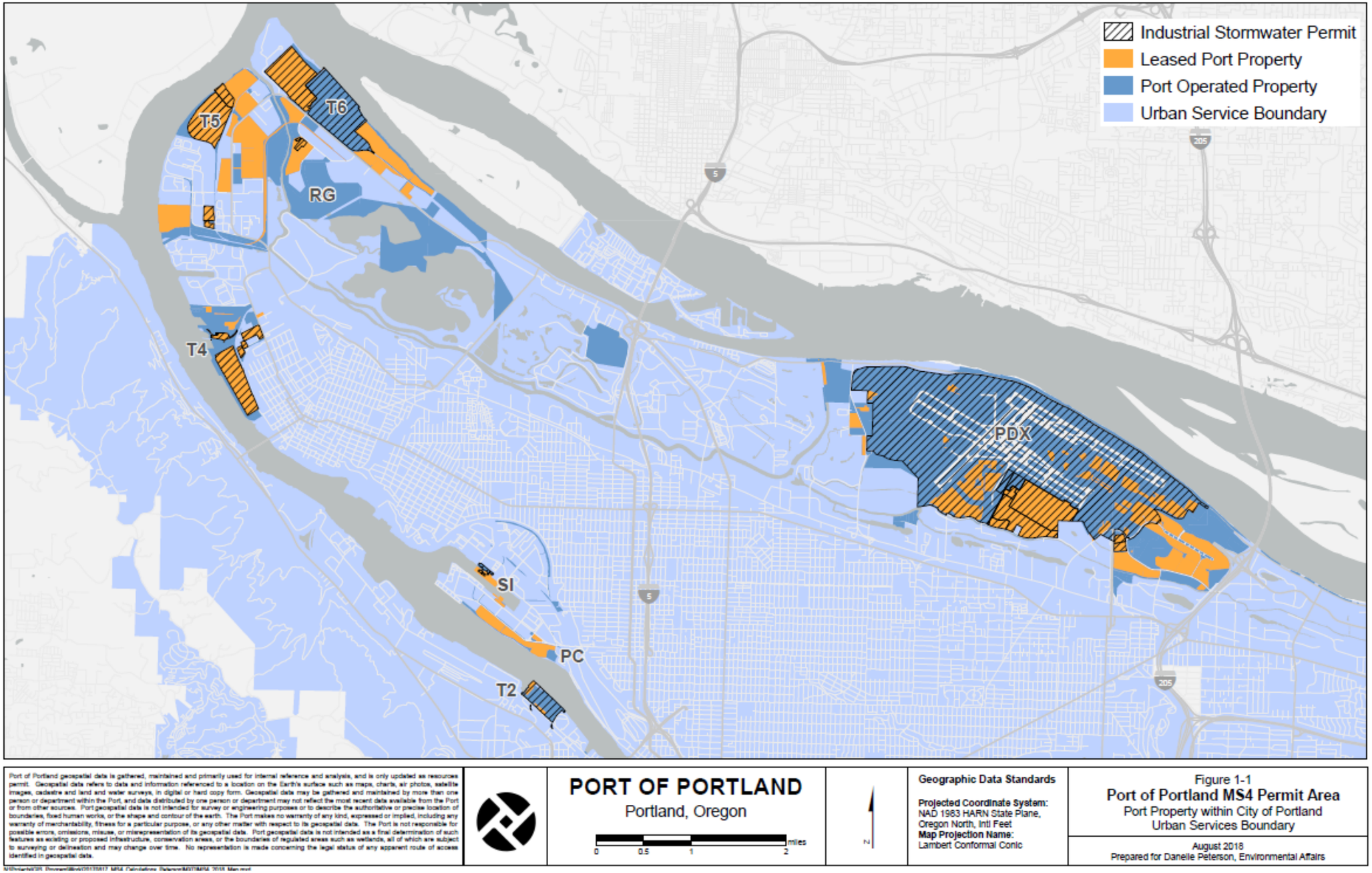
Figure 1 Port of Portland MS4 Permit Boundary Area



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The Port also owns several undeveloped properties within the USB including wetland mitigation sites, natural areas, and vacant tax lots. The Port is in a unique situation with regard to the typical municipal planning, permitting, and land use modification processes. The City of Portland is responsible for these activities and the Port complies with its process. For the purposes of this report, all reporting on these activities contained in section B.5.i will be satisfied in the City's section. With respect to the impervious surface reporting requirement in B.5.i the Port estimates during the 2017-18 reporting period it had 2337 acres of impervious surface. This represents 43% of total Port property within the City of Portland USB.

PDX, the marine terminals, and the industrial parks are partially occupied by tenants. The Port manages those tenant properties through lease agreements. Leased property represents approximately 30% of Port property within the USB. A more detailed description of Port operating areas is included in Section 2.1.

Property owned by the Port is primarily zoned for commercial and industrial use. Many of these areas accommodate industrial activities that require DEQ-issued NPDES industrial stormwater general permits or individual permits addressing stormwater discharge. Within the USB, 59% of the Port's holdings are regulated under these permits. PDX and portions of Terminal 2, Terminal 6 and the Navigation Base at Swan Island are operated by the Port under DEQ-issued industrial stormwater discharge permits. In addition, some tenants occupying leased property on Terminals 2, 4, 5, 6, and the industrial parks also operate under NPDES stormwater permits. For Port operations within these areas, several of the MS4 permit requirements are satisfied through implementation of industrial stormwater permit requirements, addressed in their Stormwater Pollution Control Plans (SWPCPs). Section 2.2 addresses how these activities are coordinated with the Port's MS4 permit responsibilities.

2.1 MS4 Permit Area

2.1.1 Portland International Airport

PDX comprises an area of approximately 2,803 acres and is in Northeast Portland between the Columbia River and the Columbia Slough. The facility is owned and operated by the Port. However, numerous aviation-related tenants also conduct operations at PDX.

Stormwater runoff from PDX property discharges into the Columbia Slough through a series of pipes, open channels, and 9 major outfalls. These stormwater discharges are permitted under the PDX NPDES Individual permit issued and administered by DEQ. The stormwater permit is structured to specifically address Columbia Slough Total Maximum Daily Load (TMDL) parameters, including dissolved oxygen, pH, nutrients, bacteria, and toxics. Currently, the Oregon Air National Guard and Yoshida Foods international have their own 1200-Z permits. PDX tenants whose operations trigger the need for a stormwater permit and have comingled stormwater with other PDX airfield tenants are required to be a co-permittee under the PDX stormwater permit.

In addition to the 1200-COLS permit, PDX also holds an NPDES a 1200-CA Construction Discharge Permit, a Water Pollution Control Facility (WPCF) 1700-B Wastewater Permit, a

NPDES Anti-icing/Deicing Waste Discharge Permit, and a pre-treatment permit issued by the City of Portland for deicing discharges to the sanitary system.

The Port is currently in the process of obtaining an individual permit for deicing and industrial stormwater discharges.

2.1.2 Marine Terminals

The Port has four active shipping terminals that are managed by the Port's Marine Business Line. The terminals collectively occupy approximately 1009 acres along the Willamette River (Terminals 2, 4, and 5) and Columbia River/Slough (Terminal 6). They handle the shipping, receiving, and temporary storage of finished goods, agricultural products, and raw materials.

Terminal 6 discharges into the Columbia River and the Columbia Slough are covered by 1200-Z permits held by the Port and tenants. In the spring of 2017 the Port took over management of an area at Terminal 6 that was formally managed by ICTSI. The Port obtained a 1200-Z permit for that portion of T6 in August of 2017. The Port continues to hold a 1200-Z permit for the Port-managed area of Terminal 2. Several properties located at Terminals 2, 4, and 5 are also leased to tenants. Several of these tenants hold 1200-Z or individual permits that are issued by DEQ and administered by the City.

2.1.3 Industrial Parks

The Port's Industrial Development Business Line manages the Port-owned industrial parks, Swan Island, Rivergate, Cascade Station, and Portland International Center (PIC), totaling approximately 1,470 acres. Several industrial park tenants hold the 1200-Z permits issued by DEQ and administered by the City.

2.1.4 Undeveloped Properties

The Industrial Development Business Line also manages approximately 1,474 acres of undeveloped property within the City's USB. This does not include West Hayden Island, which is within the unincorporated USB and does not receive city services. Stormwater management activities for undeveloped properties discharging into the Port's MS4 are conducted under the MS4 permit.

2.2 MS4 Permit Responsibilities

Many of the requirements of the industrial stormwater general discharge permits overlap with requirements of the MS4 permit. A large proportion (59%) of the area included in the Port's MS4 permit area is also regulated under industrial stormwater permits, which have been issued to either the Port or its tenants.

The City of Portland and Port are co-permittees on MS4 Permit #101314. The City regulates stormwater on a city-wide basis with some implementation overlapping the Port's MS4 area. The Port and City coordinate permit management activities through an intergovernmental agreement (IGA).

Table 1 (Permit Requirements and Responsibilities) was developed to explain the complex relationship between the Port's management of stormwater through its MS4 permit, the City's overlapping stormwater management activities through its MS4 permit, and DEQ's regulation of industrial stormwater on some Port property through other NPDES permits. This tool was included in the Port's 2012 SWMP to show specific program coverage for each MS4 permit requirement. Table 1 lists the SWMP requirements from the Port's MS4 permit along the left-hand column. Responsibility descriptions for each SWMP requirement are split according to the following two categories: (1) Port MS4 permit areas that do not have industrial stormwater permits (1200-Z or individual permits), and (2) Port MS4 permit areas where the Port or its tenant has a general industrial stormwater permit (1200-Z or individual permits). The two responsibility categories are further split between tenants and Port operations. For some tenants and Port operating areas (Terminal 2, Terminal 6, Port Navigation Base and PDX) with an industrial stormwater permit, several of the MS4 permit requirements related to specific activities are addressed through implementation of the industrial stormwater permits. These requirements are shown shaded in gray on Table 1. In addition, permit requirements within the Port's jurisdiction covered by the City's stormwater management activities are also shaded in gray on Table 1. Areas left unshaded on Table 1 are addressed by BMPs in the Port's 2012 SWMP. These unshaded areas list the specific BMPs that meet each corresponding permit requirement.

Section 7.0 of this annual report outlines the BMPs listed in the Port's 2012 SWMP and specifies responsible parties for each BMP implementation task. In addition, Section 7.0 describes the Port's SWMP implementation during the permit year to address tracking measures and progress toward meeting measurable goals under each BMP.

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Port of Portland MS4 Permit Requirements and Responsibilities (Areas shaded in gray are MS4 permit requirements that are not addressed by BMPs in the Port's SWMP because the requirements are either covered by the City of Portland, or are covered under an industrial stormwater permit. Unshaded Areas are covered by the Port's SWMP BMPs listed below in Table 1.)

Table 1. Port of Portland MS4 Permit Requirements and Responsibilities

MS4 Permit SWMP Requirements	MS4 Service Areas Not Covered Under Industrial Stormwater Permits		MS4 Service Areas With Industrial Stormwater Permits	
	Tenants	Port Operations	Tenants	Port Operations
Schedule A.4.a Illicit Discharge Detection and Elimination.				
i. Prohibit, through ordinance or other regulatory mechanism, illicit discharges	BMP: Implement the Illicit Discharge Detection and Elimination Program			
ii. Describe enforcement response procedures	BMP: Implement the Illicit Discharge Detection and Elimination Program			
iii. Develop pollutant parameter action levels	BMP: Conduct Dry-Weather Field Screening			
iv. Conduct annual dry weather inspection activities including field screening	BMP: Conduct Dry-Weather Field Screening			
v. Identify response procedures to investigate portions of the MS4 where relevant information indicates the likely presence of illicit discharges	BMP: Conduct Dry-Weather Field Screening			
vi. Maintain a system for documenting and procedures for responding to illicit discharges	BMP: Conduct Dry-Weather Field Screening			
vii. Appropriate action for illicit discharge removal	BMP: Implement the Illicit Discharge Detection and Elimination Program		Spill response activities address employee reporting and are covered under 1200-Z and 1200-COLS permits[1] BMP: Implement the Illicit Discharge Detection and Elimination Program	
viii. Spill prevention and response	BMP: Implement a Spill Response Program for Port Operated Property		Covered under 1200-Z and 1200-COLS permits[2]	
ix. Notify affected municipality of illicit discharge originating within the permittee's permit area	BMP: Implement the Illicit Discharge Detection and Elimination Program			
x. Notify responsible municipality of illicit discharge affecting the permittee, originating outside of the permittee's permit area	BMP: Implement the Illicit Discharge Detection and Elimination Program			
xi. Maintain maps showing major MS4 outfalls	BMP: Conduct Dry-Weather Field Screening			
xii. Unless identified as a significant source of pollutants, the following non-stormwater discharges are not considered illicit discharges (see Schedule A.4.a.xii)	BMP: Implement a Water Line Flushing Procedure			
Schedule A.4.b Industrial and Commercial Facilities				
i. Screen existing and new industrial facilities	BMP: Screen Existing and New Industrial Facilities		These areas are already covered by an industrial stormwater NPDES permit	
ii. Notify DEQ and facility if subject to an industrial NPDES permit	BMP: Screen Existing and New Industrial Facilities		These areas are already covered by an industrial stormwater NPDES permit	
iii. Inspection of industrial or commercial areas identified as significant sources of pollutants	BMP: Implement an Inspection Program for Significant Pollutant Source Areas			
Schedule A.4.c Construction Site Runoff Control				
i. Ordinance that requires erosion and sediment controls	Implemented through the City of Portland's erosion control ordinance; may also be covered under a 1200-C permit	Implemented through the Port's 1200-CA Permit, the City of Portland's erosion control program and related contract specifications.	Implemented through the City of Portland's erosion control ordinance; may also be covered under a 1200-C permit	Implemented through the Port's 1200-CA Permit and related contract specifications
ii. Require construction site operators to develop site plans and implement erosion and sediment control BMPs				
iii. Require construction site operators to prevent/ control non-stormwater waste				
iv. Erosion control site plan review				
v. Perform on-site inspections				
vi. Maintain enforcement response procedures				

MS4 Permit SWMP Requirements	MS4 Service Areas Not Covered Under Industrial Stormwater Permits		MS4 Service Areas With Industrial Stormwater Permits	
	Tenants	**Port Operations**	**Tenants**	**Port Operations**
Schedule A.4.d Education and Outreach				
i. Implement a documented public education and outreach strategy	BMP: Implement Public Education Measures to Protect Stormwater Quality.			
ii. Provide educational material to the community or conduct equivalent outreach activities	BMP: Implement a Tenant Stormwater BMP Program	N/A	BMP: Implement a Tenant Stormwater BMP Program	N/A
	BMP: Implement Public Education Measures to Protect Stormwater Quality			
iii. Provide public education on pesticide, herbicide, fertilizer, and other chemicals	BMP: Require Training and Licensing for Staff Conducting Pest Management Activities BMP: Implement a Tenant Stormwater BMP Program			
iv. Provide public education on proper operation and maintenance of privately-owned/ operated stormwater quality facilities	BMP: Implement a Tenant Stormwater BMP Program BMP: Implement a Program for the Tracking and Maintenance of Private Structural Controls			
v. Provide notice to construction site operators regarding training for erosion and sediment control	BMP: Provide Erosion Prevention and Sediment Control Training for Construction Inspectors			
vi. Conduct/ participate in a public education effectiveness evaluation	BMP: Participate in a Public Education Effectiveness Evaluation			
vii. Include training for municipal employees involved in MS4 activities	BMP: Implement a Spill Response Training Program. BMP: Implement a Municipal Staff Training Program for Stormwater Pollution Prevention BMP: Require Training and Licensing for Staff Conducting Pest Management Activities		Covered under 1200-Z and 1200-COLS permits[3]	
viii. Promote, publicize, and facilitate public reporting of illicit discharges	BMP: Implement the Illicit Discharge Detection and Elimination Program			
Schedule A.4.e Public Involvement and Participation				
e. Implement a public participation process for receiving and considering comments on the SWMP and TMDL benchmarks	BMP: Provide for Public Participation with SWMP and Benchmark Submittals			
e. Implement a public participation approach that provides opportunities for the public to effectively participate in the implementation of the co-permittee's stormwater management program	BMP: Implement a Public Participation Approach that Provides Opportunities for the Public to Effectively Participate in the Implementation of the Stormwater Management Program			
Schedule A.4.f Post-Construction Site Runoff				
i. Implement a post-construction stormwater pollutant and runoff control program	BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards			
ii. Identify, and where practicable, minimize or eliminate ordinance, code and development standard barriers	BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards			
iii. Develop or reference an enforceable post-construction stormwater management manual	BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards			
vi. Review, approve, and verify proper implementation of post-construction site plans	BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards			
v. Require off-site stormwater management for locations limited in their ability for on-site stormwater capture and treatment or flow reduction	BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards			
vi. Describe inspection and enforcement response procedures to address compliance issues with post-construction stormwater management performance standards	BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards			

MS4 Permit SWMP Requirements	MS4 Service Areas Not Covered Under Industrial Stormwater Permits		MS4 Service Areas With Industrial Stormwater Permits	
	Tenants	**Port Operations**	**Tenants**	**Port Operations**
Schedule A.4.g Pollution Prevention for Municipal Operations				
i. Operate and maintain public streets, roads, and highways	The City of Portland is responsible for operation and maintenance of the public right-of-way			
	BMP: Implement a Street and Vehicle Maneuvering Area Cleaning and Maintenance Program			
ii. Implement a program to control the use and application of pesticides	BMP: Limit Landscape Maintenance Activities Impact on Stormwater BMP: Require Appropriate Training and Licensing for Pest Management Activities BMP: Implement a Tenant Stormwater BMP Program			
iii. Inventory, assess, and implement a strategy to reduce the impact of stormwater runoff from facilities that treat, store, or transport municipal waste, not already covered by a 1200 series permit	No tenant properties currently accommodate municipal facility waste	The Port does not operate any facilities that fall under this requirement and are not covered under a 1200 series permit.	N/A	N/A
iv. Implement controls to limit infiltration of seepage from the municipal sanitary system	BMP: Implement a Program to limit infiltration from Port-owned sanitary sewer system to the MS4			
v. Implement a strategy to prevent or control the pollutant discharge from firefighting training activities	The only firefighting training facility is located at PDX, which is covered by a 1200-COLS permit			
vi. Retrofitting flood control facilities	The City of Portland manages water quality improvements on a master planning level. Any potential flood control retrofits will be considered as part of the Retrofit Analysis			
Schedule A.4. h Structural Stormwater Controls Operations and Maintenance				
i. Implement a program to verify structural control facilities and controls are inventoried, mapped, inspected, operated and maintained Operate and maintain public streets, roads, and highways	BMP: Implement a Stormwater System Cleaning and Maintenance Program BMP: Implement a Program for Tracking and Maintenance of Private Structural Controls		Covered under 1200-Z and 1200-COLS permits[4]	Covered under 1200-Z and 1200-COLS permits[4]
ii. Develop and implement a plan or approach to guide the long-term maintenance and management of all publicly-owned and privately owned stormwater facilities	BMP: Implement a Stormwater System Cleaning and Maintenance Program BMP: Implement a Tenant Stormwater BMP Program.		Covered under 1200-Z and 1200-COLS permits[4]	Covered under 1200-Z and 1200-COLS permits[4]
Schedule A.6.c Stormwater Retrofit Project				
ii. Identify one stormwater quality improvement project, at a minimum, to be initiated constructed and/or implemented during the permit term	BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards			
Schedule B1-B4 Monitoring Component Requirements				
The Port must assist with monitoring efforts in conjunction with requirements as stated in Table B-1, Schedule B.1.b	Pursuant to an IGA, the Port of Portland and the City of Portland have a joint monitoring program conducted by the City to meet the requirements specified under Schedule B			

Table 1 Port MS4 Permit Requirements 1

Notes:

[1]The 1200-Z and the PDX Individual Permit cover this requirement in Schedule A under "Non-Stormwater Discharges."
[2]The 1200-Z and the PDX Individual Permit cover this requirement in Schedule A under "Spill Prevention and Response Procedure."
[3]The 1200-Z and the PDX Individual Permit cover this requirement in Schedule A under "Spill Prevention and Response Procedure" and "Employee Education."
[4]The 1200-Z and the PDX Individual Permit cover this requirement in Schedule A under "Preventative Maintenance", "Control Measures for Technology Based Effluent Limits" and "Required (SWPCP) Elements"

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3.0 PORT OF PORTLAND ORGANIZATIONAL STRUCTURE

The Port's Environmental Operations Department is responsible for administering the MS4 permit and the SWMP. The Water Quality Manager serves as the MS4 permit manager. Staff from Environmental Operations and each of the three business lines (Aviation, Marine, and Industrial Development) is responsible for implementing Port environmental programs to ensure permit compliance. As a means of coordinating Port-wide programs and policies, environmental program managers regularly meet with cross-functional teams that include Port operating area staff. One means of coordination between Port staff is through the Water Resources Program Team. This Water Resources Program team includes staff from Environmental Operations, Legal, Aviation, Marine, Industrial Development, Public Affairs, and Engineering. The team meets periodically and is responsible for providing input on Port-wide stormwater policy issues, water quality, and permit implementation. The Senior Water Resource Manager serves as the lead.

With respect to implementation of the Port's industrial stormwater discharge permits, Environmental Operations staff prepares, updates, and ensures implementation of the PDX SWPCP in coordination with the co-permittees as well as the SWPCP requirements for non-Port operators at Terminals 2 and 6. Tenants with industrial stormwater discharge permits are also required to prepare, maintain and implement SWPCPs. The City (DEQ's agent) coordinates directly with Port tenants holding these permits.

4.0 STORMWATER EXPENDITURES

The Port's state-mandated mission is to enhance the region's economy and quality of life by providing efficient cargo and air passenger access to global and national markets. In support of this mission, the Port annually undertakes budget and business planning to identify areas of focus and actions needed to address them.

The Port derives almost all revenue from business transactions with the users and tenants of Port facilities. A small proportion (approximately three to four percent) of the Port's overall revenue is from property tax. Business transactions generally occur between the Marine Business Line, the Aviation Business Line (Commercial Aviation and General Aviation), the Industrial Development Business Line, and associated users and tenants of those properties. Industrial Development Business Line revenue sources can also include sales of property. The Port also receives revenue from the U.S. Army Corps of Engineers for dredging services.

Commercial Aviation (PDX) resources are derived primarily from charges to airline passengers and air cargo customers, airport parking, rental car revenue, passenger facility charges, Federal grants, and tenant fees. PDX resources cannot be comingled with any other resources of the Port and are restricted for use at Aviation facilities by bond ordinances and Federal Aviation Administration (FAA) regulations.

The Port annually budgets resources to fund projects and programs identified in the Strategic and Business Line Plans. Program expenses are allocated among Business Lines and departments involved in implementation of the program. Specifically, stormwater resources are allocated across the following business lines, Information Technology (IT), Legal, Engineering, Marine and Industrial Development and Aviation. Stormwater program expenditures include the cost of

staff salary (including fringe costs), permit fees, contractor and consultant fees, stormwater infrastructure, City of Portland stormwater fees, disposal of collected material, sample analysis, stormwater training, and outreach materials.

The estimated stormwater program expenditures are broken out by area and in total for fiscal year 2017-18 and the estimates for 2018-2019 in Table 2. Marine and Industrial Development Business Lines are shown together.

Table 2. Summary of Port Stormwater Expenditures

Business Line	Estimated 2017-18 Stormwater Expenditures	Projected 2018-19 Stormwater Expenditures
Marine, and Industrial Development	$1,248,401	$1,266,000
Aviation	$3,489,254	$3,490,000
Engineering	$5,967,343	$5,000,000
IT	$74,610	$74,610
Legal	$48,672	$50,000
Total	**$10,828,280**	**$9,390,610**

5.0 DEMONSTRATION OF CONTINUED LEGAL AUTHORITY TO IMPLEMENT THE PROGRAMS OUTLINED IN THE SWMP

The Port has authority to implement programs outlined in the SWMP through ordinance, permits, and contracts.

The Port has statutory authority to enact ordinances to regulate stormwater sewers that it owns, operates, maintains, or controls. The Port Commission adopted Ordinance No. 361 in 1992, which asserts the Port's regulatory authority over its stormwater system and discharges into that system. Section 3 prohibits any person from making, causing, or allowing an illicit discharge into a storm sewer owned or operated by the Port. Section 4 requires written permission from the Port to make a connection to a Port storm sewer. Section 5 authorizes the Port to inspect Port-owned property for violations of the Ordinance or applicable law that governs the conveyance or disposal of stormwater. In addition, the Ordinance provides the Port with authority to control the contribution of pollutants to storm sewers owned or operated by the Port; the quality of stormwater discharged from the sites of industrial activity on land owned by the Port; and the discharge to storm sewers owned or operated by the Port of pollutants from spills, dumping, or the disposal of materials other than stormwater.

In addition to the Ordinance, the Port has legal authority to control the contribution of pollutants to the municipal storm sewer through contracts with Port tenants. However, the Port has no contractual authority over stormwater runoff from private and public property that discharges stormwater into the Port's MS4 but is not owned by the Port. Lease and operating agreements require compliance with the Port's MS4 permit. Through these regulatory and contractual mechanisms, the Port works with tenants and users of Port facilities to implement BMPs that control the contribution of pollutants to Port storm sewers.

6.0 STORMWATER MONITORING

The Port's monitoring program consists of environmental and BMP monitoring elements. Activities within these groups are in place to meet Schedule B monitoring requirements, including the following MS4 monitoring objectives:

1. Evaluate the source(s) of the 2004/2006 303(d) listed pollutants applicable to the co-permittee's permit area;
2. Evaluate the effectiveness of BMPs to help determine BMP implementation priorities;
3. Characterize stormwater based on land use type, seasonality, geography, or other catchment characteristics;
4. Evaluate long-term trends in receiving water quality associated with storm water discharges;
5. Assess the chemical, biological, and physical effects of MS4 runoff on receiving waters;
6. Assess progress towards meeting TMDL pollutant load reduction benchmarks.

A description of each monitoring program element is provided below.

6.1 Environmental Monitoring

The Port satisfies the MS4 environmental monitoring requirements through an IGA with the City of Portland. The IGA specifies the terms and conditions regarding how the Port shares costs with the City for environmental monitoring efforts. The City's Quality Assurance Monitoring Plan (QAMP) consists of in-stream (event), in-stream (continuous), stormwater, pesticide, mercury, and macroinvertebrate monitoring elements. The plan can be downloaded at https://www.portlandoregon.gov/bes/article/387705. A discussion of this program and its operations during FY2018 is included in City of Portland's Monitoring Compliance Report (Section IV of the Annual Report).

6.2 Best Management Practice (BMP) Monitoring

The Port's BMP monitoring activities are described as tracking measures and measurable goals in the most recently approved SWMP, submitted to DEQ on December 28, 2012. These monitoring activities are specific indicator metrics that help document the completion of tasks and assess the relative effectiveness of BMPs. The implementation tasks, tracking measures, and measurable goals associated with each Port BMP are provided in Sections 7.1.1 through 7.1.8.

6.3 Additional Elements

The following additional elements listed in Schedule B.5.j were submitted to the City separately for November 1, 2014 deadline:

- The TMDL Pollutant Load Reduction Evaluation,
- The Wasteload Allocation Attainment Assessment,
- The 303(d) evaluation and
- Stormwater Retrofit Strategy.

6.4 Additional Stormwater Monitoring Activities

The Port collects and submits additional stormwater monitoring data to DEQ as required by the Port's various NPDES Stormwater permits. Data collected for these permits is not included in the MS4 permit annual report however this data is available upon request.

This monitoring provides data about stormwater discharges from Port industrial properties. Information resulting from these sampling events has been used to manage the stormwater programs at these facilities and may continue to be useful for understanding water quality impacts from different types of industrial sources.

The Port submitted stormwater monitoring data to DEQ for the following industrial stormwater discharge permits in FY2018

- NPDES 1200-COLS Industrial Stormwater Discharge Permits, DEQ File No. 107220 (PDX)
- NPDES 1200-Z Industrial Stormwater Discharge Permit, DEQ File No. 114024 (Terminal 2)
- NPDES 1200-Z Industrial Stormwater Discharge Permit, DEQ File No. 125313 (Terminal 6)
- NPDES 1200-Z Industrial Stormwater Discharge Permit, DEQ File No. 125569 (Navigation Base)
- NPDES Deicing Permit No. 101647

7.0 ACCOMPLISHMENTS FOR PERMIT YEAR TWENTY-THREE (2017-2018)

7.1 SWMP Implementation

The annual report content and format is based on the SWMP submitted to DEQ on December 28th, 2012. The SWMP is structured into eight major elements. These elements contain the necessary BMPs to address MS4 permit requirements included in Schedule A (4) (a-h). Reporting on tracking measures and progress towards associated measurable goals are shown in italics for each BMP below. Reporting regarding any task not addressed by the corresponding tracking measures or measurable goal response is addressed in italics directly under the task.

7.1.1 Element #1: Illicit Discharge Detection and Elimination

BMP: Implement the Illicit Discharge Detection and Elimination (IDDE) Program

Implementation Tasks:

1. Continue to implement documented illicit discharge detection and elimination procedures (Responsibility: Operations Environmental).
2. Update the illicit discharge detection and elimination procedures by November 1, 2011 per provisions consistent with the MS4 NPDES permit language (Responsibility: Environmental Affairs).
3. Implement a reporting program for potential illicit discharges by maintaining spill notification signs throughout Port property (Responsibility: Operations Environmental, Marine Properties Maintenance, Marine Facilities Maintenance (MFM), and PDX Maintenance).
   - ✓ *Operations staff continues to be trained on spill notification annually. Notification signage is maintained on both Marine and Aviation properties.*

Tracking Measures:

1. Track the status of updating the illicit discharge detection and elimination procedures.
   - ✓ *Previously completed (FY2011).*
2. Track the number, type, location, and resolution of any illicit discharge investigations conducted.
   - ✓ *Aviation did not have any reportable illicit discharge investigations in FY2018. (*See summary under BMP: Conduct Dry-Weather Field Screening tracking measures.)*
   - ✓ *Marine did not have any reportable illicit discharges investigations in FY2018. (*See summary under BMP: Conduct Dry-Weather Field Screening tracking measures.)*

Measurable Goals:

1. Update the illicit discharge detection and elimination procedures by November 1, 2011.
   - ✓ *Previously completed (FY2011)*

BMP: Conduct Dry-Weather Field Screening

Implementation Tasks:

1. Conduct annual dry-weather field screening activities at all priority outfall locations (Responsibility: Environmental Operations).
2. Annually, as necessary, update Port data files related to outfall locations, in accordance with dry-weather field screening activities (Responsibility: Environmental Operations).
3. Update the dry-weather field screening procedures by June 30, 2012 to be in accordance with MS4 permit requirements (Responsibility: Environmental Affairs).
   - ✓ *Previously completed (FY2012)*

Tracking Measures:

1. Track the number and location of priority outfalls inspected during dry-weather field screening activities.
   - ✓ *Aviation inspected 16 outfalls.*
   - ✓ *Marine inspected 52 outfalls.*
   - ✓ *The location of Port "Priority Outfalls" for dry-weather field screening is mapped in the Port's GIS system.*
2. Summarize dry-weather field screening inspection results and indicate outfalls requiring sampling or follow up activities.
   - ✓ *Aviation screening was conducted on 07/28/2017.*
     - ***Summary:*** *Thirteen outfalls were inspected. Outfalls for PDX basins, 3, and 7A, displayed visible flow. The outfalls with flow have been investigated in previous years and the source has been determined to be groundwater infiltration and/or landscape irrigation water (both allowable discharges). The flow was described as a trickle at the basin 3 outfall. as low at outfall 7A. Each outfall with flow has been previously sampled. Visual observations were similar to those in the past, and no other potential source of the flow could be identified to indicate an*

illicit discharge. PDX has an extremely high water table; studies performed for the Port have documented significant groundwater infiltration into the Port's stormwater system.

- ✓ *Marine screening was conducted on 08/29/2017 and 09/14/2017.*
  - ***Summary:*** *Fifty-Two Port outfalls were inspected. Visible discharge was observed at the Swan Island Daimler outfall ID Number SI-E The discharge was a trickle, clear, with no odor or sheen. The outfall drainage was investigated, and the source was determined to be irrigation runoff from the landscaped areas surrounding the Daimler main headquarters building.*

3. Indicate the outcome and resolution of inspection activities conducted.
   - ✓ ***Aviation:***
     - ***Outfall 3****: A trickle of flow was observed 07/28/2017. The flow did not have any distinguishing characteristics that would indicate it was illicit. Historically groundwater flows have been present during previous dry weather field inspections. Flow attributed to groundwater, no sources were observed during the drainage basin inspection. In the past, samples were collected and sent to the lab for analysis of ammonia, chlorine, conductivity and temperature and pH were measured in the field. Results indicated that the flow was most likely groundwater.*
     - ***Outfall 7A:*** *A low flow was observed 07/28/2017. The flow did not have any distinguishing characteristics that would indicate it was illicit. Historically groundwater flows have been present during previous dry weather field inspections. Flow attributed to groundwater, no sources were observed during the drainage basin inspection. In the past, samples were collected and sent to the lab for analysis of ammonia, chlorine, conductivity and temperature and pH were measured in the field. Results indicated that the flow was most likely groundwater.*

<u>Measurable Goals:</u>

1. Update dry-weather field screening procedures, in accordance with permit requirements by July 1, 2012.
   - ✓ *Previously completed (FY2011)*
2. Inspect priority outfalls annually.
   - ✓ *A total of 68 priority outfalls were inspected Port-wide as part of dry-weather field screening activities in 2017-2018.*

BMP: Implement a Spill Response Program for Port Operated Property

Implementation Tasks:

1. Implement the Port's spill response procedure and update as necessary (Responsibility: Environmental Operations).
2. Participate in the City's Spill Response Committee (Responsibility: Environmental Operations).
   - ✓ *Due to retirements at the City of Portland, the Regional Spill Committee has not maintained quarterly meetings in the 2017-2018 fiscal year. The Port will resume participation as soon as the group reconvenes. However, staff continues to participate in the Maritime Fire and Safety Association Oil Spill committee and is a member of Board. Staff participates in the Clean Rivers Cooperative annual drills and as well as with the EPA's Region 10 Regional Response Team.*
3. Ensure trained Port staff members are available for on-call spill response, in addition to ensuring current contracts with on-call spill response contractors (Responsibility: Environmental Operations).

Tracking Measures:

1. Track the number of spills of a reportable quantity in which a spill response was conducted.
   - ✓ *Two reportable spills were responded to at the Aviation facilities in FY 2017-2018.*
   - ✓ *Three reportable spills were responded to at the Marine facilities in FY 2017-2018.*

Measurable Goals:

1. Implement the Port's Spill response procedures.
   - ✓ *The Port continues to train appropriate employees to properly implement effective spill response procedures. Reportable quantity spill cleanup is conducted by on-call contractors trained and equipped to minimize discharges to the environment. Incidental spill response is performed by trained employees.*

BMP: Implement a Water Line Flushing Procedure

Implementation Tasks:

1. Implement a water line flushing procedures to ensure appropriate disposal of chlorinated water (Responsibility: PDX Maintenance, MFM).

Measurable Goals:

1. Implement waterline flushing consistent with guidelines described in the BMP description included in the December 28, 2012 SWMP.
   - ✓ *Marine and Aviation staff are aware of the requirements associated with this type of discharge and implement procedures to comply with the Port's work instruction ("Disposal of Chlorinated Water: Hydrant & Waterline Flushing") on the subject. This work instruction has been posted for operating area reference and is covered in stormwater pollution prevention training.*

7.1.2 Element #2: Industrial and Commercial Facilities

BMP: Screen Existing and New Industrial Facilities

Implementation Tasks:

1. Coordinate with the City of Portland over the permit term to develop a screening process for industrial facilities (Responsibility: Environmental Operations).

Tracking Measures:

1. Track leaseholds that have an individual or industrial stormwater permit.
   - ✓ *The Port maintains a list of tenants who hold individual and general Industrial Stormwater Permits. These include: Yoshida Foods International Limited Partnership, International Container Terminal Services, Inc., Kinder Morgan Bulk Terminal 4, Toyota Logistics Services, Inc. Auto Warehousing Company (for Hyundai), Swan Island Batch Discharge Plant (Rinker), the Oregon Air National Guard, Con Global Industries, Millbank Materials Northwest Cascade Honey Bucket and Solaicx.*

Measurable Goals:

1. Coordinate with the City of Portland on a process for screening industrial facilities over the permit term.
   - ✓ *The Port has an IGA with the City which states that the City will cover the screening of Port tenants regarding the need for an industrial permit.*

BMP: Implement an Inspection Program for Significant Pollutant Source Areas

Implementation Tasks:

1. Conduct inspections of Priority Facilities annually, or more frequently if needed (Responsibility: Environmental Operations).
2. If inspections identify conditions needing improvements, coordinate with tenant and Port property manager to ensure appropriate control measures to minimize pollutant loading from priority facilities (Responsibility: Environmental Operations).

Tracking Measures:

1. Track the number of facilities inspected annually.
   - ✓ *14 inspections of Aviation Priority Facilities were conducted.*
   - ✓ *9 inspections of Marine Priority Facilities were conducted.*
2. Track improvements made to Priority Facilities resulting from inspections.
   - ✓ *Inspection follow up letters are kept by Environmental Operations documenting any issues that require attention. The issues addressed included, maintaining spill and stormwater training documentation, updating Spill Prevention Control and Countermeasures plans, compliance with monthly inspection requirements, conducting required good housekeeping measures, documentation of catch basin cleaning, labeling hazardous material storage areas and proper storage of recycling dumpsters.*

Measurable Goals:

1. Conduct Annual Inspections at Priority Facilities.
   - ✓ *Complete for FY2018. (See Tracking Measures response above).*
2. Document the procedure and rationale for selection of "Priority Facilities" by 11/1/2011.
   - ✓ *Previously completed and reported (FY2011).*

7.1.3 Element #3: Construction Site Runoff Control

Construction projects on Port property comply with the MS4 permit's runoff control requirements through compliance with the NPDES 1200-CA Permit (for Port operations), NPDES 1200-C permits (for tenant projects and some Port projects) as required by DEQ, or the City of Portland's erosion control ordinance (for smaller tenant projects). In addition, these requirements are incorporated into contracts to the extent construction site operators are performing work for the Port. Therefore, control of construction site runoff is addressed independently from the Port's SWMP. Coverage for Port operations and tenants is outlined in Table 1.

7.1.4 Element #4: Education and Outreach

BMP: Implement Public Education Measures to Protect Stormwater Quality

Implementation Tasks:

1. During inspections conducted under BMP – "Implement Inspections of Significant Pollutant Source Areas", and BMP – "Implement a Stormwater System Cleaning and Maintenance Program", identify catch basins where it would be relevant and appropriate to apply "Dump No Waste, Drains to Stream" decals and apply decals (Responsibility: MFM, PDX Maintenance).
2. Include stormwater education materials at Port sponsored outreach events (Responsibility: Public Affairs).

Tracking Measures:

1. Track the number of "Dump No Waste, Drains to Stream" decals applied to catch basins.
   - ✓ *The Port applied 341 decals in FY2018.*
2. Track events where stormwater educational materials were made available.
   - ✓ *Columbia Slough Regatta – August 6, 2017*
   - ✓ *Explorando with the Columbia Slough Watershed Council- June 30, 2018*

Measurable Goals:

1. "Dump No Waste, Drains to Stream" decals will be applied to catch basins associated with all new Port construction annually (except for FAA restricted areas).
   - ✓ **Completed in FY 2018, see the tracking measure response above.*
2. Provide stormwater education materials at outreach events.
   - ✓ *The Port continues to address stormwater issues in a broad variety of outreach events. The details are presented in the tracking measure response above. Moving forward, the Port intends to maintain some outreach to the public at events. However, our primary focus will be on outreach to industrial/commercial tenants since the Port's jurisdiction does not include any residential property. Education and outreach materials addressing target pollutants have been developed and posted to the Port's public website for this target audience.*
   - ✓ *Columbia Slough education materials were installed inside of the breakroom of the ground transportation lot facility. Posters were created to inform taxi and ride share drivers of stormwater impacts to the Columbia Slough.*

BMP: Implement a Tenant Stormwater BMP Program

Implementation Tasks:

1. Maintain an inventory of all tenants or lease holders (Responsibility: Properties Management)
2. Provide technical assistance to the tenants regarding structural and non-structural/ source control stormwater BMPs (Responsibility: Environmental Operations).
3. Maintain an active property management role by conducting inspections of property vacated by tenants to ensure proper disposal of waste materials (Responsibility: Environmental Operations, Aviation and Marine Properties Management).

Tracking Measures:

1. Compile/ update a leasehold inventory annually.
   - ✓ *Marine, Aviation, and Industrial Development Properties groups provide an updated list of leaseholders annually. Tenant information is also updated on its own GIS layer within PortGIS, through a separate process. However, many of these leaseholds do not have any significant exposure to stormwater. Operating area environmental staff are familiar with the circumstances and needs of specific leaseholders. This information is taken into consideration when selecting priority facilities for inspection.*
2. Provide technical information related to structural and non-structural/ source control BMPs to tenants over the permit term.
   - ✓ *In FY2018, this was done during the Port's Priority Facility Inspections. *See issues addressed under BMP: Implement an Inspection Program for Significant Pollutant Source Areas (pg. 20). The Port has developed stormwater BMP education and outreach materials targeting industrial properties. These will be used in conjunction with the industrial inspection program and distributed to a larger group of industrial/commercial entities within the Port's jurisdiction.*

Measurable Goals:

1. Verify the completion and/ or update of a leasehold inventory.
   - ✓ *Completed in FY2018, see tracking measure response above.*
2. Track technical assistance documentation provided to tenants.
   - ✓ *Completed in FY2018 see a list of issues under BMP: Implement an Inspection Program for Significant Pollutant Source Areas (pg. 20). Technical assistance was provided on all stormwater issues encountered during priority facility inspections.*
3. Describe property management activities for lease termination inspections.
   - ✓ *Inspections include several different areas including stormwater. The stormwater portion is focused on determining if the condition of the vacated property presents a source of potential stormwater contaminants. Any sources are identified and mitigated by the former tenant or by the Port and billed back to the responsible party. This means cessation of activities exposed to stormwater, such as outdoor storage. The stormwater system is surveyed and the tenant is asked to clean the*

catch basins and storm lines if necessary. Sweeping or clean-up of surface staining can also be requested before a tenant is released from the lease.

BMP: Require Training and Licensing for Staff Conducting Pest Management Activities

Implementation Tasks:

1. Require all pesticide applicators to obtain and maintain licenses issued by the Oregon Department of Agriculture (ODA) (Responsibility: PDX Maintenance, PDX Landscape, Marine Properties Maintenance, and MFM).

Tracking Measures:

1. Track the Port employees who are ODA-licensed pesticide applicators.

   ✓ *The following Port employees are ODA-licensed; Tim Cooper, Mark Griffith, Dustin Sandberg, Aaron Zest, Dustin Sandberg, Luis Guevara, Marco Guevara, Kevin Pack, Ryan Snow, Corrine Fritz, Shawn Groom, Tim Guymon, Andrew Glass and Michael Sands.*

Measurable Goals:

1. All pesticide applicators will be licensed by the ODA.

   ✓ *All pesticide applicators working on Port-operated properties are licensed by the ODA. This includes five groups within the Port operating areas who work with these materials (PDX Maintenance, PDX Landscape, Marine Facilities Maintenance (MFM), Marine Property Maintenance/Landscape and Environmental Operations Natural Resources).*

BMP: Provide Erosion Prevention and Sediment Control Training for Construction Inspectors

Implementation Tasks:

1. Provide annual erosion prevention and sediment control training for all Port construction inspectors (Responsibility: Environmental Operations).

Tracking Measures:

1. Track the number of employees receiving erosion and sediment control training.

✓ *The Port provided a one-hour training session to 22 staff members involved in construction inspection activities for Port projects. Staff trained through this process inspects projects regulated under the Port's 1200-CA permit. There are 10 Port staff members that have the Certification for Erosion and Sediment Control Lead (CESCL). Staff are recertified every three years.*

Measurable Goals:

1. Erosion prevention and sediment control training will be conducted annually for Port construction inspectors.

   ✓ *Completed in FY2018. *See the tracking measure response above.*

BMP: Participate in a Public Education Effectiveness Evaluation

Implementation Tasks:

1. Coordinate with other local, Phase I jurisdictions in providing/ compiling information regarding a public education effectiveness evaluation by November 1, 2014 (Responsibility: Environmental Operations).

Tracking Measures:

1. Track related efforts annually.
   - ✓ *Completed in October 2014. The Port participated in a DEQ approved project with other Phase I jurisdictions to conduct a large scale Public Education Effectiveness Evaluation. The effort was spearheaded by the Association of Clean Water Agencies (ACWA).*

Measurable Goals:

1. Coordinate with other local, Phase I jurisdictions regarding a public education effectiveness evaluation by November 1, 2014.
   - ✓ *Completed in October 2014.*

BMP: Implement a Spill Response Training Program

Implementation Tasks:

1. Distribute updated emergency contact information and spill response procedures to employees responsible for responding to spills (Responsibility: Environmental Operations).
2. Conduct general spill response training annually for designated employees (Responsibility: Environmental Operations).

Tracking Measures:

1. Document spill response training activities.
   - ✓ *Environmental Operations maintains documentation listing operations area personnel receiving annual spill response training. The criteria used to determine which employees receive training are explained under the second measurable goal below.*

Measurable Goals:

1. Annually train designated Port employees on spill response.
   - ✓ *Spill response training was provided for 69 employees at Marine facilities*
   - ✓ *Spill response training was provided for 110 employees at Aviation facilities*
2. Document the procedure to determine which employees will receive spill training by November 1, 2011.
   - ✓ *Completed in FY2011.*

BMP: Implement a Staff Training Program for Stormwater Pollution Prevention

Implementation Tasks:

1. Continue to conduct training for new employees during their orientation (Responsibility: Environmental Operations).
2. Provide targeted annual stormwater pollution prevention training for specific staff that conducts activities relevant to stormwater (Responsibility: Environmental Operations).
3. Port staff to attend conferences and educational presentations (Responsibility: Environmental Operations).

Tracking Measures:

1. Document all staff training activities.
   - ✓ *Environmental Operations maintains documentation for all annual stormwater training provided to existing employees, as well as the new employee stormwater training provided during orientation. The Port provided stormwater pollution prevention training to 179 existing employees and 43 new employees.*
2. Document attendance at conferences.
   - ✓ *Environmental Operations collects documentation of stormwater-related conferences attended by environmental staff. These conferences ensure Port staff is up to speed on relevant implementation, technology, and regulatory issues (examples may include, StormCon, NEBC Industrial Stormwater Conference, CASQA Stormwater Conference, Northwest Environmental Conference, and various stormwater related training courses).*

Measurable Goals:

1. Participate in water quality organizations and stakeholder groups annually.
   - ✓ *The Port continues to participate as a board member of the following organizations, Columbia Slough Watershed Council, Friends of Trees, Solve, Lower Columbia Estuary, The Intertwine Alliance, and Willamette Partnership. Other participation includes financial sponsorship, membership, volunteer assistance at events, and in-kind services for the following stakeholder groups, Oregon Environmental Council, Oregon Association of Clean Water Agencies, Sandy River Basin Council, Honoring Our Rivers, PDX Community Advisory Committee and KOIN 6 Water… Do Your Part Clean Water Partners.*
2. Conduct annual training.
   - ✓ *Completed in FY2018, see the tracking measure response above.*
3. Conduct new employee training.
   - ✓ *Completed in FY2018, see the tracking measure response above.*

7.1.5 Element #5: Public Involvement and Participation:

BMP: Provide for Public Participation with SWMP and Benchmark Submittals

Implementation Tasks:

1. Provide opportunities for public comment on the SWMP and pollutant load reductions benchmarks for a minimum of 30 days prior to submittal of the permit renewal to DEQ (Responsibility: Environmental Operations and Public Affairs).

Tracking Measures:

1. Report annually on public participation in these areas.

   ✓ *Completed in FY2015. Port's Stormwater Management Plan and the Pollutant Load Reduction Benchmark Analysis report were updated as part of the MS4 permit renewal application and put on Public notice via the Portland website June 15 through July 15, 2015.*

Measurable Goals:

1. Provide for public participation on the SWMP revisions and pollutant load reduction benchmarks (developed for permit renewal).

   ✓ *Completed in FY2015, see the tracking measure response above.*

2. Provide public access to the Port's most current MS4 Annual Report via its public website.

   ✓ *The Port's annual reports are available on-line via a link (on the "Stormwater Management Page" of the Port's public website) to the City of Portland's website http://www.portlandonline.com/bes/index.cfm?c=50289 and are also posted on the Port's website, https://www.portofportland.com/Environment/StormwaterManagement*

BMP: Implement a Public Participation Approach that Provides Opportunities for the Public to Effectively Participate in the Implementation of the Stormwater Management Plan

Implementation Tasks:

1. Determine what projects are appropriate for public involvement (Responsibility: Environmental Operations, Public Affairs).

2. Make the public aware of the selected involvement opportunities via the Port's website, and the Columbia Slough Watershed Council (Responsibility: Environmental Operations and Public Affairs).

   ✓ *In FY2018, the public was made aware of involvement opportunities via communications from the Environmental Outreach Coordinator using the website, email, and the Port's digital magazine PORTSIDE.*

3. Implement selected projects and document public involvement (Responsibility: Environmental Operations and Public Affairs).

Tracking Measures:

1. Describe any projects implemented where the public has opportunity to participate and the extent of public involvement for each.

- ✓ *The following FY2018 events provided the opportunity for the public to participate in implementation of the Port's stormwater program:*
  - *Sponsor of 2018 Columbia Slough Regatta,*
  - *The Port funded 5 Friends of Trees planting projects for tree canopy and vegetation enhancements in areas impacted by airport operations. Volunteers planted 1,695 trees and native shrubs during events at Columbia Children's Arboretum (1/20/18), Argay, Parkrose, Russel and Wilkes (02/24/2018), Columbia Slough Natural Area (03/10/2018) Arbor Lodge, Kenton, Overlook and Portsmouth (03/17/2018) Beaumont-Wilshire, Cully & Roseway (03/31/2018). Employees participated as planting volunteers.*
  - *Honoring Our Rivers – sponsorship and in-kind support of student anthology of writing and art works focusing on rivers; served as judge for student work.*

<u>Measurable Goals:</u>

1. Document what projects are identified as public involvement opportunities.
   - ✓ *The following have been identified as possibilities for next year:*
     - *The Port will continue to sponsor events that connect the public to stormwater and participate with organizations whose mission is to enhance water quality through public outreach.*

7.1.6 Element #6: Post-Construction Site Runoff Control

BMP: Develop, Adopt, and Implement New Port-Specific Post-Construction Runoff Control Standards

Implementation Tasks:

1. By January 1, 2014, adopt and implement Port-wide post-construction standards for development and redevelopment. Airport specific standards will be consistent with FAA and airport operations requirements (Responsibility: Environmental Operations)
2. By December 2012, update Intergovernmental Agreement (IGA) with the City of Portland to clarify responsibilities, so that one set of post-construction standards are applied to the Port's MS4, avoiding duplication and conflicting requirements (Responsibility: Environmental Affairs).
3. By end of permit term, design and initiate construction on a stormwater capital improvement retrofit to address at least one applicable TMDL pollutant of concern (Responsibility: Environmental Operations).

Tracking Measures:

1. Adopt Port-wide post-construction development/ redevelopment standards by January 1, 2014.
   - ✓ *The Port's Design Standards Manual (DSM) was completed November 2013.*
   - ✓ *The DSM allows for the use of regional structures to treat multiple capital projects.*
     - *The Port's DSM currently applies to the PDX airfield and certain designated properties surrounding the airfield.*
     - *The Port has developed an accounting system to track the number of acres treated and the total number of acres requiring treatment per calendar year.*
     - *The Port is in compliance with post-construction control standards in the DSM. Actual acres of treatment per project are verified as part of close-out and reconciled with the accounting system.*
2. Update IGA with the City of Portland by December 31, 2012.
   - ✓ *Completed in 2012.*
3. Design and initiate construction on a stormwater retrofit project to address a TMDL pollutant of concern.
   - ✓ *A pavement removal project at Terminal 4 was identified as the Port's required retrofit project and completed in FY2012. It removed 1.24 acres of impervious area, and six catch basins. Thereby, infiltrating an estimated 3.6-acre feet of stormwater annually and reducing potential bacterial loading to the Willamette River.*

Measurable Goals:

1. Document the design, construction, and rationale for the retrofit project addressing a TMDL pollutant of concern.
   - ✓ *Completed in 2012, see the third tracking measures response.*

7.1.7 Element #7: Pollution Prevention for Municipal Operations

BMP: Implement a Street and Vehicle Maneuvering Area Cleaning and Maintenance Program

Implementation Tasks:

1. Sweep the McCarthy Park (Swan Island) parking lot annually (Responsibility: Marine Properties Maintenance).
2. Sweep Port-managed areas of the marine terminals annually. If additional sweeping is needed, Environmental Operations will coordinate with MFM staff (Responsibility: Environmental Operations, MFM).
3. Sweep Airport Way, Frontage Road, and PDX employee parking lots twice per week in winter and once per week in summer (Responsibility: PDX Maintenance).
4. Maintain and repair roadway areas to minimize pollutant impacts to stormwater as needed (Responsibility: MFM, PDX Maintenance).
5. Follow manufacturer's recommendation for application of deicing products (Responsibility: MFM, PDX Maintenance, Marine Properties Maintenance).
   - ✓ *Operating area personnel apply pavement deicing materials per the manufacturer's requirements. Application equipment is calibrated by weight and volume to apply the material at the suggested rate to avoid over application.*
6. As necessary, decant street sweeping wastes in covered, water-tight drop boxes (Decant Water Collection Boxes) that drain to an approved sanitary sewer discharge point (Responsibility: PDX Maintenance, MFM).
   - ✓ *Completed for FY2018.*

Tracking Measures:

1. Track sweeping frequency at McCarthy Park.
   - ✓ *MFM contracts sweeping for McCarthy Park. Sweeping was conducted twice per month during the summer and spring and was increased once per week in the fall and winter.*
2. Track sweeping frequency at the marine terminals.
   - ✓ *Sweeping was conducted during April 2018 at Terminal 2. Terminal 4 annual sweeping was conducted in June 2018, additional sweeping operations for the Kinder Morgan leased area were conducted in December 2017, April 2018, and June 2018. The T6 601 yard and Auto West yard were swept in April 2018.*
   - ✓ *The Port performed 46-hours of sweeping at the marine terminals.*
3. Track sweeping frequency at Airport Way, Frontage Road, and the PDX employee parking lots.
   - ✓ *PDX Maintenance performs regular sweeping for these areas.*
   - ✓ *The Port performed 3,728-hours of sweeping.*
4. Report the amount of materials removed. Materials will include those collected from catch basins and other structural devices.

- ✓ *288.21 tons of material were removed from catch basins and sweeping combined at Aviation facilities. The PDX Basin 2 quiescent pond was cleaned, resulting in the removal of an additional 65.85 tons of sediment.*
- ✓ *17.91 tons of material were removed from catch basins and sweeping combined at Marine facilities.*

Measurable Goals:

1. Sweep McCarthy Park parking lot annually.
   - ✓ *Completed in FY2018, see tracking measure response above.*
2. Sweep Port-managed, accessible areas of the marine terminals annually.
   - ✓ *Complete in FY2018, see tracking measure response above.*
3. Sweep Airport Way, Frontage Road, and the PDX employee parking lots a minimum of once per week.
   - ✓ *Completed in FY2018, see tracking measure response above.*

BMP: Limit Landscape Maintenance Activities Impact on Stormwater

Implementation Tasks:

1. Apply pesticides and fertilizers, using an Integrated Pest Management approach to minimize impacts to stormwater (Responsibility: Marine Properties Maintenance, MFM, PDX Maintenance and Landscape).
   - ✓ *Marine Properties Maintenance staff is responsible for the landscaping and maintenance of the Port's industrial parks, marine terminals, and mitigation sites. Staff continued to implement the IPM and Work Schedules Program for Port-owned mitigation sites. This program identifies problem plant species at each site, provides a profile for each species, recommends control methods, and outlines monitoring protocol and schedules.*

     Environmental Operations provides Port maintenance staff and Port-contracted workers with the Vegetation Management Plan. The plan gives information on the appropriate herbicides and use of those herbicides to control invasive plant species, and it identifies the locations where specific herbicides can be applied.

     MFM conducts weed control activities at marine parking areas, rail yards, and specific vegetated areas at Marine Terminals 2, 4, and 6 on an as-needed basis.

     PDX Landscape staff, responsible for landscaping at PDX facilities, continues to implement BMPs aimed at improving stormwater quality at the airport. Some of the issues they focused on included testing pesticide alternatives recommended by the Oregon Department of Agriculture, reducing the concentration of pesticides/herbicides/fertilizers applied where possible, and incorporating native plants into the landscaping to reduce water and chemical requirements.

     PDX Maintenance staff applies pesticides on the airfield to comply with FAA requirements. They continue to look for ways to reduce chemical usage where possible by working with different pesticide combinations to achieve required conditions.

2. Review the Port's program to control pesticides, herbicides and fertilizers annually, and update as appropriate (Responsibility: Environmental Operations, Marine Properties Maintenance, MFM, PDX Maintenance, PDX Landscape).

   ✓ *The Port groups applying pesticides documented new approaches for consideration. Some of the issues include: Making pesticides more effective by rotating product, use pre-emergent controls to minimize difficult invasive such as crab grass, using mulches to minimize bare soil, and reviewing best management practices for safely storing and applying pesticides.*

3. Maintain an inventory of pesticides used on Port property and update annually (Responsibility: Environmental Operations, Marine Properties Maintenance, MFM, PDX Maintenance, PDX Landscape).

<u>Tracking Measures:</u>

1. Document the annual pesticide use update.

   ✓ *The amounts of each pesticide/herbicide/fertilizer used are presented below for each of the groups listed above.*

Table 3 Pesticide/Herbicide/Fertilizer Use

PDX Landscape Maintenance	
Atrimmec Growth Regulator	9- gal
Lontrel Herbicide	5-oz
Pendululm	33-gal
Tryclopir 3A Herbicide	6.5-gal
Ranger Pro Herbicide	10-gal
Speedzone Herbicide	2.5 gal
Casoron Herbicide	20-lbs
Specticle herbicide	50-lbs
Simazine Pre. Em. Herbicide	16-gal
Tower Herbicide	8.5
Ronstar G Herbicide	130-lbs
PDX General Maintenance	
Alligare	390-lbs
Direx 4L	130-gal
Crossroads	405-gal
Ranger Pro	33-gal
Blue Dye	2-gal
ZP Oats (Vole bait)	7,800-lbs
Undeveloped Properties	
Element 3A	116 oz
Rodeo	2,716 oz
Transline	113 oz
Vastlan	1,272 oz

Marine Property Landscape Maintenance	
Ranger Pro -glyphosphate	3,032-oz
AquaStar- glyphosphate	50-oz
TriChlophr 3/A-chloropyridinyl	3,299-oz
Surflan Pro-oryzalin	615-oz
Square One-quinclorac	121-oz
Power Zone-MCPP 2-ethylehexyl	34-oz
Marine Facility Maintenance	
Agri Star Triclopyr 3A	52.16-gal
Ranger Pro	52.21-gal
SFM 75	253.48-oz
LI-700 Surfactant	0.5-gal
QuikFire - Weed Killer	5-gal

Measurable Goals:

1. Annually update the Port's pesticide use inventory.
   - ✓ *Completed for FY2018, see Table 3.*

BMP: Require Training and Licensing for Staff Conducting Pest Management Activities (partial applicability)

*See section 7.1.4 for information on implementation of this BMP.

BMP: Implement a Tenant BMP Program (partial applicability)

* See section 7.1.4 for information on implementation of this BMP.

BMP: Implement a Program to Limit Infiltration from Port-Owned Sanitary Sewer System into the MS4

Implementation Tasks:

1. Monitor pump stations electronically to ensure proper function of Aviation pump stations (Responsibility: PDX Maintenance).
2. Monitor pump stations through weekly inspections and audible/visual alarms to ensure proper function of Marine pump stations (Responsibility: MFM).
   - ✓ *MFM staff documented monthly inspections. The MFM plumber and electricians contribute to meeting this requirement.*
3. Conduct annual pump station maintenance, including flushing, float and alarm testing, and debris removal for all pump stations (Responsibility: PDX Maintenance, MFM).
   - ✓ *Work orders were generated to ensure the completion of this work at PDX and Marine operated sanitary lift stations.*
4. Clean Port-owned grease interceptor vaults at PDX on an annual basis (Responsibility: Aviation Facilities Maintenance).
   - ✓ *PDX maintains two large grease interceptor vaults as a back-up to grease traps maintained by PDX concessions tenants under the FOG program. Documentation of this maintenance is provided to Environmental Operations.*
5. Continue to implement the tenant FOG (fats/oils/grease) program to ensure proper handling of these materials at PDX (Responsibility: PDX Business/Properties).

Tracking Measures:

1. Maintain a list of Port tenants implementing the FOG program.
   - ✓ *Environmental Operations maintains a list of tenants who are inspected as part of the effort to prevent fats, oil, and grease from clogging sanitary sewer lines. These are primarily concessions tenants located in the terminal. This relates to stormwater, as it prevents overflow in obstructed sanitary lines from entering the storm system.*

Measurable Goals:

1. Document completion of implementation tasks (2-4) associated with this BMP (with PDX Maintenance, Aviation Facilities Maintenance, MFM, and PDX Business/Properties)
   - ✓ *Completed for FY2018. Environmental Operations maintains documentation for the lift station inspections/maintenance, grease vault cleaning and grease trap inspections (FOG program).*

BMP: Implement a Stormwater System Cleaning and Maintenance Program (partial applicability)

* See section 7.1.8 for information on implementation of this BMP.

7.1.8 Element #8: Structural Stormwater Controls Operations and Maintenance

BMP: Implement a Stormwater System Cleaning and Maintenance Program

Implementation Tasks:

1. Continue to implement a stormwater system feature inspection and maintenance program (Responsibility: Environmental Operations, MFM, Marine Properties Maintenance).
2. Inspect and clean catch basins (as necessary) annually in Port-managed Marine Business Line areas (Responsibility: MFM).
3. Conduct litter pickup and vegetation management activities to ensure adequate access and performance of all stormwater system features as needed (Responsibility: MFM, Marine Properties Maintenance).
   - ✓ *Marine Properties Maintenance staff maintained landscaped areas within the industrial parks at Swan Island and Rivergate and at the marine terminals. Crews removed and disposed of vegetative debris, scrap metal, and garbage. They also cleared vegetation around stormwater outfalls and associated stormwater conveyance system infrastructure on Port-owned industrial park properties to provide better access for inspections and illicit discharge monitoring.*
4. Coordinate updates of storm sewer system maps to include updated stormwater conveyance system features and Port-owned and operated structural controls (Responsibility: Environmental Operations and Engineering).
5. By June 30, 2012, review and update the existing inspection and maintenance procedures for structural stormwater controls, in accordance with requirements outlined in the Port's MS4 NPDES permit (Responsibility: Environmental Operations and Maintenance)
   - ✓ *Previously completed in FY2011.*
6. As necessary, decant storm system and catch basin cleaning wastes in covered, water-tight drop boxes (Decant Water Collection Boxes) that drain to an approved sanitary sewer discharge point (Responsibility: MFM, PDX Maintenance).
   - ✓ *Completed for FY2018.*

Tracking Measures:

1. Track number of catch basins cleaned annually.
   - ✓ *761 catch basins and manholes were cleaned at Aviation facilities.*
   - ✓ *375 catch basins were cleaned at Marine facilities.*
2. Track cleaning frequency for the Port owned and operated structural stormwater controls by facility type.
   - ✓ *Marine-operated water quality treatment facilities are inspected at least on a quarterly basis and cleaned as needed to maintain proper operation. Catch basins in Marine-operated areas are scheduled to be inspected and cleaned (if necessary) on an annual basis.*
   - ✓ *Aviation-owned water quality treatment facilities (except for quiescent ponds) are cleaned on an annual basis. The ponds are cleaned on a three-year rotating basis. The drainage basin 2 quiescent pond was cleaned in FY2018, resulting in the removal of 65.85 tons of material.*

- ✓ *PDX has over 3,000 catch basins. PDX Maintenance inspects and cleans those associated with industrial activity on an annual basis. Many of these facilities also have catch basin inserts that are inspected and changed as needed monthly. The balance of PDX catch basins are cleaned on a 4-year rotating basis. If necessary, catch basins are moved to a more frequent cleaning schedule or fitted with an insert based on field observations.*

3. Track storm sewer system pipe cleaning activities annually.
   - ✓ *1,940 feet of storm line were cleaned at Aviation facilities.*
   - ✓ *00 feet of storm line were cleaned at Marine facilities.*
4. Track updates to the stormwater system features maps.
   - ✓ *All Port storm system maps are available to operations and administrative personnel through the PortGIS interphase located on Navigator (the Port's intranet). The PortGIS system is continuously updated.*
5. Report amount of materials removed. Materials will include those collected from catch basin cleaning and street sweeping.
   - ✓ **See BMP: Implement a Street and Vehicle Maneuvering Area Cleaning and Maintenance Program.*

<u>Measurable Goals:</u>

1. Inspect and clean all catch basins within the Port-managed areas not otherwise covered by a 1200-series industrial stormwater permit annually.
   - ✓ *PDX completed this work based on their schedule (listed above under tracking measure for this BMP).*
   - ✓ *MFM completed this work in FY2018.*
2. Inspect and maintain all Port-owned and operated structural controls within the Port-managed areas not otherwise covered by a 1200-series industrial stormwater permit annually.
   - ✓ *Completed in FY2018, see the Tracking Measure response above.*

BMP: Implement a Program for the Tracking and Maintenance of Private Structural Controls

Implementation Tasks:

1. Work with the City of Portland to establish and maintain an inventory of existing private structural control facilities on tenant properties by December 31, 2012 (Responsibility: MID Properties Management, and Environmental Operations).
2. Develop a program in conjunction with the City of Portland to track private structural control facilities on tenant properties over the permit term (Responsibility: Environmental Operations).
3. By June 30, 2012, develop an updated inspection and maintenance procedure for structural stormwater controls for distribution to owners of private structural control facilities (Responsibility: Environmental Operations).

Tracking Measures:

1. Track the number of existing and new private structural control facilities installed on Port-properties.
   - ✓ *The Port coordinated with the City of Portland to develop a complete list of water quality treatment facilities on Port property that includes tenant operated facilities.*

Measurable Goals:

1. Develop an inventory and mechanism for tracking of private structural controls on tenant properties.
   - ✓ *The Port's IGA with the City of Portland (completed in December 2012) addresses the tracking requirements. The City will cover all water quality treatment facility maintenance tracking for Port tenants outside of the PDX security fence through its Maintenance Inspection Program. The Port will track all remaining facilities on Port property.*

BMP: Implement a Tenant BMP Program (partial applicability)

* See section 7.1.4 for information on implementation of this BMP.

8.0 ADAPTIVE MANAGEMENT PROCESS IMPLEMENTATION AND PROPOSED SWMP CHANGES

As it has, since permit year one, the Port continues to use adaptive management to modify and improve BMPs and to implement practices that reduce pollutant loading to the maximum extent practicable. This process involves direct coordination with operating area personnel who provide suggested BMP modifications.

In permit year 23, an adaptive management process was used to ensure all ideas are heard, documented, and implemented, if viable. PDX and Marine MX have continued to refine data collection for cleaning and documenting maintenance of the storm sewer system. Based on monthly observations it was determined that the frequency of sweeping in the trash collection area under the PDX terminal building needed to be increased as well as the frequency of trash pickup for the taxi and ride share waiting areas. We are currently working with the engineering and GIS groups to develop a mobile application that maintenance and survey staff can use in the field to make observation and corrections to the storm sewer system

The Port is not seeking SWMP revisions at this time.

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Part III
MONITORING REPORT

City of Portland, Oregon

National Pollutant Discharge Elimination System (NPDES)

Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314

MONITORING COMPLIANCE REPORT

Permit Year 2017-2018

(July 1, 2017 – June 30, 2018)

Prepared for:

Oregon Department of Environmental Quality

Submitted by:

City of Portland
Port of Portland

Submitted on:

November 1, 2018

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1 INTRODUCTION

The purpose of this annual Monitoring Report is to comply with Schedule B of Portland's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit Number 101314. Schedule B of the MS4 permit (Table B-1) contains specific requirements on the monitoring types, locations, frequency, and parameters. This report summarizes monitoring activities conducted by the City of Portland (the City) during the 2017-18 permit year (July 1 to June 30) in accordance with Schedule B and discusses pertinent results.

The City's sampling activities and results are summarized in Sections 2 and 3, respectively. Section 4 includes an evaluation of long-term trends in water quality, as well as an assessment of changes in the macroinvertebrate communities. A map of all monitoring locations is included in Appendix A. All monitoring data collected during the 2017-18 permit year are included in Appendix B.

2 SAMPLING ACTIVITIES

The City conducts sampling and analysis of stormwater, instream, and biological (macroinvertebrates) parameters to fulfill Municipal Separate Storm Sewer System (MS4) permit requirements. The monitoring also supports and informs the City's actions in meeting Total Maximum Daily Load (TMDL) objectives related to receiving water health. Detailed information on the City's monitoring strategy is described in the 2016 Monitoring Plan, including the methods used to collect samples, frequency of collection, and the number of sampling locations.

During 2017-18, the City completed all permit-required monitoring activities (Table 1). In addition to the activities required by the Monitoring Plan, the City also collected water quality samples from 20 perennial streams throughout Portland as part of the Portland Area Watershed Monitoring and Assessment Program (PAWMAP)[5]. PAWMAP is a coordinated long-term monitoring effort designed to measure the City's current and changing ecological resources that began in 2010. The program is designed to systematically measure changes in habitat, water quality, and biological communities over time.

[5] More information about PAWMAP is available here: https://www.portlandoregon.gov/bes/article/489038

Table 1. Summary of monitoring activities conducted during the 2017-2018 permit year and the commitments included in the monitoring plan. A range is provided when the frequency varied by site.

	Monitoring Plan		2017-2018 Activities	
Monitoring Type	**Number of Sites**	**Frequency**	**Number of Sites**	**Frequency**
Probabilistic Stormwater	30	1 Storm Event	30	1 Storm Event
Historic Fixed Land Use	4	3 Storm Events	4	3 Storm Events
Fixed Instream	11	2 Dry Weather 2 Storm Events	11	4-9 Dry Weather 2-4 Storm Events
Probabilistic Instream (PAWMAP)	*NA*	*Not included*	20	4 Dry Weather 1 Storm Event
Continuous Instream (USGS)	7	Continuous: 30-minute interval maximum	7	Continuous: 30-minute interval maximum
Macroinvertebrates	14	1 Sample	14	1 Sample

Throughout the permit year, City staff collected water quality samples from multiple storm events. Over the course of the permit year, City staff monitored weather conditions and conducted sampling to target storms with characteristics, as described in the monitoring plan.

2.1 Probabilistic Stormwater

The City implements a monitoring program to characterize the stormwater entering the City's underground injection control (UIC) system. The monitoring effort is used to comply with both UIC and MS4 permit requirements. The UIC monitoring program is based on a probabilistic approach that selects a subset of the UICs in the City to sample as part of an annually rotating panel of sites. This monitoring approach allows for the efficient characterization of the City's large UIC system (over 9,000 individual UICs) while maintaining statistical power. Each year, the City targets two panels that each consist of 15 UIC locations. Each UIC is investigated and field verified before the sampling panel is finalized.

During 2017-18, the City successfully sampled 30 UIC locations. The samples were collected from five separate storm events (Table 2). Greater than 0.1 inches of rain were recorded for each of the sampled storm events.

Table 2. Summary of storm events sampled as part of the City's probabilistic stormwater monitoring during the 2017-18 permit year. Recorded rainfall is based on the closest rain gage to each UIC monitoring location. The Event Length and Event Total columns represent the number of hours with measurable rainfall leading up to the sample collection time and the total rainfall measured during that period respectively. The 24-hour antecedent rainfall is the total recorded rain during the full 24-hours prior to sample collection. Ranges are provided given the variability between sites.

Sampling Date	Number of Sample Locations	Event Length (hours)	Event Total (in)	24-hr Antecedent Rainfall (in)
Oct 19, 2017	9	7.7–13.9	0.31–0.69	0.32–0.69
Nov 15, 2017	5	6.4–10.0	0.18–0.55	0.19–0.56
Nov 21, 2017	5	6.3–13.9	0.20–0.40	0.34–0.42
Dec 19, 2017	6	7.8–13.0	0.14–0.71	0.17–0.72
Jan 11, 2018	5	11.1–15.2	0.42–0.59	0.46–0.62

2.2 Historic Fixed Land Use Stormwater

During the 2016-17 permit year, the City resumed stormwater monitoring at four sites that were historically monitored between 1991 and 2011 to evaluate stormwater characteristics associated with different land uses (Table 3). The City conducts flow-weighted composite sampling during rain events using methods that are consistent with the methods used to collect the previous historic data, allowing for direct comparison of results. Flow-weighted composite sampling characterizes the overall water quality concentrations as an event mean concentration for the total volume of runoff from that storm and captures the variability across the duration of a storm event.

Table 3. Historic fixed land use flow-weighted composite stormwater monitoring locations. Annual monitoring at the four sites was reinitiated in the 2016-17 permit year.

Site ID	Watershed	Predominant Land Use	Location	Historic Data Collection
M1	Columbia Slough	Mixed	NE 122nd Ave at Columbia Slough	1991-2011
OF19	Willamette River	Forest Park and Industrial	NW Front Ave and Kittridge Ave	2000-2011*
R1	Fanno Creek	Residential	Fanno Creek at SW 56th St**	1991-2001
R2	Columbia Slough	Residential	NE 141st Ave and Sandy Blvd	1991-1996

* Sampling at OF19 originally began in 1995; however, data collection methods were inconsistent and are not considered comparable prior to 2000.

** R1 is an instream sampling location.

City staff monitor weather forecasts to target storm events for sampling. Using real-time telemetered flow meters, monitoring staff can adjust sampling increments based on precipitation patterns and anticipated flow rates to ensure that a composite sample adequately represents runoff from the storm event.

Each year, the City targets sample collection for three storm events at each site. The City sampled three separate storm events at each of the four locations during the 2017-18 permit year (Table 4). Composite sampling was attempted at all four sites during the October 17-18, 2017, event. Sites M1 and R2 experienced issues that required the samples to be discarded and the event to be repeated for the affected sites on March 13, 2018. At M1, gravel was drawn into the intake tubing, which affected the volume of collected subsamples in October. At R2, leafy debris on the flow sensor resulted in missed subsamples during the October event. The time period between the second and third events at M1 is slightly less than the 14-day interval specified in the monitoring plan, but samples are still considered representative since all other storm target criteria were met.

Table 4. Storm events sampled during the 2017-18 permit year at the four historic fixed land-use composite stormwater monitoring locations. The Sampling Period is the length of time between the first and last subsamples collected for the composite. The 24-Hour Antecedent Rainfall is the total recorded rain in the 24 hours prior to the collection of the first subsample. The Sample Collection Rainfall is the amount of rainfall recorded during the sampling period at the nearest rainfall gage.

Site ID	Sample Date	Sampling Period (hours)	24-Hour Antecedent Rainfall (in)	Sample Collection Rainfall (in)
M1 Columbia Slough	Jan 17-18, 2018	20.8	0.06	0.51
	Feb 28-Mar 1, 2018	16.3	0.07	0.47
	Mar 13, 2018	5.8	0.05	0.20
OF19 Willamette River	Oct 17-20, 2017	65.4	0.00	1.31
	Jan 17-18, 2018	18.3	0.01	0.59
	Feb 28-Mar 1, 2018	24.5	0.02	0.41
R1 Fanno Creek	Oct 18-20, 2017	41.0	0.01	1.32
	Jan 17-18, 2018	18.6	0.24	0.19
	Feb 28-Mar 1, 2018	22.8	0.08	0.31
R2 Columbia Slough	Jan 17-18, 2018	20.8	0.08	0.50
	Feb 28, 2018	11.2	0.09	0.40
	Mar 13, 2018	4.5	0.06	0.17

2.3 Instream Water Quality

The City collects and analyzes water quality samples from multiple streams throughout the City that receive MS4 discharges. The City currently conducts two instream ambient water quality monitoring efforts. The first is a comprehensive ambient monitoring program with 11 fixed sites that are sampled monthly or bi-monthly. Sites are located on the Columbia Slough, Fanno Creek, Johnson Creek, Tryon Creek, and the Willamette River. These sites have been monitored routinely since the early to mid-1990s, providing a long-term record of water quality conditions.

The City also collects water quality samples as part of PAWMAP. This program uses a probabilistic survey design to monitor the City's aquatic resources. PAWMAP includes 80 stream sites in multiple watersheds throughout the City. The sample sites are divided into four panels, with 20 perennial sites included in each panel that are sampled on a 4-year rotating basis. Seasonal (once per quarter) water quality samples are collected at each perennial site throughout the year, as well as one sample each during a storm event. Given the program design, the number of monitoring sites in each watershed will vary from year to year.

Table 5. Summary of the instream water quality monitoring locations and the number of samples collected at each site during permit year 2017-18 for both the fixed and probabilistic (PAWMAP) locations.

	Fixed Locations				Probabilistic Locations			
Watershed	**Number of Sites**	**Dry Weather Samples**	**Wet Weather Samples**	***Subtotal of Samples***	**Number of Sites**	**Dry Weather Samples**	**Wet Weather Samples**	***Subtotal of Samples***
Columbia Slough	2	4	2	*12*	6	4	1	*30*
Johnson Creek	2	4	2	*12*	4	4	1	*20*
Tualatin River Tributaries	1	9	2	*11*	5	4	1	*25*
Willamette River Tributaries*	3	9	2	*33*	5	4	1	*25*
Willamette River **	3	8-9	3-4	*36*	--	--	--	--
Totals	***11***			***104***	***20***			***100***

* Tryon Creek is included in the Willamette River Tributaries watershed.
** PAWMAP does not incorporate monitoring in large rivers (Columbia and Willamette).

During the 2017-18 permit year, the City collected water quality samples from all of the instream water quality monitoring sites (Table 5). The City collected all the planned dry and wet weather samples from the 20 perennial PAWMAP sites. Additionally, the City collected all the planned samples from the fixed monitoring sites in the Columbia Slough, Johnson Creek, and Willamette River. Sampling at the Fanno Creek (Tualatin tributary) and Tryon Creek (Willamette Tributary) fixed sites is typically done every month. Due to scheduling constraints the planned February samples were not collected at the fixed site on Fanno Creek and the three fixed sites on Tryon Creek. The intended monthly monitoring frequency at the fixed sites exceeds the requirements of the monitoring plan; consequently, the City still met the sample requirement included in the monitoring plan during the 2017-18 permit year.

2.4 Instream Flow and Temperature

Continuous instream flow and temperature monitoring provides a high-resolution dataset that can be used to evaluate the physical characteristics of streams that receive MS4 discharges. The U.S. Geological Survey (USGS) operates seven stream gages in the Portland area (Table 6). The City provides partial funding for the monitoring sites through joint funding agreements. All seven of the gages record stream discharge, and four gages also record water temperature. The Willamette gage measures additional parameters, including chlorophyll-*a*, dissolved oxygen, nutrients, pH, specific conductance, and turbidity.

Table 6. Stream gage stations maintained by the USGS in the Portland area. Gages provide a continuous record of stream flow (discharge) at all seven locations and water temperature at four locations.

Gage #	Location	Discharge Period of Record	Temperature Period of Record
14211820	Columbia Slough (RM 0.25) at Portland	1989 – Present	N/A
14206900	Fanno Creek (RM 11.9) at 56th Ave.	1990 – Present	N/A
14211500	Johnson Creek (RM 10.2) at Sycamore	1940 – Present	1998 – Present
14211550	Johnson Creek (RM 0.7) at Milwaukie	1989 – Present	1998 – Present
14211499	Kelley Creek (RM 0.0) at 159th Dr.	2000 – Present	2010 – Present
14211315	Tryon Creek (RM 1.0) near Lake Oswego	2001 – Present	N/A
14211720	Willamette River (RM 12.8) at Morrison Bridge	1972 – Present	1975 – Present

All seven gages were operational throughout the permit year, with the exception of Gage #14211550 on Johnson Creek at Milwaukie. The temperature sensor at the Milwaukie gage malfunctioned; consequently, no temperature readings are available for the final 3 days of the permit year (June 27-30, 2018). The USGS makes the instantaneous flow and temperature data available prior to the completion of their full data review process. A portion of the data presented here are provisional at the time of reporting and may be subject to change after the USGS completes the full quality assessment.

2.5 Macroinvertebrates

Macroinvertebrate monitoring provides information on biological communities within water bodies that receive MS4 discharges. It is designed to evaluate whether, and to what degree, the biological conditions within a stream are changing. Macroinvertebrate monitoring is timed to occur during the low-flow period to facilitate sampling and capture conditions during the period of highest stress for many organisms. Results from macroinvertebrate monitoring may also indicate the effects of stressors and instream conditions that preceded the sampling event by significant periods of time. Instream water quality samples are also collected at the same time.

The City collected benthic macroinvertebrates at 14 perennial stream sites during the summer and early fall of 2017. No sampling issues were encountered, and all of the wadeable, riffle-dominated sites were sampled. Macroinvertebrates were not collected at the non-wadeable perennial sites located in the Columbia Slough, per the Monitoring Plan.

2.6 Permit Year Precipitation Patterns

Precipitation patterns across the City of Portland are variable, delivering different amounts of rain to different parts of the City. The City operates a network of rain gages as part of the HYDRA Rainfall

Network[6]. Each rain gage records rainfall amounts in 0.01-inch increments. For the purposes of summarizing the precipitation patterns observed during the permit year, data from eight gages located across the City were summarized (Figure 1). During the 2017-2018 permit year, the City received a total of approximately 37.6 inches of precipitation. Over the previous 15 years, the eight rain gages recorded a mean total annual rainfall amount of 43.1 inches.

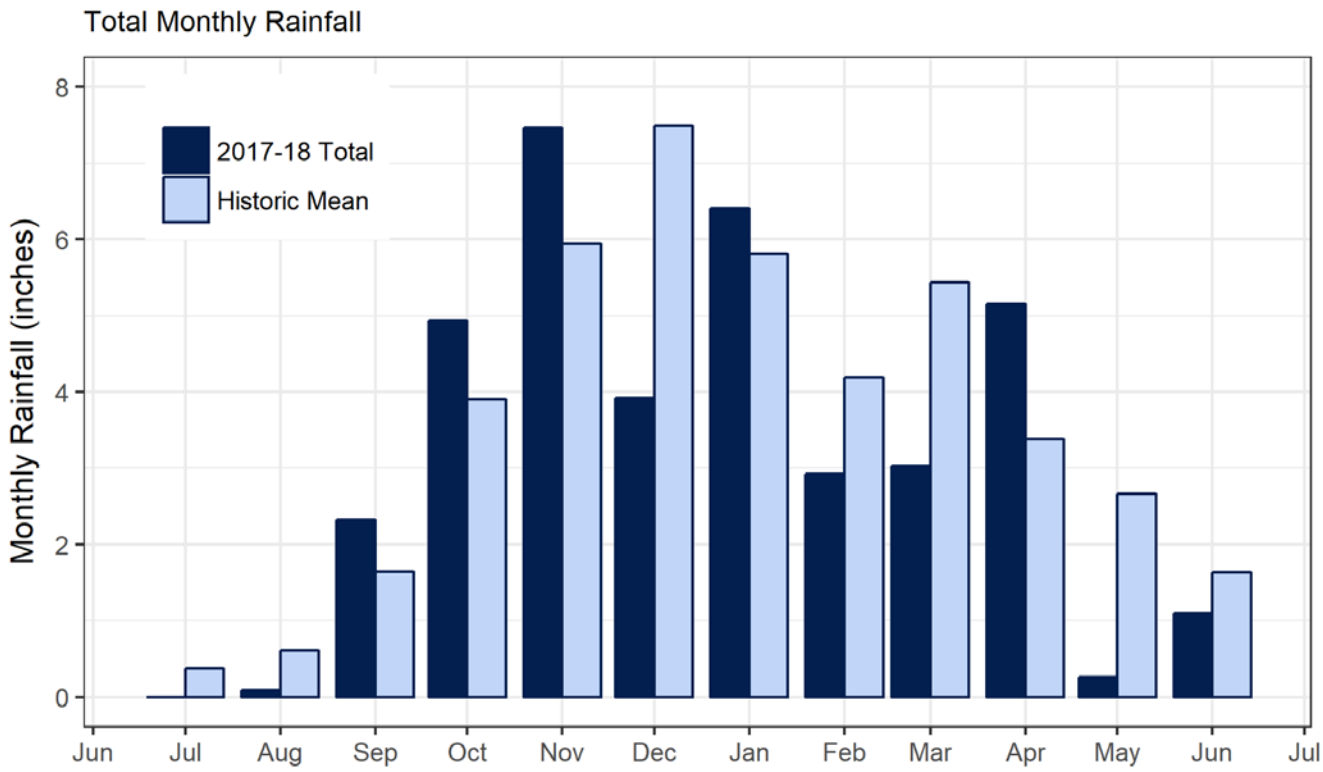

Figure 1. Mean total monthly rainfall recorded at eight stations across Portland from July 1, 2017, to June 30, 2018, compared to the mean monthly totals recorded over the previous 15 years (2002-2017).

Compared to previous years, the City received less rain by approximately 5.5 inches during the 2017-18 permit year. Many months experienced lower than average rainfall amounts, with the largest deviations occurring in December, March, and May (Figure 1).

3 MONITORING RESULTS

The following sections describe the results of the instream, stormwater, and biological monitoring conducted by the City during the 2017-18 permit year. Results are presented and summarized for each monitoring effort.

[6] More information about the HYDRA Rainfall Network can be found here: https://or.water.usgs.gov/non-usgs/bes.

3.1 Stormwater Monitoring

As described previously, the City conducts two sampling efforts to monitor stormwater conditions in the City of Portland: (1) probabilistic stormwater sampling and (2) historic fixed land-use stormwater sampling. The following sections describe the results of these sampling efforts.

3.1.1 Probabilistic Stormwater

Over the course of the 2017-18 permit year, the City sampled two rotating panels of underground injection control (UIC) sites during five storm events (Table 2). As described in Section 2.1, the UIC monitoring program is based on a probabilistic approach to characterize the stormwater runoff entering the City's UIC system. As such, the results presented in Table 7 represent population estimates for all of the City's UICs using the data collected during the 2017-18 permit year[7]. The water quality samples collected were analyzed for the full suite of required parameters, and the full set of results are included in Appendix B.

Total suspended solids (TSS), dissolved copper, and dissolved zinc were consistently detected in the stormwater runoff entering the City's UICs (100% detection; Table 7). Dissolved lead and total phosphorus (TP) were frequently detected, but not in all samples. The mean concentration estimates for all of the parameters presented in Table 7 is higher than the median concentrations. This indicates that there are a small number of higher concentration results that increase the mean value, but do not occur frequently enough to increase the median concentrations.

Table 7. Summary of probabilistic stormwater monitoring results from 2017-18 permit year. The results presented below represent population estimates for all of Portland's UICs based on 2017-18 sampling of 30 sites. The range of 95% confidence intervals from the sites is presented below each estimate.

	Dissolved Copper (µg/L)	**Dissolved Lead (µg/L)**	**Dissolved Zinc (µg/L)**	**Total Phosphorus (mg/L)**	**Total Suspended Solids (mg/L)**
No. of Samples	30	30	30	30	30
Detections	100% *100–100%*	68% *43–93%*	100% *100–100%*	91% *74–100%*	100% *100–100%*
Mean	1.92 *1.41–2.44*	0.27 *0.13–0.42*	9.72 *6.66–12.78*	0.20 *0.12–0.27*	71.48 *29.76–113.21*
Median	1.70 *0.87–2.4*	0.12 *0.1–0.19*	8.06 *5.66–11.22*	0.13 *0.08–0.29*	37.78 *11–125.64*
90th Percentile	2.50 *2.41–6.64*	0.53 *0.19–1.21*	12.77 *11.11–33.7*	0.38 *0.29–1.84*	177.21 *92.61–1930*

[7] In past monitoring reports, the probabilistic stormwater results were presented based on two traffic categories: (1) average daily vehicle trips (ADT) greater than 1,000, and (2) less than 1,000. The ADT traffic statistic was originally used as the stratification variable in the sample design of the probabilistic monitoring program. ADT values were calculated by the Portland Bureau of Transportation and used in the program design to ensure that a sufficient number of sites on high-traffic roads were included in the sample population. The ADT values have not been updated, and the distinction between the two categories used in the original sample design no longer reflects current traffic patterns. As such, this report does not use the ADT distinction to present the probabilistic stormwater results.

Overall, the dissolved copper, lead, and zinc concentrations show low variability. TSS concentrations, however, were highly variable. The probabilistic stormwater results were not compared to any water quality standards because no criteria apply directly to stormwater runoff.

3.1.2 Historic Fixed Land-Use Stormwater

The City sampled stormwater during three storms at each of the four historic fixed land-use sites during the permit year. As described in Section 2.2, the samples were collected as flow-weighted composite samples and represent the range of conditions observed over the course of the sampled storm.

All metals except for dissolved lead were detected during every storm event at all four sites (Table 8). The two non-detect dissolved lead samples were collected at the R2 site in the Columbia Slough watershed. Ammonia, nitrate, and TP were detected at all sites during each storm. Orthophosphate was detected at all of the sites; however, concentrations were below detection during the late-February storm sampled at both the M1 and R2 sites.

Table 8. Summary of water quality results from the 2017-18 permit year flow-weighted composite stormwater sampling at the four historic fixed land-use sites. At sites M1 and R2 during the October storm event, E. coli *grab samples were collected, but no flow-weighted composite stormwater samples were collected when interference by solids caused equipment malfunctions, as described in Section 2.2. A separate event was sampled to make up for this malfunction.*

Parameters	Mean	Median	Minimum	Maximum	Detections/ Samples
E. coli (MPN/100mL)	4,240	2,130	75	>24,000	14/14
Hardness (mg $CaCO_3$/L)	29.5	32.6	6.3	51.4	12/12
Total Organic Carbon (mg/L)	5.18	4.02	2.22	11.90	12/12
Total Suspended Solids (mg/L)	111	65	22	538	12/12
Metals (µg/L)					
Copper	13.01	12.15	4.64	25.50	12/12
Copper, dissolved	3.85	2.80	1.46	9.71	12/12
Lead	8.57	8.69	1.50	25.40	12/12
Lead, dissolved	0.27	0.21	<0.10	0.75	10/12
Zinc	115.8	129.5	30.8	234.0	12/12
Zinc, dissolved	46.3	31.9	8.5	122.0	12/12
Nutrients (mg/L)					
Ammonia	0.14	0.09	0.03	0.39	12/12
Nitrate	0.52	0.45	0.11	1.40	12/12
Orthophosphate	0.04	0.03	<0.02	0.08	10/12
Total Phosphorus	0.25	0.19	0.07	0.84	12/12

The Oregon Association of Clean Water Agencies (ACWA) sponsored a project to evaluate water quality data collected from land-use-based stormwater monitoring in Oregon[8]. The ACWA stormwater evaluation included the calculated mean concentrations for select pollutants based on the contributing land use (Table 9). The results from the ACWA stormwater evaluation provide a benchmark against which the composite stormwater sampling can be evaluated.

Table 9. Mean stormwater concentrations for select pollutants by dominant land use. Values are from Table 3-2 (p. 3-6) of the 1997 ACWA stormwater report.

Land Use	Total Suspended Solids (mg/L)	Total Copper (µg/L)	Total Zinc (µg/L)	Dissolved Copper (µg/L)	Total Phosphorus (mg/L)
Commercial	92	32	168	9	0.39
Industrial	194	53	629	9	0.63
Open	58	4	25	4	0.17
Residential	64	14	108	6	0.37
Transportation	169	35	236	8	0.38

TSS concentrations collected during the 2017-18 permit year were consistently lowest at the residential R2 site (22–27 mg/L; Figure 2) and lower than the mean TSS concentration of 64 mg/L for residential land use found by the ACWA study (Table 9). While the dominant land use contributing to the R1 site is also residential, R1 is an instream sampling location on Fanno Creek. The ACWA study included stormwater samples from the R1 site and found that TSS concentrations from the instream site were significantly different from the other residential sampling locations. The 2017-18 range of TSS concentrations from the instream R1 site were substantially higher than (58–538 mg/L; Figure 2) than those at R2, consistent with ACWA observations that differences in concentrations of water quality parameters may be explained by differences in conveyance systems and the physical processes at work.

The range of TSS concentrations (34–69 mg/L; Figure 2) observed during the 2017-18 permit year at the industrial site (OF19) were below the 194 mg/L mean TSS stormwater concentration for industrial land uses from the ACWA study. TSS concentrations from the mixed land use site (M1) did not vary substantially between storm events (101–113 mg/L; Figure 2). The contributing area to M1 is dominated by commercial and residential land use, but also includes a small industrial area.

[8] Eric W. Strecker, Binhong Wu, Michael Iannelli (1997). *Analysis of Oregon Urban Runoff Water Quality Monitoring Data Collected from 1990-1996*. Prepared for the Oregon Association of Clean Water Agencies by Woodward-Clyde Consultant, Portland, OR.

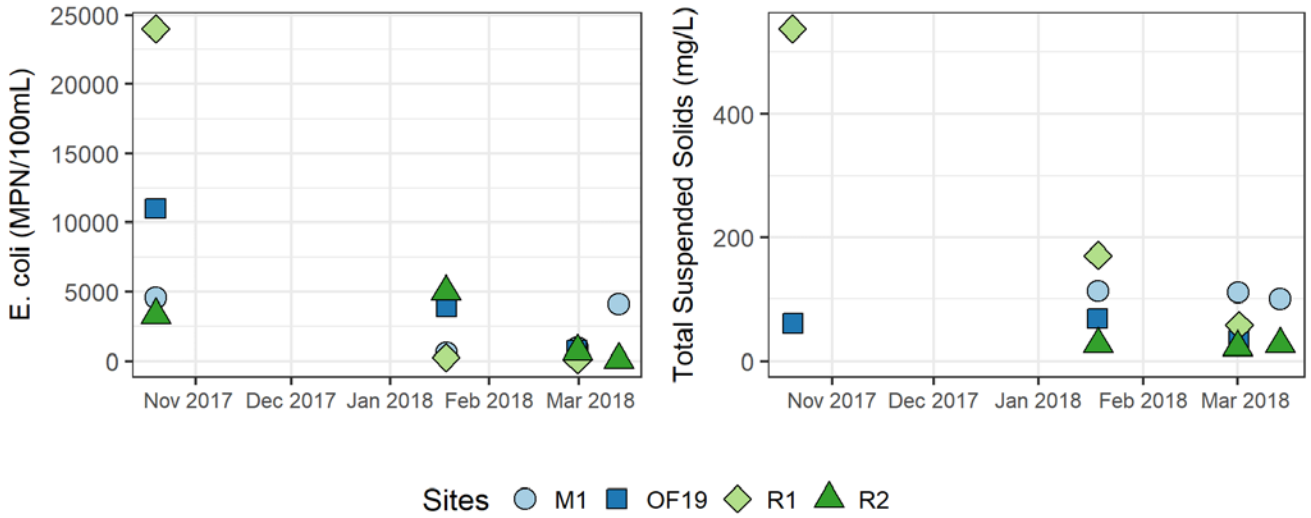

Figure 2. E. coli *grab samples and total suspended solids (TSS) flow-weighted stormwater concentrations observed at the four sites during the 2017-18 permit year.* E. coli *grab samples were collected at M1 and R2 during the October event; however, due to the sampling issues described in Section 2.2, the flow-weighted composite TSS samples were not collected at these two sites.*

The total copper concentrations from the industrial site (OF19) ranged from 9.7 to 14.2 µg/L, lower than the mean concentration of 53 µg/L found in the ACWA study. Total copper concentration range at the residential land use site R2 (4.6–12.3 µg/L; Figure 3) also fell below the mean concentration of 14 µg/L from the ACWA study. Dissolved copper concentrations varied between sampled storms but did not vary substantially between sites (Figure 3). This ACWA study also noted that mean dissolved copper concentrations did not differ substantially by land use, ranging from 4 to 9 µg/L. The range of dissolved copper concentrations observed during the 2017-18 permit year at all of the sites fell within the range of mean concentrations reported in the ACWA study.

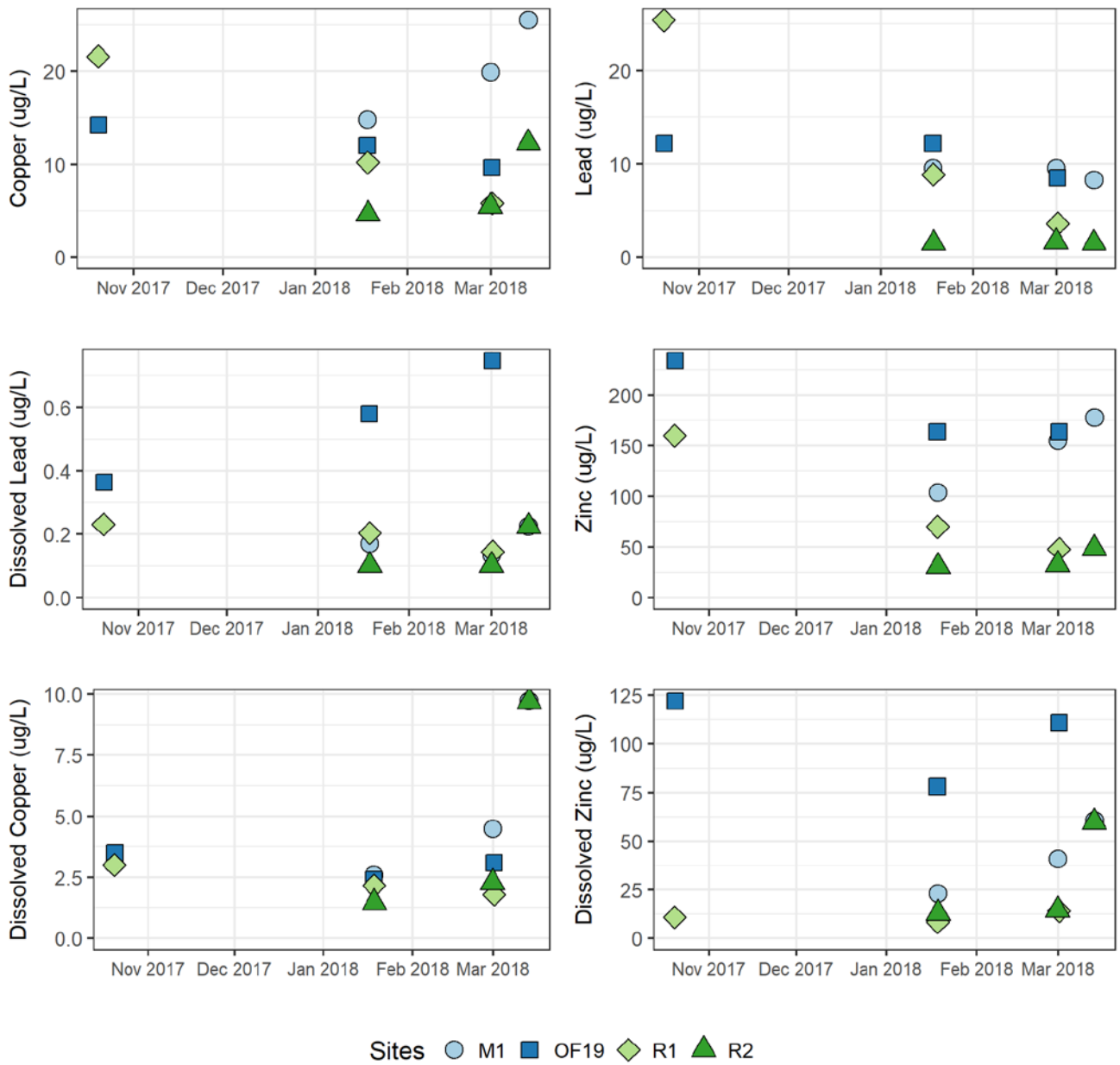

Figure 3. Flow-weighted stormwater concentrations of total and dissolved metals at the four historic fixed land-use sites during the 2017-18 permit year.

Except for the October sample at R1, total lead concentrations were highest at the industrial (OF19) and mixed (M1) land-use sites. Dissolved lead concentrations were consistently higher at the industrial land-use site (OF19) than any of the other sites (Figure 3).

Zinc concentrations—both total and dissolved—were typically highest at the industrial site (OF19). The concentration range for total zinc (164–234 µg/L) was substantially lower than the mean concentration 629 µg/L for industrial stormwater identified by the ACWA study. The concentration range for the R2 residential land use site (30.8 to 48.5 µg/L; Figure 3) was also lower than the mean total zinc concentration (108 µg/L) from the ACWA study. The range in concentrations of total zinc from 104 to 178 µg/L at the mixed land use site (M1) overlapped with the mean commercial (168 µg/L) and residential (108 µg/L) concentrations reported in the ACWA study (Table 9).

Nutrient concentrations varied between sites and storm events; however, concentrations at the R2 residential site were frequently lower than the other sites across all of the storm events. The ACWA study found that the mean TP concentrations associated with commercial and residential stormwater runoff were 0.37 and 0.39 mg/L, respectively. During the 2017-18 permit year, the range of TP concentrations (0.21–0.42 mg/L) from the mixed land-use site (M1) overlapped with the ACWA range.

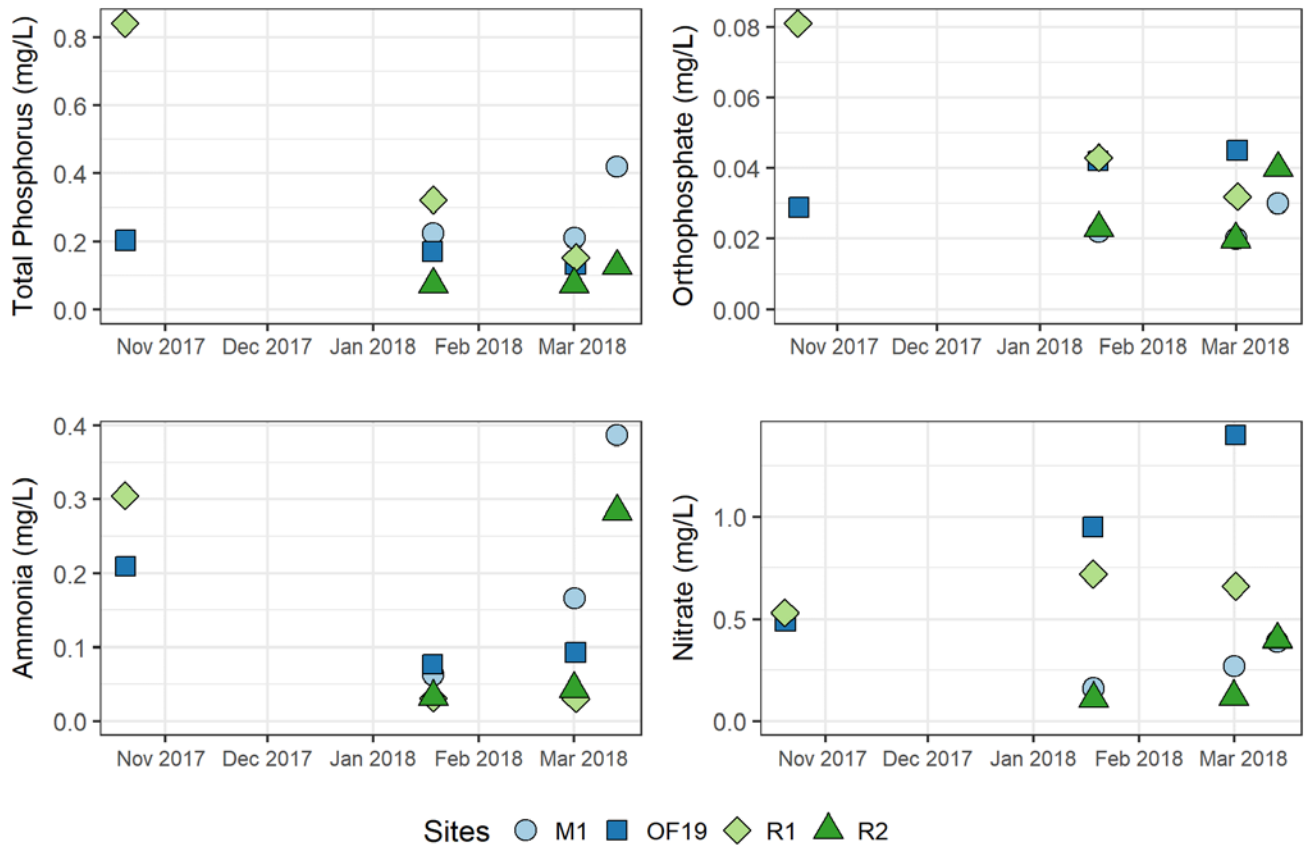

Figure 4. Flow-weighted stormwater nutrient concentrations observed at the four historic fixed land-use sites during the 2017-18 permit year.

Higher concentrations of many of the parameters were observed during the October storm event. Substantially more rainfall was recorded during the October event compared to the other sampled storms (Table 4). Additionally, the majority of the rainfall was recorded within a 12-hour period, which may have resulted in the higher concentrations.

3.2 Instream Monitoring

The City operates or supports multiple sampling efforts to monitor water quality and biological conditions within the City's streams and watersheds. The following sections describe the results of these sampling efforts.

3.2.1 Instream Water Quality

As described in Section 2.3, the City operates two monitoring programs that collect instream water quality samples (fixed sites and probabilistic sites). Throughout the 2017-18 permit year, the City collected 204 water quality samples across a range of flow and seasonal conditions. The water quality samples collected were analyzed for the full suite of required parameters, and the full set of results are included in Appendix B. The results presented here include the parameters with water quality criteria.

Table 10. Instream water quality results for dissolved copper from the 2017-18 permit year. Biotic Ligand Model chronic criteria ranged from 0.36 to 32.96 µg/L, with a mean of 5.2 µg/L. For the probabilistic samples, the exceedance percent represents an estimate of the probability of an exceedance occurring for the perennial streams in each watershed.

		Dissolved Copper (µg/L)				
Watershed		**Detections /Samples**	**Median**	**Minimum**	**Maximum**	**Exceedance Percent**
Columbia Slough	Fixed	12/12	0.66	0.43	1.38	0
	Probabilistic	28/30	0.55	<0.20	2.08	0
Johnson Creek	Fixed	12/12	1.18	0.43	1.49	0
	Probabilistic	20/20	0.96	0.46	1.33	0
Tualatin River	Fixed	11/11	1.09	0.79	2.86	0
	Probabilistic	25/25	0.68	0.28	2.87	0
Willamette Tributaries	Fixed	33/33	1.16	0.58	3.32	3
	Probabilistic	25/25	0.58	0.23	2.76	0
Willamette River	Fixed	36/36	0.44	0.34	1.24	0
	Probabilistic	--	--	--	--	--

Dissolved copper was consistently detected during the permit year—it was detected in all but two of the samples (Table 10). The median concentrations of dissolved copper did not vary substantially between watersheds; however, concentrations were typically lowest in the Columbia Slough. Only one exceedance of the dissolved copper water quality criteria was recorded during the permit year (Willamette River tributary). The chronic and acute water quality criteria for dissolved copper are calculated using the Biotic Ligand Model and are based on the concentration of ions, alkalinity, organic carbon, pH, and temperature of the sample. As such, a different calculated criterion applies to each water quality sample. For the samples collected during the 2017-18 permit year, the chronic dissolved copper criteria were consistently lower than the acute criteria, and ranged from 0.36 to 32.96 µg/L with a mean of 5.2 µg/L.

Table 11. Instream water quality results for dissolved lead from the 2017-18 permit year. The chronic water quality criterion for dissolved lead is based on hardness in the water column, ranging from 10.9 to 155.0 µg/L with a mean of 51.1 µg/L. For the probabilistic samples, the exceedance percent represents an estimate of the probability of an exceedance occurring for the perennial streams in each watershed.

Watershed		Dissolved Lead (µg/L)				
		Detections /Samples	Median	Minimum	Maximum	Exceedance Percent
Columbia Slough	Fixed	1/12	--	<0.10	0.11	0
	Probabilistic	0/30	--	<0.10	--	0
Johnson Creek	Fixed	1/12	--	<0.10	0.11	0
	Probabilistic	5/20	0.10	<0.10	0.13	0
Tualatin River	Fixed	6/11	0.11	<0.10	0.29	0
	Probabilistic	7/25	0.10	<0.10	0.48	0
Willamette Tributaries	Fixed	9/33	0.10	<0.10	0.26	0
	Probabilistic	7/25	0.10	<0.10	0.59	0
Willamette River	Fixed	36/36	0.02	0.01	0.05	0
	Probabilistic	--	--	--	--	--

Dissolved lead concentrations in all of the watersheds, except for the mainstem Willamette, were frequently below the detection limit. The chronic water quality criterion for dissolved lead is based on hardness in the water column. Each water quality sample is analyzed for hardness in order to calculate the appropriate water quality criterion for the sample. The mean calculated chronic criterion for dissolved lead was 51.1 µg/L, and ranged from 10.9 to 155.0 µg/L. No exceedances of the chronic dissolved lead criterion were observed during the 2017-18 permit year.

The analytical laboratory method used to analyze the Willamette River mainstem samples for dissolved lead differs from the method used for the other samples. The method used for the Willamette mainstem samples has a lower detection limit, which is reflected in the Table 11 by the higher rate of detections for the Willamette River mainstem and the lower reported concentrations. The City uses the low-level analytical method for Willamette River samples, as total and dissolved lead concentrations are consistently lower and below the detection limit of the standard procedure.

Table 12. Instream water quality results for dissolved zinc from the 2017-18 permit year. The chronic water quality criterion for dissolved zinc is based on hardness in the water column, ranging from 11.2 to 159 µg/L with a mean of 55.7 µg/L. For the probabilistic samples, the exceedance percent represents an estimate of the probability of an exceedance occurring for the perennial streams in each watershed.

Watershed		Dissolved Zinc (µg/L)				
		Detections /Samples	Median	Minimum	Maximum	Exceedance Percent
Columbia Slough	Fixed	9/12	1.97	<0.50	7.61	0
	Probabilistic	24/30	1.38	<0.50	8.36	0
Johnson Creek	Fixed	12/12	2.37	0.67	7.86	0
	Probabilistic	20/20	1.82	0.59	5.83	0
Tualatin River	Fixed	11/11	4.19	1.53	35.30	0
	Probabilistic	25/25	2.60	0.61	18.50	0
Willamette Tributaries	Fixed	33/33	12.90	2.34	47.30	12
	Probabilistic	17/25	0.69	<0.50	11.90	0
Willamette River	Fixed	23/36	0.55	<0.50	1.15	0
	Probabilistic	--	--	--	--	--

Dissolved zinc was frequently detected in all of the watersheds as part of both monitoring programs. The chronic water quality criterion for dissolved zinc is also based on hardness in the water column. As with dissolved lead, each water quality sample is analyzed for hardness in order to calculate the appropriate water quality criterion for the sample. The mean calculated criterion for dissolved zinc was 55.7 µg/L and ranged from 11.2 to 159.0 µg/L. Exceedances of the chronic dissolved zinc criterion were only observed in the Willamette River tributaries during the 2017-18 permit year (12%; Table 12). The higher concentrations of dissolved zinc are associated with the Fixed sampling program on the Willamette River tributaries. The 33 samples collected as part of this program are from three sampling locations on Tryon Creek.

Samples collected from the Willamette River mainstem consistently had lower concentrations of dissolved metals than samples from the other four watersheds (Tables 10-12). For all three dissolved metals, the Willamette mainstem samples had the lowest median concentration as well as the lowest maximum concentration of all the watersheds.

Table 13. Instream water quality results for total phosphorus (TP) from the 2017-18 permit year. The water quality criteria for TP vary by watershed. Samples from sites in the Tualatin watershed were evaluated using the appropriate TMDL limit and all other sites were evaluated against the 0.155 mg/L state criterion. For the probabilistic samples, the exceedance percent represents an estimate of the probability of an exceedance occurring for the perennial streams in each watershed.

		Total Phosphorus (mg/L)				
Watershed		**Detections /Samples**	**Median**	**Minimum**	**Maximum**	**Exceedance Percent**
Columbia Slough	Fixed	12/12	0.09	0.057	0.21	8
	Probabilistic	30/30	0.12	0.047	0.27	20
Johnson Creek	Fixed	12/12	0.08	0.035	0.21	17
	Probabilistic	20/20	0.05	0.028	0.14	0
Tualatin River	Fixed	11/11	0.13	0.040	0.19	45
	Probabilistic	25/25	0.08	0.034	0.23	16
Willamette Tributaries	Fixed	33/33	0.08	0.025	0.73	12
	Probabilistic	25/25	0.07	0.039	0.47	4
Willamette River	Fixed	31/31	0.05	0.030	0.07	0
	Probabilistic	--	--	--	--	--

TP was detected in all 204 samples collected during the 2017-18 permit year (Table 13). Oregon does not have a single water quality criterion for TP; however, two TMDLs for TP have been developed for two watersheds within the City: the Tualatin sub-basin (including Fanno Creek and Rock Creek) and the Columbia Slough. The maximum instream TP concentration set by the Columbia Slough TMDL is 0.155 mg/L. The Tualatin TP TMDL includes variable instream concentrations for each tributary, ranging from 0.04 to 0.19 mg/L. Sites within these two watersheds were assessed against the appropriate TP limit. For the purposes of evaluating TP concentrations in other part of the City, the 0.155 mg/L load allocation from the Columbia Slough TMDL has been used.

During the 2017-18 permit year, the highest median TP concentrations were observed in the Columbia Slough and Tualatin watersheds. Higher exceedance percentages were also recorded in these watersheds with approximately 45% of the samples from the fixed site on Fanno Creek exceeding the applicable 0.13 mg/L criterion (Table 13).

Table 14. Instream water quality results for E. coli *from the 2017-18 permit year. Results from the two instream monitoring programs (Fixed and Probabilistic programs) are included. All samples were evaluated against the chronic water quality criteria of 406 MPN/100 mL to determine exceedances. For the probabilistic samples, the exceedance percent represents an estimate of the probability of an exceedance occurring for the perennial streams in each watershed.*

Watershed		Detections /Samples	*E. coli* (MPN/100 mL) Median	Minimum	Maximum	Exceedance Percent
Columbia Slough	Fixed	12/12	58	10	360	0
	Probabilistic	25/30	34	<10	260	0
Johnson Creek	Fixed	12/12	220	63	1,200	33
	Probabilistic	20/20	310	30	650	30
Tualatin River	Fixed	11/11	460	120	5,800	55
	Probabilistic	24/25	110	<10	2,300	32
Willamette Tributaries	Fixed	33/33	400	10	10,000	48
	Probabilistic	16/25	10	<10	1,800	8
Willamette River	Fixed	36/36	24	1	180	0
	Probabilistic	--	--	--	--	--

E. coli is used by the Department of Environmental Quality as an indicator of human pathogens to protect recreational contact. The numeric bacteria criteria include two limits for freshwater contact: (1) a 90-day geometric mean of 126 *E. coli* organisms per 100 mL and (2) no single sample may exceed 406 *E. coli* organisms per 100 mL. The two instream sampling programs do not collect samples at a sufficient frequency to evaluate exceedances of the first criteria. As such, all of the instream *E. coli* samples were evaluated against the maximum allowable concentration of 406 organisms per 100 mL.

No exceedances of the *E. coli* criterion were observed in the Columbia Slough or mainstem Willamette during the 2017-18 permit year (Table 14). In each watershed, the highest exceedances were associated with samples from the fixed sites. While the probabilistic sampling program includes sites on larger streams, multiple smaller tributaries are also sampled. Conversely, the fixed sites are all located on larger streams with large drainage areas which may explain the higher exceedance percentages within the Johnson Creek, Tualatin River, and Willamette River Tributary watersheds.

3.2.2 Instream Flow and Temperature

Stream discharge was recorded at the seven U.S. Geological Survey (USGS) stream gages in the Portland area. Water temperature was recorded at four of the seven gages. The following sections present the results from the 2017-18 permit year.

3.2.2.1 Instream Flow

The effect of precipitation patterns during the permit year were observed in the stream discharge recorded at the USGS gages within the City. The effects of the drier than usual December (Figure 1) can be seen in the instream flow recorded at the five tributary gages (Figure 5 and Figure 6). Flows in Fanno Creek fell below the historic 10th percentile in December, and flows in Tryon Creek reached the 10th percentile low flow in mid-December (Figure 5). Instream flows in Fanno and Tryon Creeks also responded to increased precipitation in April with peak flows that exceeded both the 90th and 95th percentiles for discharge in April.

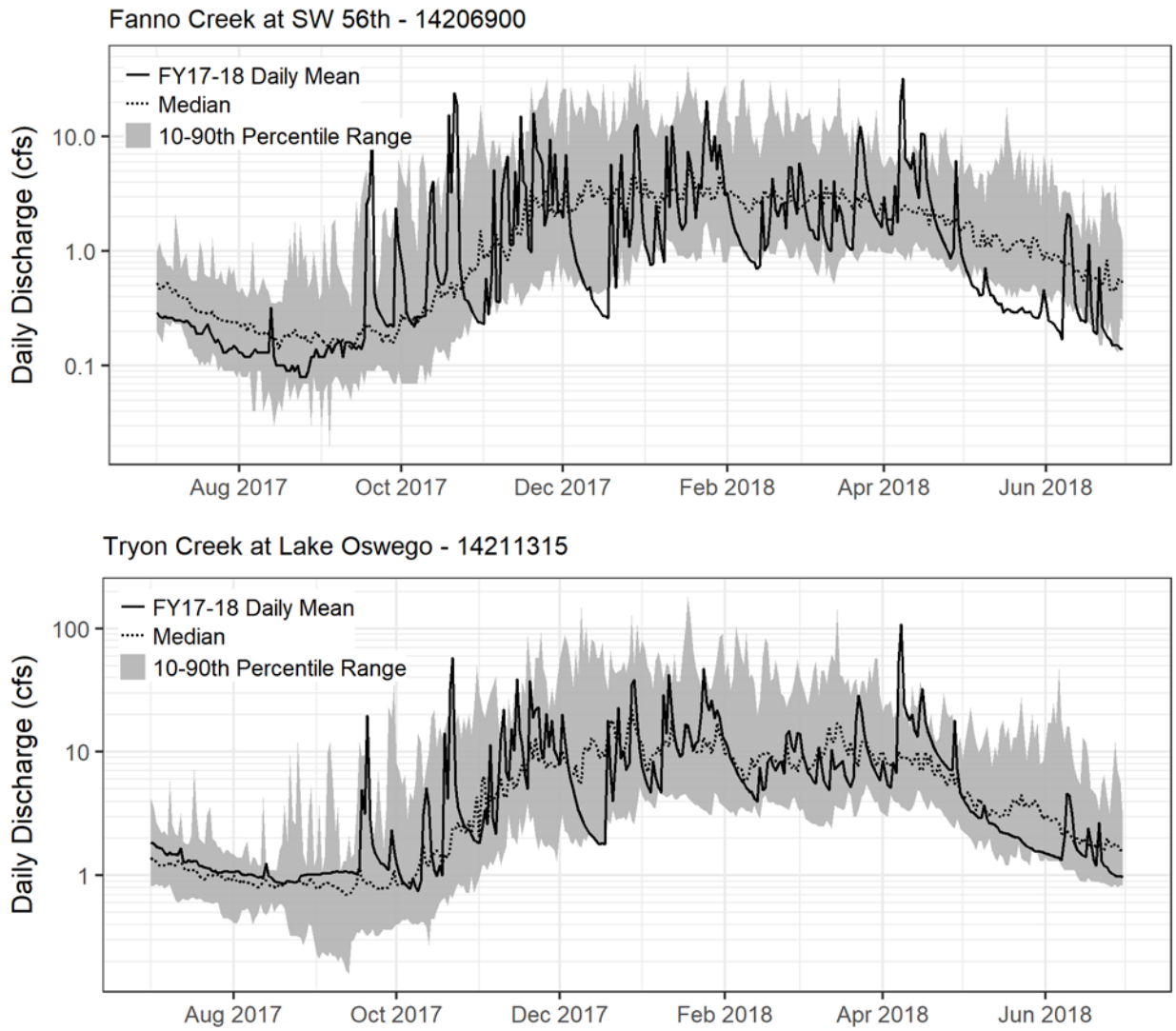

Figure 5. Mean daily discharge (solid line) recorded at the two westside USGS gages #14206900 (Fanno) and #14211315 (Tryon) during the 2017-18 permit year and the historic median (dotted line) and 10-90th percentile range (grey area) of observed flows from the available period of record (27 and 16 years, respectively).

Flows in the Johnson Creek watershed also responded to the precipitation patterns observed during the permit year. Kelley and Johnson Creek discharges decreased during the period of dry weather in December, approaching the 10th percentile low flows (Figure 6). May and June flows in Kelley and Johnson Creek were typically below the historic median flows in 2018 (Figure 6). The heavy precipitation in early April resulted in high flows throughout the Johnson Creek watershed; however, gage heights did not exceed flood stage.

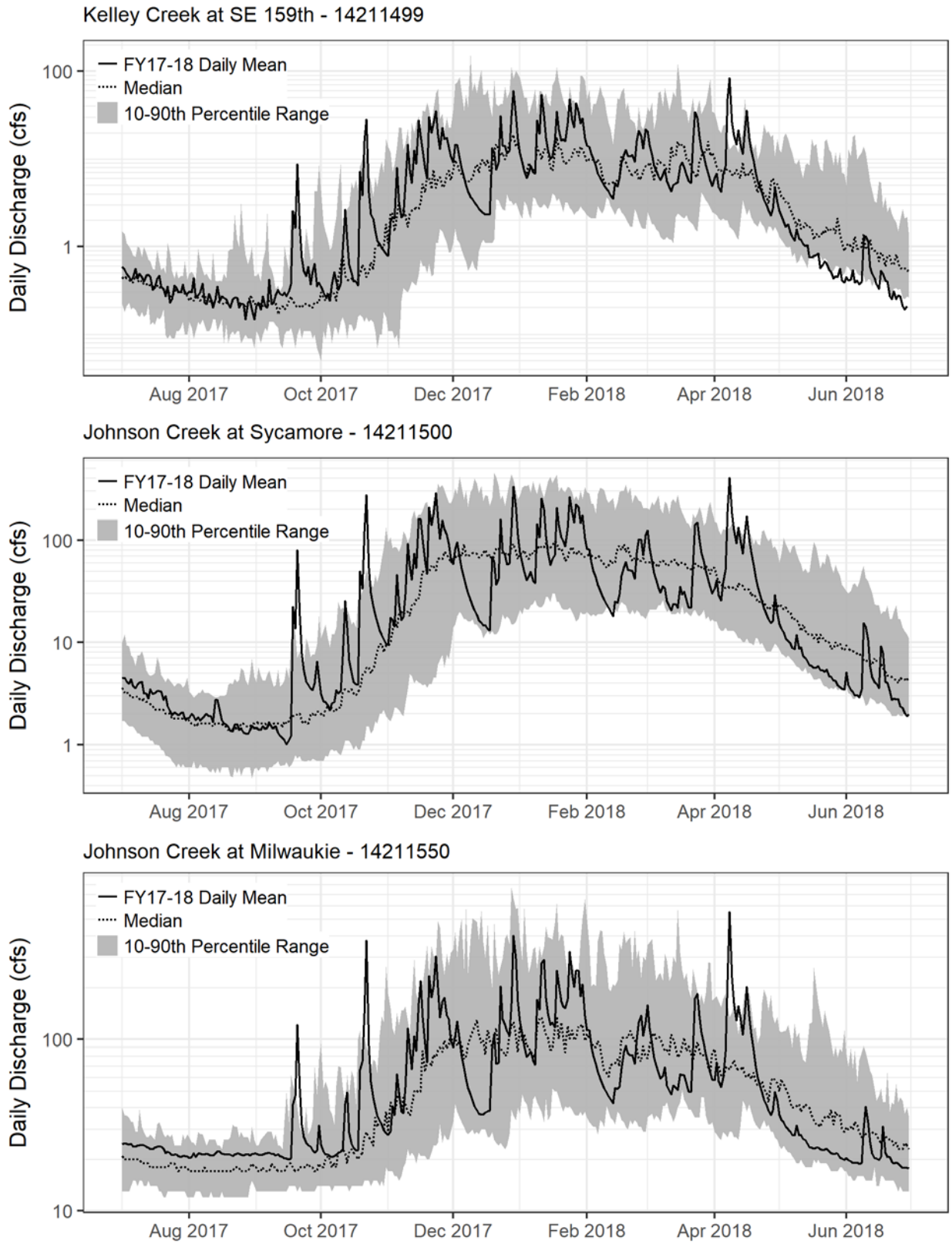

Figure 6. Mean daily discharge (solid line) recorded at the three eastside USGS gages (#14211499, #14211500, and #14211550) during the 2017-18 permit year and the historic median (dotted line) and 10-90th percentile range (grey area) of observed flows from the available period of record (17, 77, and 28 years, respectively).

The Columbia Slough is tidally influenced, and negative flows are routinely observed as a result of the tidal fluctuations. The substantial negative flow in early to mid-May (Figure 7) corresponds to the period of elevated discharge in the Columbia River during the spring freshet.

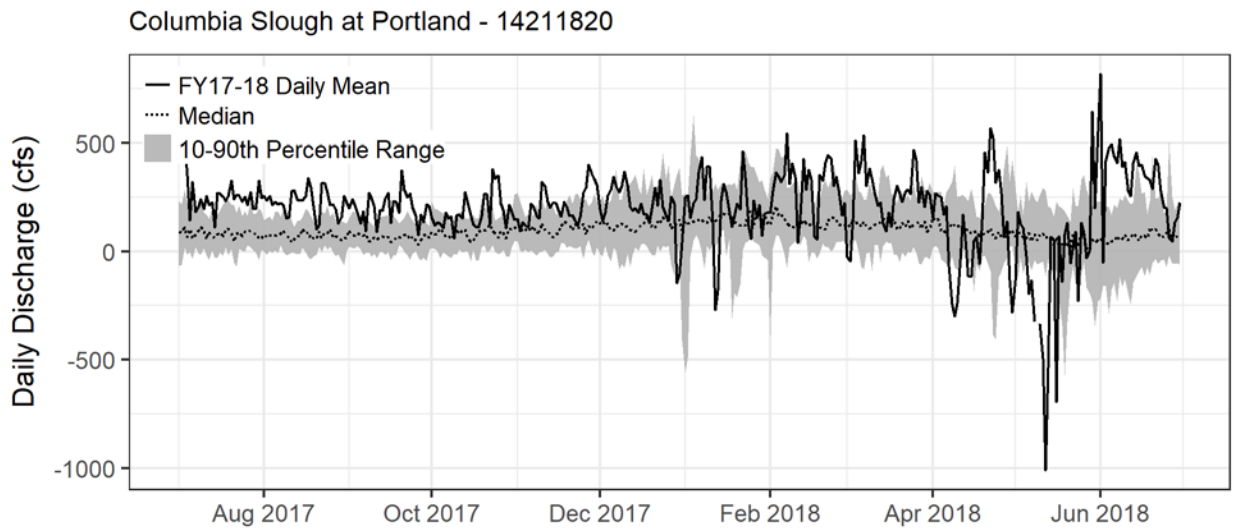

Figure 7. Columbia Slough mean daily discharge (solid line) recorded at USGS gage #14211820 during the 2017-18 permit year and historic median (dotted line) and 10-90th percentile range (grey area) of observed flows from the available 28-year period of record (1990-2018). The Columbia Slough is tidally influenced, and the data presented have not been corrected.

Willamette River flows in Portland were generally consistent with previous years. The spring freshet occurred in early April, when a combination of rain and snowmelt resulted in peak discharge of 90,500 cfs (Figure 8). After the spring freshet, flows in the Willamette River decreased and remained below historic median flow for the remainder of the permit year.

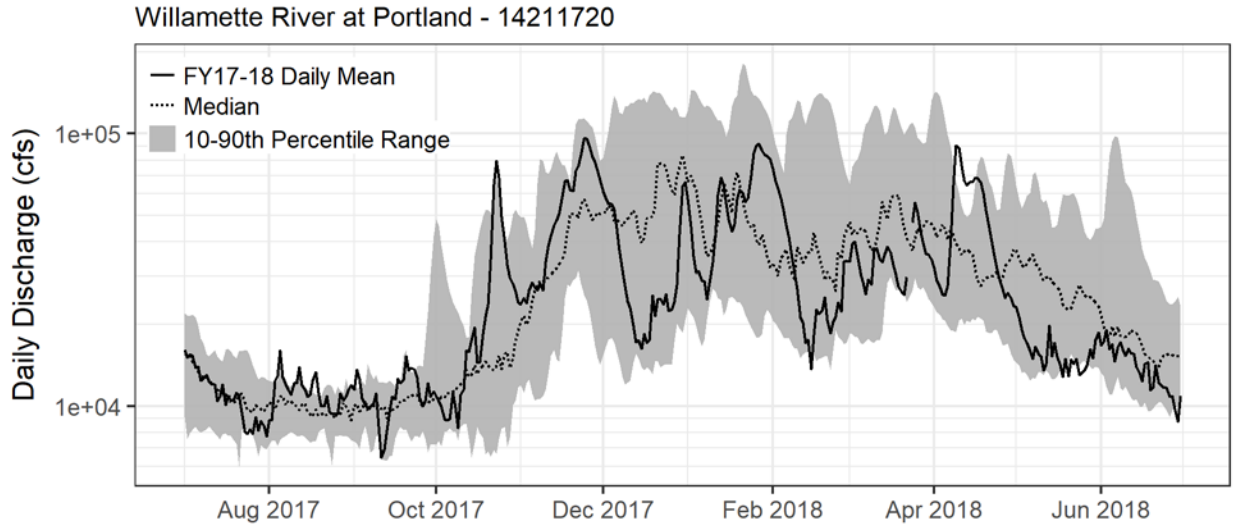

Figure 8. Willamette mean daily discharge (solid line) at Portland recorded at USGS gage #14211720 during the 2017-18 permit year and the historic median (dotted line) and 10-90th percentile range (grey area) of observed flows from the available 11-year period of record (2007-2018). Discharge values have been corrected for tidal influences by the USGS using the 2011 method for Processing and Publication of Discharge and Stage Data Collected in Tidally-Influenced Areas. Unfiltered discharge values are available from 1988-2018.

3.2.2.2 Temperature

Johnson Creek water temperatures at the Sycamore gage exceeded the 7-day average daily maximum (7DADM) temperature criterion for rearing and migration (18°C) from July 1 to September 17 in 2017 (Figure 9). In 2018, water temperatures exceeded the rearing and migration criterion periodically in late spring and early summer, with the 7DADM temperature consistently exceeding 18°C for the last 2 weeks of June. Water temperatures at the Sycamore gage remained below the spawning criterion throughout all of the fall and winter. In the late spring, however, water temperatures increased, resulting in exceedances of the spawning criterion from late-April to mid-May. In total, water temperatures at the Sycamore gage exceeded the temperature criterion for less than 10% of the spawning season (21 of 213 days).

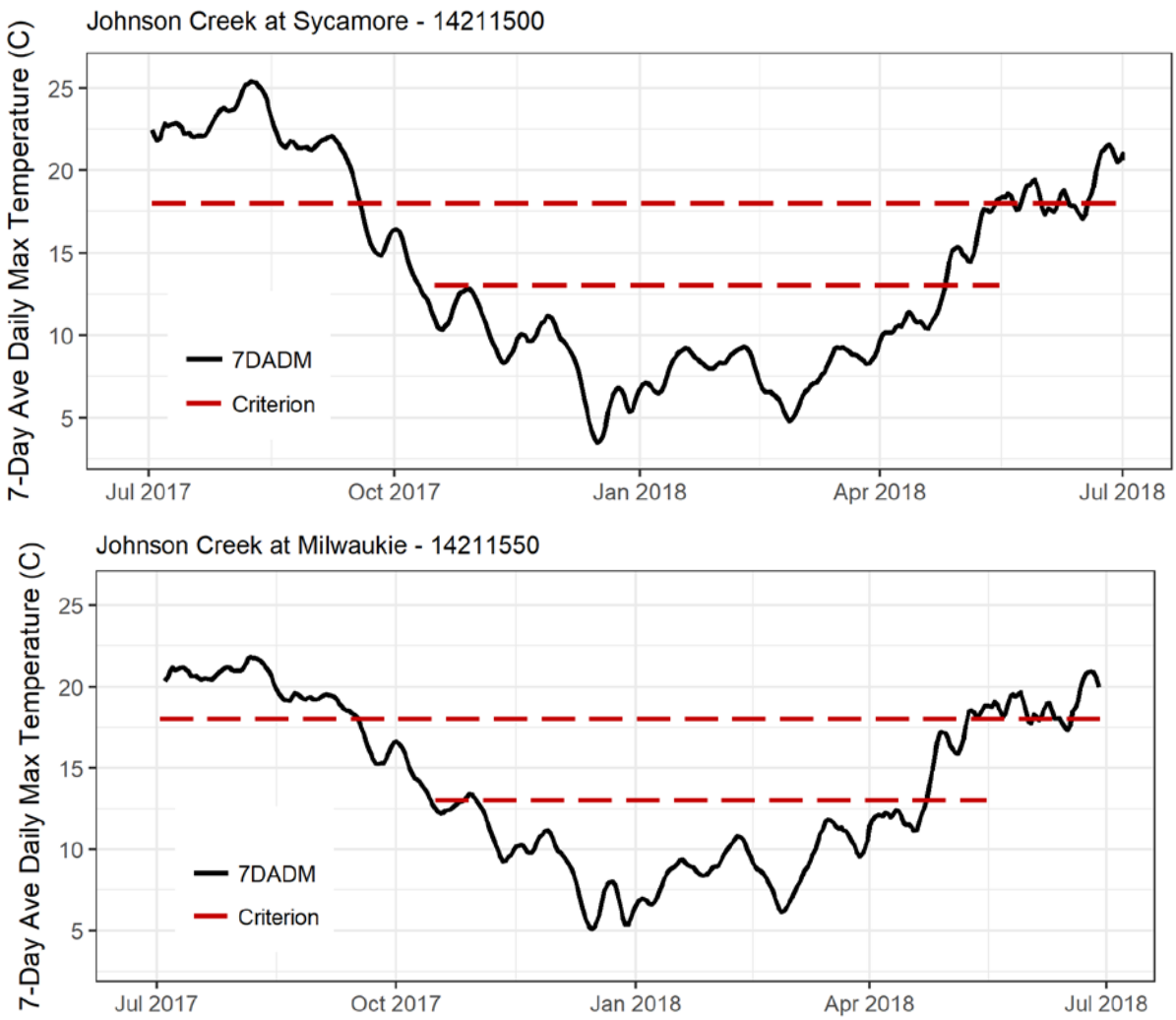

Figure 9. Seven-day average daily maximum (7DADM) Johnson Creek water temperatures recorded at USGS gage #14211500 at Sycamore and USGS gage #14211550 at Milwaukie during the 2017-18 permit year. The dashed red lines represent the applicable temperature criteria for salmonid spawning (13°C) and rearing and migration (18°C).

Johnson Creek water temperatures at the Milwaukie gage followed a similar pattern to those recorded at the upstream Sycamore gage. Summer temperatures exceeded the 7DADM temperature criterion for rearing and migration (18°C) from July 1 to September 16 in 2017 (Figure 9), dipping below the criterion one day earlier than the Sycamore gage. Water temperatures exceeded the spawning temperature

criterion for 5 days at the end of October. The water temperatures above the spawning criterion in October exceeded the criterion by less than 0.5°C. As with the Sycamore gage, water temperatures began increasing quickly in mid-April and exceeded the spawning criterion for the final 24 days of the spawning window. In 2018, water temperatures exceeded the rearing and migration criterion periodically in late spring and early summer, with the 7DADM temperature consistently exceeding 18°C for the last 2 weeks of June.

Johnson Creek water temperatures at the downstream gage at Milwaukie are consistently cooler than the upstream gage at Sycamore during the summer and early fall (Figure 9). The observed downstream cooling effect is a result of multiple cold-water tributaries flowing into Johnson Creek between the two gages. One of the larger tributaries is Crystal Spring Creek, which flows into Johnson Creek approximately 1 mile upstream of the Milwaukie gage.

City staff collected additional temperature data at the Crystal Springs confluence in 2017 as part of the Bureau of Environmental Services' project effectiveness monitoring. During the summer, staff deployed two temperature loggers, one in Johnson Creek and one in Crystal Springs. Both loggers were located upstream of the confluence. The data collected at the confluence highlighted the important cooling effect of Crystal Springs on Johnson Creek (Figure 10). Johnson Creek water temperatures downstream of the confluence were substantially cooler that those upstream of Crystal Springs. The daily maximum Johnson Creek water temperatures recorded by the USGS gage at Milwaukie were approximately 2-3°C cooler than the temperatures upstream of the Crystal Springs confluence.

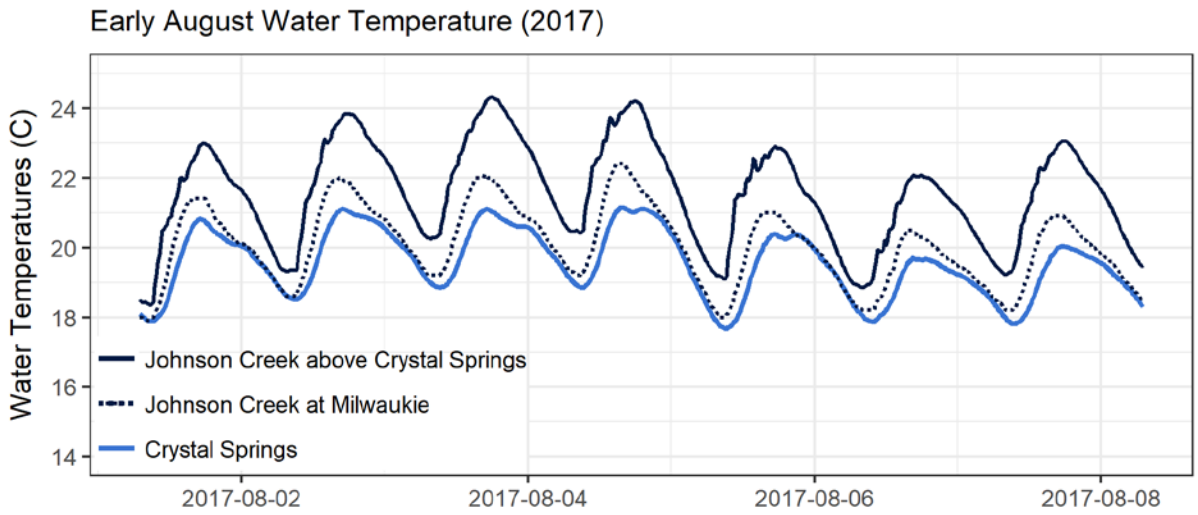

Figure 10. Continuous water temperatures readings for Crystal Springs and Johnson Creek, both upstream of their confluence, and temperatures recorded at the Milwaukie USGS stream gage (#14211550) in early August 2017.

Consistent with the two other Johnson Creek gages, summertime temperatures in Kelley Creek remained above the rearing criterion throughout the summer of 2017 until mid-September. Kelley Creek water temperatures remained below the spawning criterion throughout the fall and winter. Beginning in late April, water temperatures started exceeding the spawning criterion and remained above the criterion for the final 21 days of the spawning window. While water temperatures in Kelley Creek followed a similar warming pattern to the two Johnson Creek gages in May 2018, the increase did not result in temperatures over the rearing criterion until the end of June.

Figure 11. Seven-day average daily maximum (7DADM) Kelley Creek water temperatures recorded at USGS gage #14211499 at SE 159th Ave. during the 2017-18 permit year. The dashed red lines represent the applicable temperature criteria for salmonid spawning (13°C) and rearing and migration (18°C).

Like Crystal Springs, Kelley Creek provides cold water to Johnson Creek. Kelley Creek flows into Johnson Creek approximately half a mile upstream of the Sycamore gage. The impact on Johnson Creek water temperatures, however, is smaller than the change seen at the Crystal Springs confluence. This is likely a result of lower instream flow from Kelley Creek. Summertime flows in Kelley Creek are low, typically less than 1 cfs (Figure 6) and represent only a small fraction of the total flow in Johnson Creek.

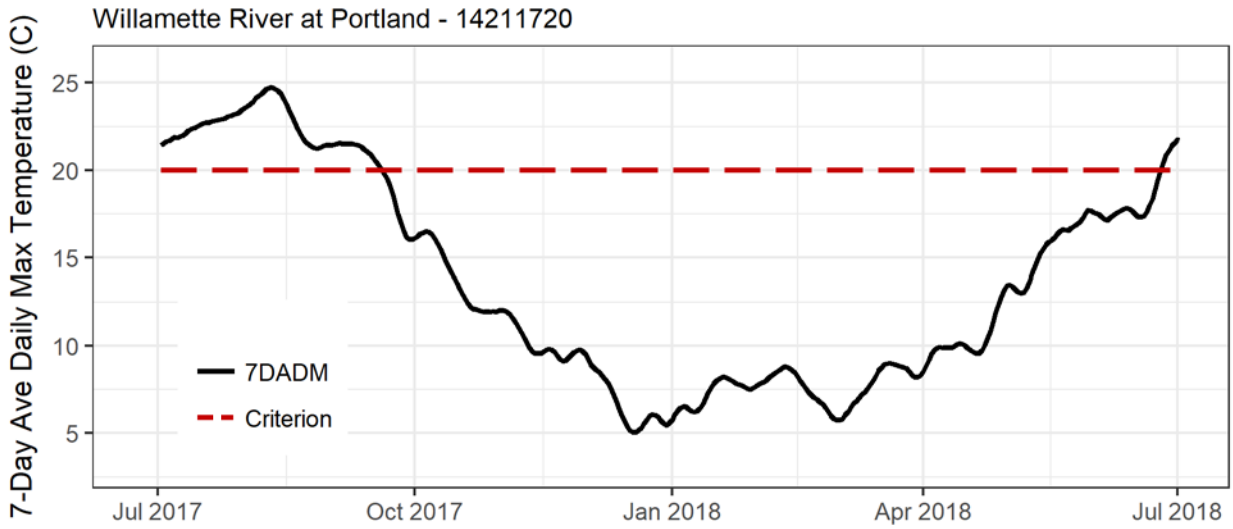

Figure 12. Seven-day average daily maximum (7DADM) Willamette River water temperatures recorded at USGS gage #14211720 at the Morrison Bridge during the 2017-18 permit year. The dashed red line represents the applicable temperature criterion for salmonid migration (20°C).

Unlike the Johnson and Kelley Creeks, the Willamette River in Portland is designated a migration corridor for salmon and steelhead with no rearing or spawning uses. As such, a single temperature criterion applies for the entire year (20°C). Willamette River water temperatures exceeded the migration corridor temperature limit from July 1 to September 18 in 2017 (Figure 12). Temperatures declined quickly in late

September and remained below the temperature criterion until the end of June. In the summer of 2018, the Willamette exceeded the migration corridor temperature criterion for the final 7 days of the permit year.

3.2.3 Macroinvertebrates

Aquatic macroinvertebrate samples were collected at 14 perennial sites during the 2017-18 permit year as part of the Portland Area Watershed Monitoring and Assessment Program (PAWMAP) monitoring program. Samples are not collected from stream sites in the Columbia Slough as these sites are not riffle-dominated wadeable systems. As described in Section 2.3, the probabilistic instream sampling included in PAWAMP is based on four rotating panels, with 20 perennial sites included in each panel. Each 4-year PAWMAP cycle includes the same 80 perennial monitoring sites[9]. The 2017-18 permit year corresponded to the final year of the second 4-year PAWMAP monitoring cycle. Consequently, two full cycles of macroinvertebrate data have been collected.

DEQ uses the PREDATOR model to evaluate the condition of macroinvertebrate communities. The PREDATOR model was developed by DEQ and can be used to evaluate the observed macroinvertebrate community compared to the expected macroinvertebrate community[10]. The model uses reference and site conditions to predict the expected community characteristics in the absence of human influences. The ratio between the sampled macroinvertebrate (observed) score to the predicted macroinvertebrate (expected) score provides an estimate of the level of impact. The PREDATOR model includes benchmarks to describe the biological conditions of a sample that are based on the distribution of Observed/Expected (O/E) ratios from reference sites. The benchmarks are based on the 10th and 25th percentiles of reference distribution. For the Marine Western Coastal Forest region, samples with Observed/Expected (O/E) ratios above 0.91 are considered to be “least impacted,” and those between 0.85 and 0.91 “minimally impacted.”

The highest O/E ratios during the 2017-18 permit year were observed on the sites on the Willamette River Tributaries (Table 15). The highest O/E ratio in the 2017-18 permit year was 0.86 in Miller Creek (Willamette River tributary). This was the only site with a “minimally impacted” O/E ratio. The median O/E ratios and ranges in Johnson Creek and the Tualatin Tributaries were similar and are indicative of impacted macroinvertebrate communities.

[9] Between the first and second monitoring cycles, some monitoring sites have been removed from the program and replaced with alternate sites. This has occurred due to a withdrawal of landowner permissions or changing site conditions.

[10] Hubler, S. (2008). *PREDATOR: Development and use of RIVPACS-type macroinvertebrate models to assess the biotic condition of wadeable Oregon streams*.

Table 15. Median Observed/Expected (O/E) macroinvertebrate ratio. Samples from the 2017-18 permit year were collected in the fall of 2017 and are included in the median value for Cycle 2. The "minimally impacted" benchmark value set by DEQ is an O/E ratio of 0.85 or higher.

	Macroinvertebrate Observed/Expected Ratio			
Watershed	**Cycle 1 Median (2010-2013)**	**Cycle 2 Median (2014-2017)**	**2017-18 Median**	**2017-18 Range**
Johnson Creek	0.49	0.39	0.39	0.34–0.44
Tualatin Tributaries	0.41	0.43	0.43	0.34–0.49
Willamette Tributaries	0.69	0.62	0.73	0.58–0.86

4 EVALUATION OF TRENDS

One of the objectives of the monitoring program is to evaluate long-term trends in receiving waters associated with Municipal Separate Storm Sewer System (MS4) stormwater discharges. Evaluating the biological and water quality data collected over a period of time provides insight into whether conditions in Portland's streams are changing. The following sections discuss some of the observed trends.

4.1 MACROINVERTEBRATE TRENDS

As described in previous sections, the 2017-18 permit year represented the final monitoring year in the second 4-year Portland Area Watershed Monitoring and Assessment Program (PAWMAP) monitoring cycle. With the two full cycles of macroinvertebrate data, it is possible to evaluate whether there has been a change in the macroinvertebrate community between the two cycles.

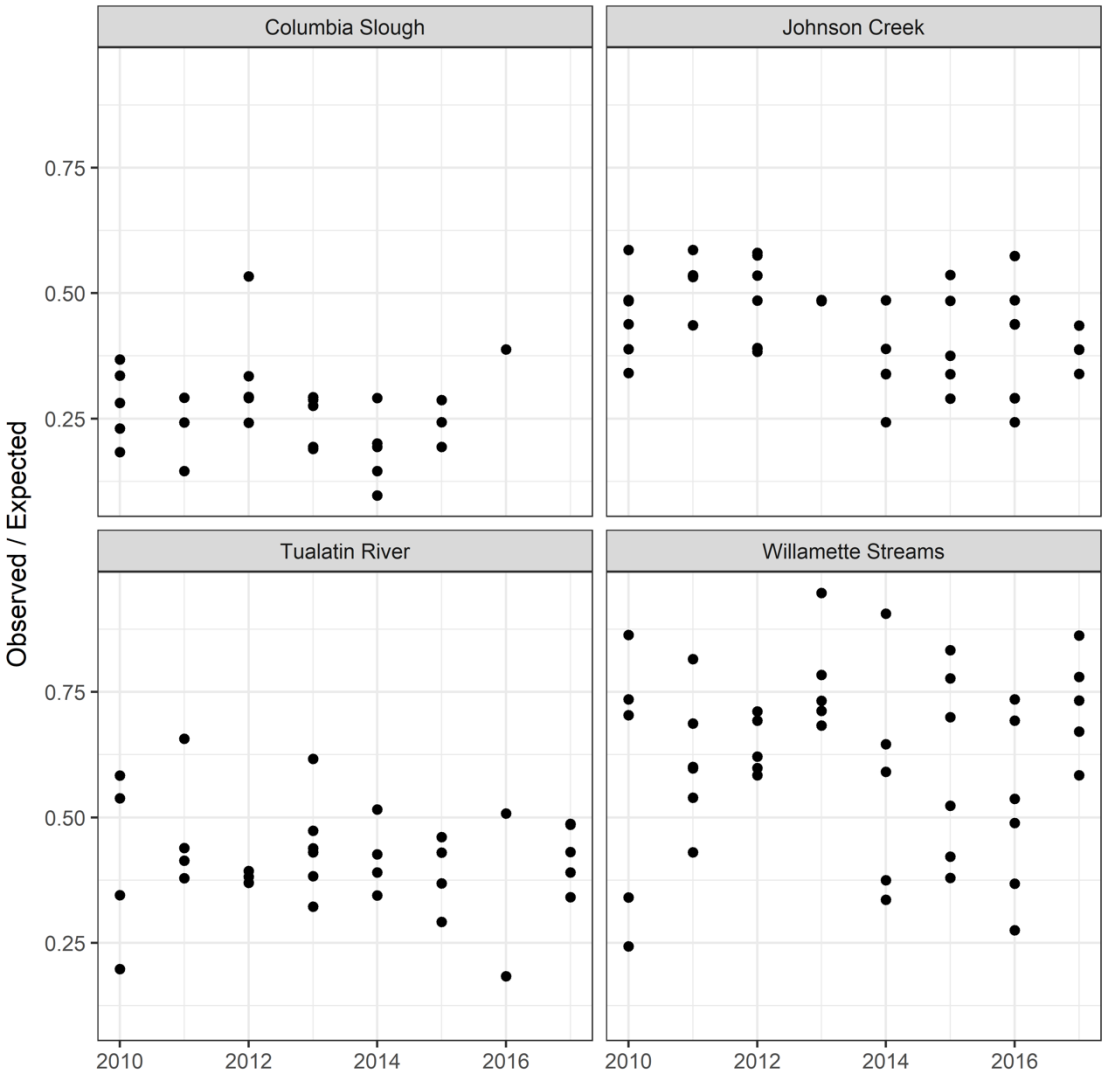

Figure 13. Observed/Expected (O/E) ratios for all eight years of macroinvertebrate samples. Columbia Slough results are included for illustration; however, macroinvertebrate samples are no longer collected at sites in the Columbia Slough. Samples with O/E ratios above 0.91 are considered to be "least impacted," and those between 0.85 and 0.91 "minimally impacted."

The O/E ratios vary between watersheds, with the highest ratios typically seen in the Willamette River tributaries (Figure 13). In Portland, "minimally impacted" macroinvertebrate communities are only found in the Willamette River tributary streams (O/E ratios ≥0.85; Figure 13).

It is also possible to compare changes at individual monitoring sites. Figure 14 plots the O/E ratio for the first monitoring cycle (2010-13) against the O/E ratio for the second cycle (2014-17) for each sampling location. Sites that fall along the solid 1:1 line saw no change in the macroinvertebrate O/E ratio between the two monitoring cycles. Sites below the line had a higher O/E ratio during the first cycle (2010–13), and sites above the line had a higher O/E ratio during the second cycle (2014–17).

The results of the individual site comparison suggest that there was a change in the macroinvertebrate community between the two monitoring cycles, resulting in lower O/E ratios. Approximately 60% of the sites had a lower O/E ratio, while approximately 30% had a higher O/E ratio during the second cycle. The

remaining 10% of the sites had a negligible change in O/E ratios. The O/E ratios for the two 4-year monitoring cycles were compared using a Wilcoxon signed-rank test. The O/E ratios from the first cycle (2010-13) were significantly higher than the O/E ratios from the second cycle (2014-17).

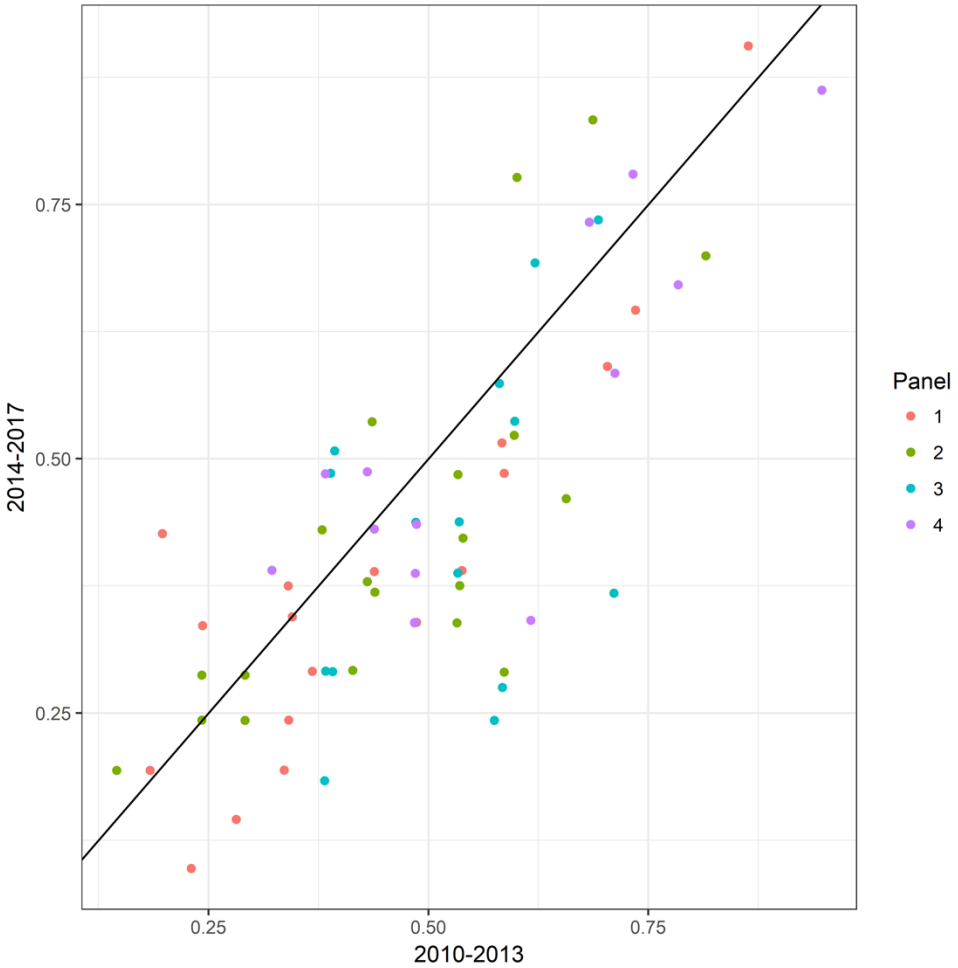

Figure 14. Comparison of macroinvertebrate Observed/Expected ratio from the two complete monitoring cycles for each monitoring site. The solid black line represents the 1:1 line.

Many factors can affect the composition of a macroinvertebrate community, including differences in weather or instream flows. Other factors, such as water quality or instream habitat, can also have an effect on the macroinvertebrate community composition at a site. Changes in these characteristics, however, may reflect anthropogenic impacts rather than natural variability. As the monitoring program continues to collect additional data, it will be important to evaluate whether these trends of declining O/E ratios continue. Additionally, a more thorough investigation into the site conditions (e.g., stream habitat and water quality) is needed to more fully evaluate the trend in O/E ratios, as well as other metrics for biological integrity. The O/E ratio is one of many metrics that can be used to characterize the health of the macroinvertebrate community at a site.

4.2 Probabilistic Stormwater Trends

The City's probabilistic stormwater monitoring program has included the collection of water quality data for over a decade, providing a long-term water quality dataset for stormwater runoff and insight into the year-to-year variability in water quality concentrations for multiple stormwater parameters. For all the sampled metals, the median concentrations (solid lines in Figure 15) were consistently lower than the mean concentrations (dashed lines in Figure 15). The difference in mean and median concentrations, as well as the large range between the 50th and 90th percentile concentrations, indicate that concentrations are typically lower and closer to the median value, with a small number of high concentration samples. These characteristics are seen consistently from year to year and across all of the parameters.

The results from the long-term probabilistic stormwater monitoring for total suspended solids (TSS) provides an example of the observed variability. The mean and median 2017-18 TSS results (Figure 15) initially suggest that there was an increase in the most recent sampling year; however, the 95% confidence intervals for TSS were large (Table 7). The confidence interval for the median TSS concentration ranged from 11 to 126 mg/L (Table 7), which fully encompasses the calculated median values for all previous sampling years (Figure 15). Outliers are observed across all the parameters, but overall the concentration ranges are consistent and any trends in concentrations fall within the calculated confidence intervals.

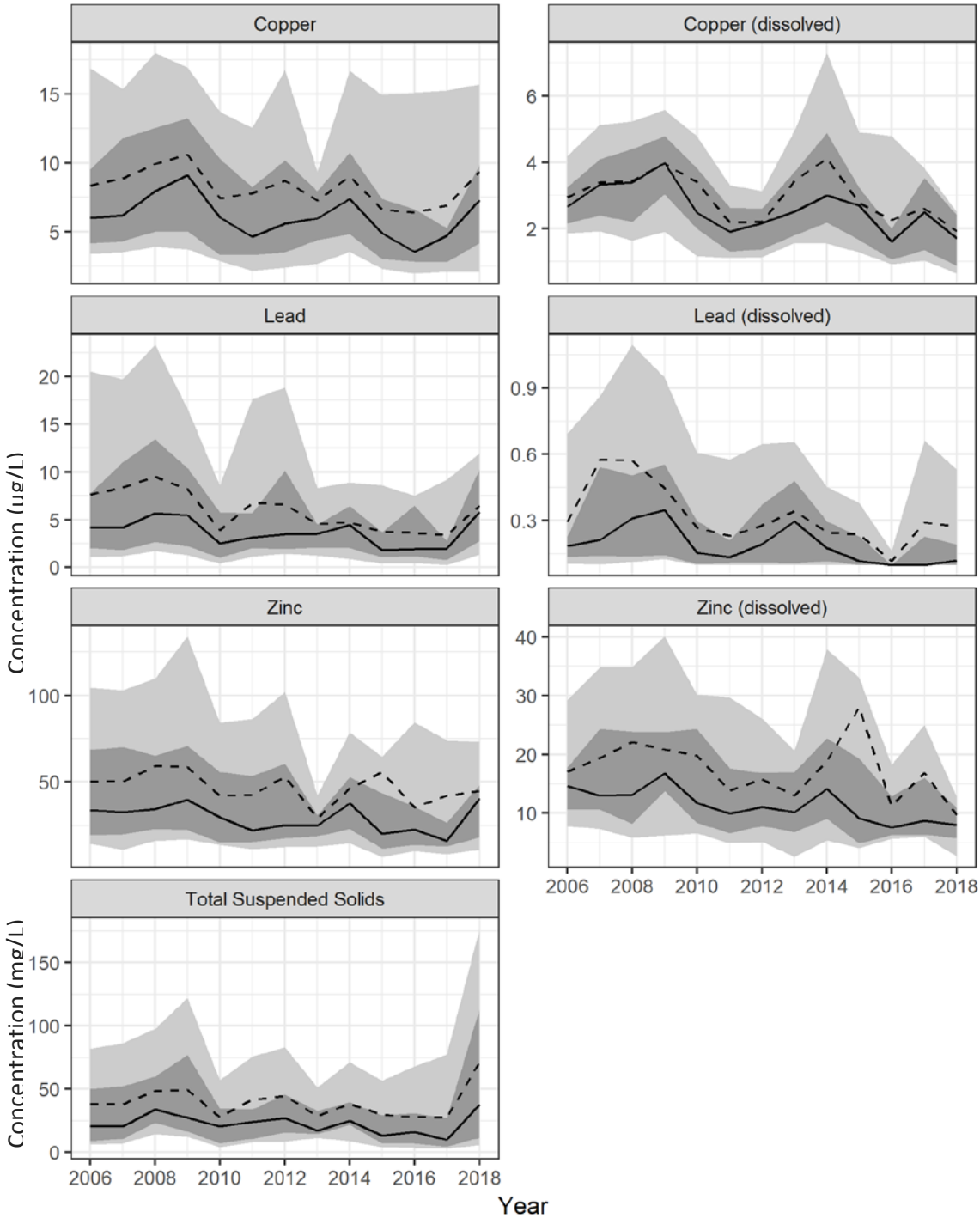

Figure 15. Trends in the probabilistic stormwater metal and total suspended solids concentrations . The solid line represents the median concentration, the dashed line represents the mean concentration, the dark grey shading represents the 25th to 75th percentiles, and the light gray represents the 10th to 90th percentiles.

4.3 Historic Fixed Land Use Stormwater Trends

As described in Section 2.2, the City resumed composite stormwater sampling at four of the fixed historic land-use sites during the 2016-17 permit year. Two of the four sites (R1 and R2) had long gaps (greater than 15 years; Table 3) with no sampling prior to the renewed sampling in the 2016-17 permit year. As such, these sites were not included in the long-term trends analysis. Sites M1 and OF19, however, had only a 5-year gap in sampling and were both evaluated for long-term water quality trends.

Long-term trends in water quality concentrations were evaluated using a Mann-Kendall test for monotonic trend in a time series for both the M1 (mixed land use) and OF19 (industrial and forested land use) sites. No significant trends in water quality were observed over the 18-year period at the M1 site for any of the parameters. Four significant downward trends in water quality concentrations were identified at the OF19 site (Figure 16). The strongest observed downward trend was for dissolved copper (Figure 16). A significant downward trend in total copper was also observed at OF19 (Figure 16; note the log-scale for total copper). Significant downward trends for both total and dissolved zinc at OF19 were also observed (Figure 16).

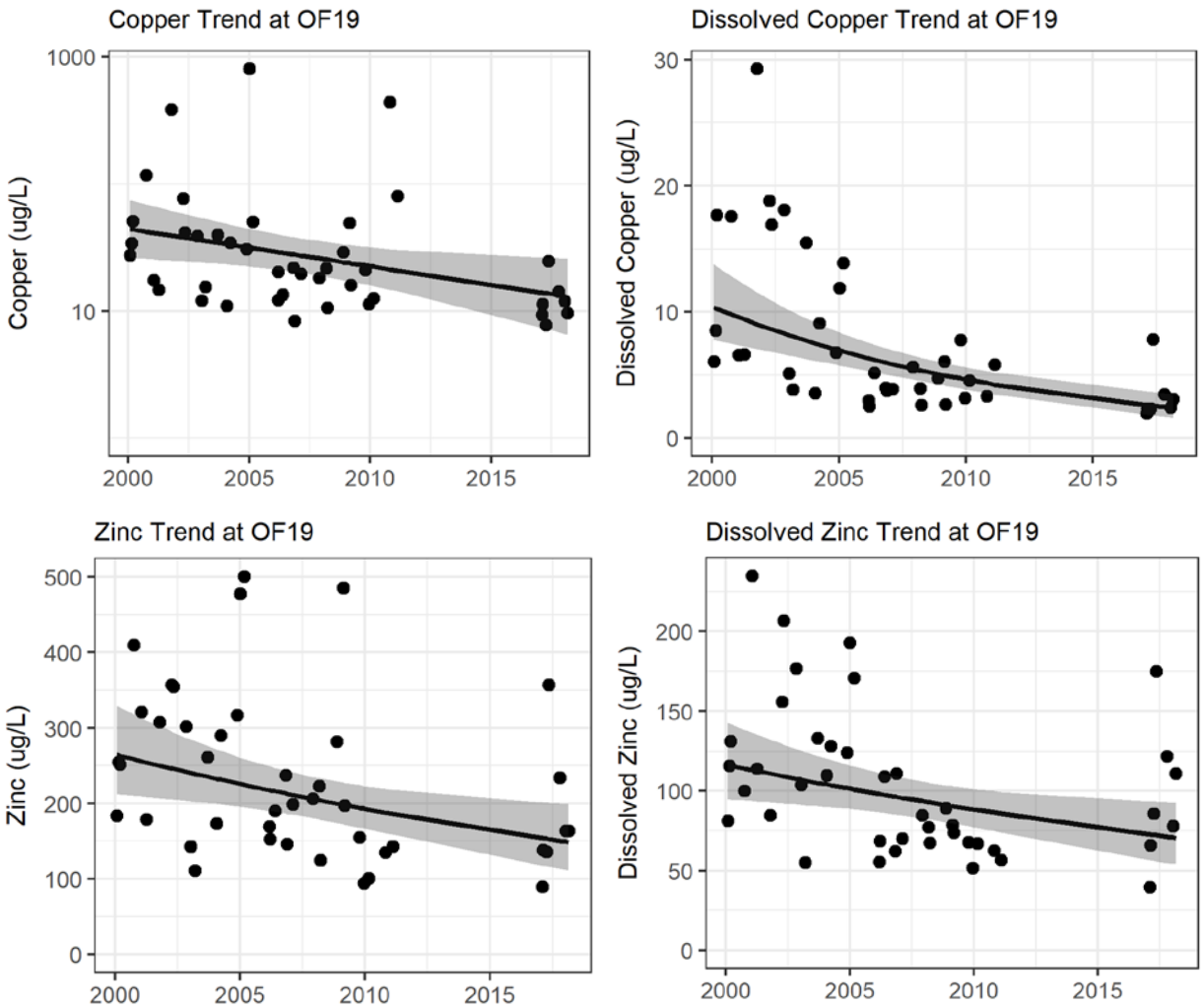

Figure 16. Trends in copper and zinc (total and dissolved) concentrations at OF19 since 2000. The decreasing trends are significant for both total and dissolved cooper and zinc. Note the log-scale for total copper. The shaded area represents the 95% confindence interval of the trend line.

The cause of the decreasing trend in copper and zinc concentrations at OF19 is likely not a result of changes in TSS concentrations as no significant trend in TSS was observed during the period (Figure 17). Consequently, the changes may be a result of land-use changes or the implementation of improved stormwater management techniques within the site's drainage area. The City's Industrial Stormwater program inspects industrial sites routinely in this basin to determine compliance with the 1200-Z permit and provide technical assistance on the implementation of best management practices to address water quality issues associated with stormwater runoff. Future composite stormwater sampling at these four sites will provide additional information that can be used to assess whether observed water quality trends are continuing.

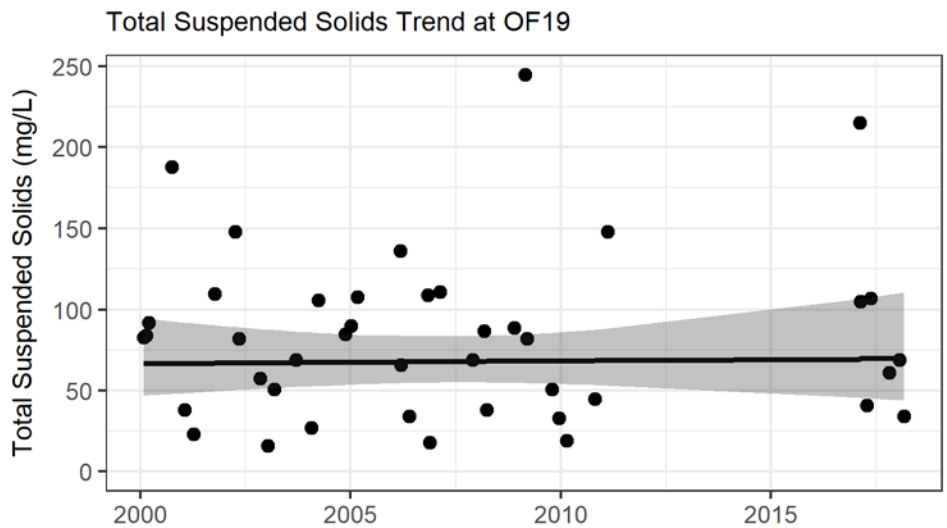

Figure 17. Total suspended solids concentrations at OF19 since 2000. No statistically significant trend was observed.

5 SUMMARY

The City completed all of the activities required by Schedule B of the City's NPDES MS4 discharge permit. The City's 2017-18 monitoring activities met all the specific requirements for monitoring types, locations, frequency, and parameters. All monitoring data collected during the 2017-18 permit year are included in Appendix B. Key findings from the 2017-18 permit year include the following:

- Water quality concentrations from the probabilistic stormwater monitoring are not highly variable, and no long-term trends in concentrations have been identified.
- Flow-weighted composite stormwater concentrations in 2017-18 were similar to, or lower than, the corresponding mean concentrations identified by the 1997 ACWA study for the corresponding land uses.
- Decreasing trends copper and zinc concentrations at the industrial site (OF19) were identified.
- With the exception of total phosphorus in the Tualatin River watershed and *E. coli*, sites throughout the City typically met the applicable instream water quality criteria.
- Summer instream water temperatures typically exceed the water quality temperature criteria for rearing and migration at all four monitoring stations.
- Macroinvertebrate communities vary across watersheds and all watersheds show signs of anthropogenic impacts.

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Appendix A: Monitoring Locations for the 2017-18 Permit Year

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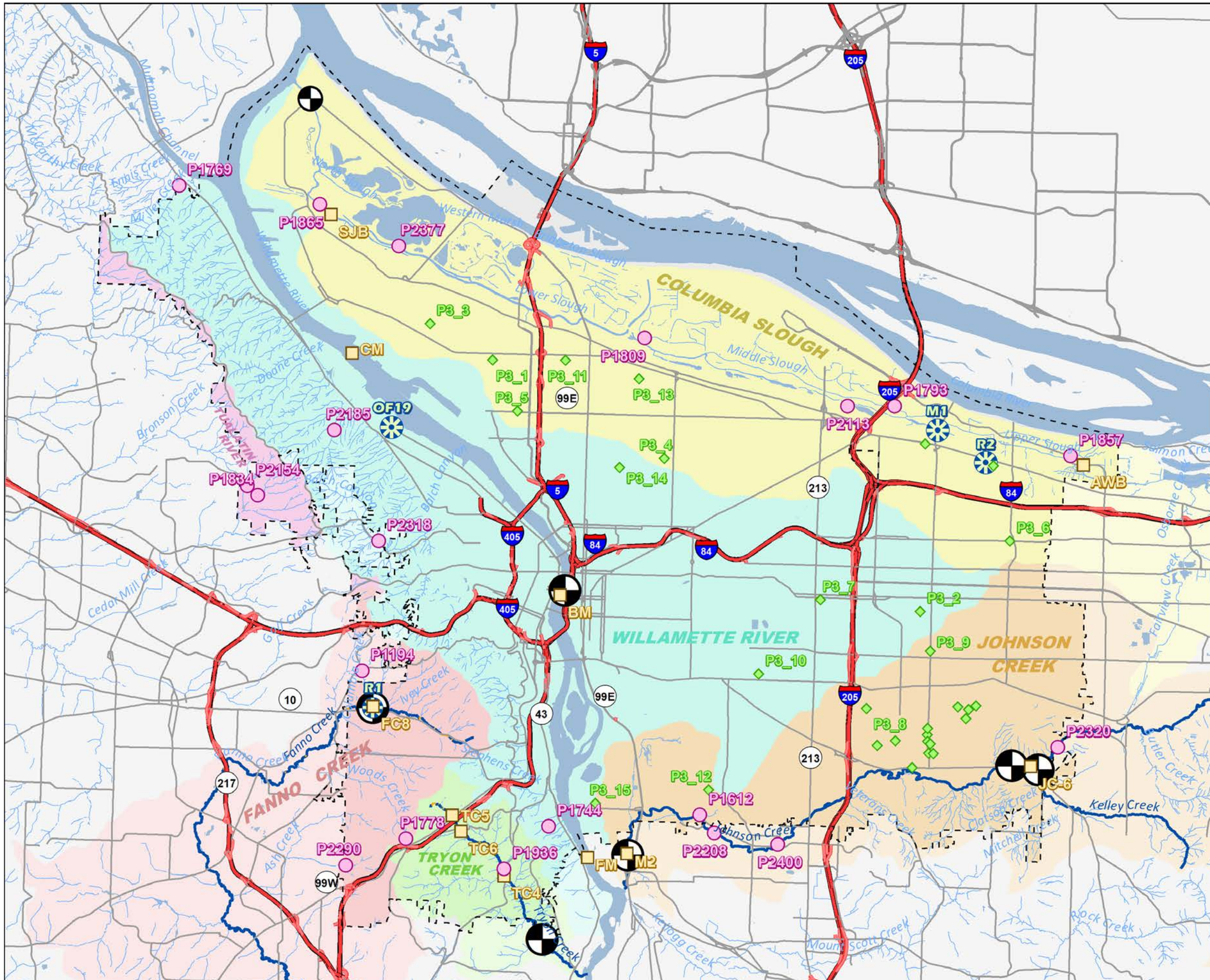
FY 2017-18 Monitoring Locations
Stormwater & Instream Sites

City of Portland NPDES MS4 Permit



Legend

Monitoring Locations

- Probabilistic Stormwater (UICs)
- Probabilistic Instream (PAWMAP)
- Fixed Instream
- Historic Fixed Land Use
- Continuous Instream (USGS)

Watersheds

- Columbia Slough
- Fanno Creek
- Johnson Creek
- Tualatin River
- Tryon Creek
- Willamette River

Other Features

- City of Portland
- Major City Streams
- Other Streams
- Waterbodies
- Major Highways & Freeways
- Local Highways & Arterials

N W E S

SCALE
1:110,000
1 in = 2 miles

0 1 2 3 4 Miles

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Notes:

Only main stems of major streams are mapped; tributaries are not shown.

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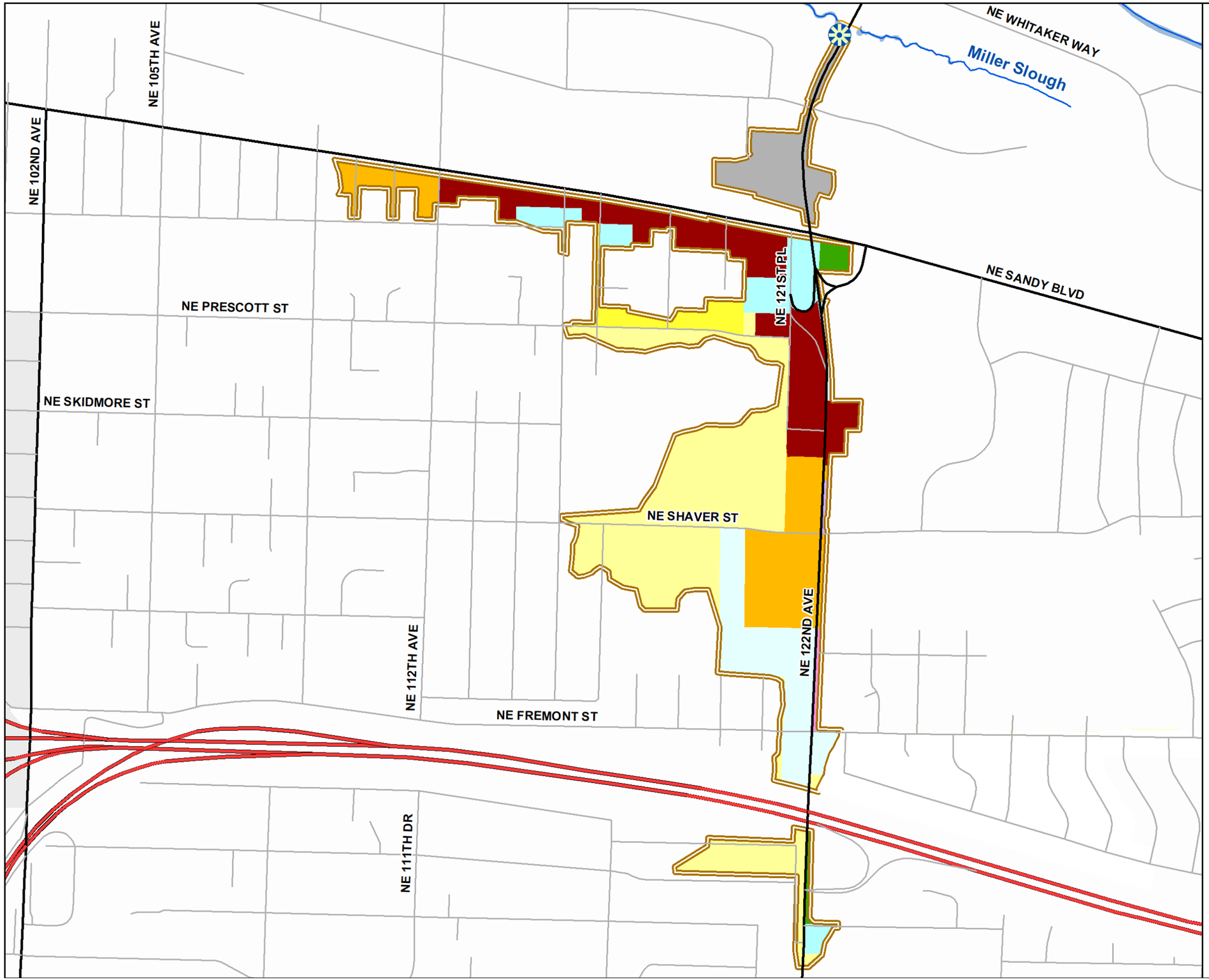

FY 2017-18 Monitoring Locations Stormwater & Instream Sites

City of Portland NPDES MS4 Permit

Historic Fixed Land Use Drainage Area M1

Legend

- Historic Fixed Land Use
- Drainage Area

Streets

- Freeway
- Local Highway
- Arterial
- Residential & Local Streets

Zoning

- Open Space (OS)
- Residential 7,000 (R7)
- Residential 5,000 (R5)
- Residential 3,000 (R3)
- Residential 2,000 (R2)
- Commercial Mixed Use 1 (CM1)
- Commercial Mixed Use 2 (CM2)
- Commercial Employment (CE)
- General Employment 1 (EG1)
- General Employment 2 (EG2)
- General Industrial 2 (IG2)

N W E S

SCALE
1:8,000
1 inch = 667 feet

0 0.07 0.14 0.21 0.28 Miles

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Notes:

Only main stems of major streams are mapped; tributaries are not shown.

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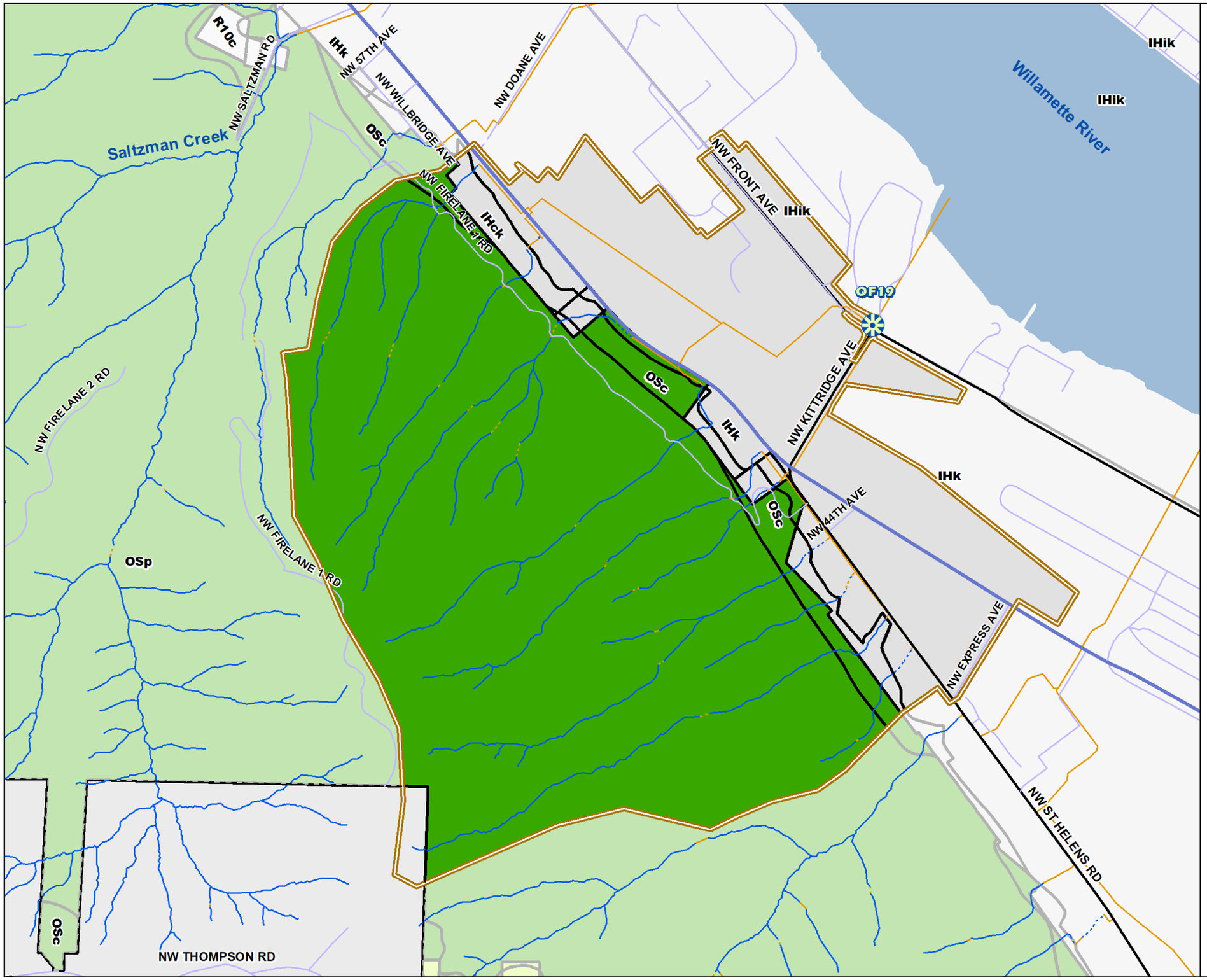
FY 2017-18 Monitoring Locations
Stormwater & Instream Sites

City of Portland NPDES MS4 Permit



Legend

- Historic Fixed Land Use
- Drainage Area

Streets

- Freeway
- Local Highway
- Arterial
- Residential & Local Streets

Waterways

- Open Channel
- Ditch
- Stormwater Pipe
- Stormwater Culvert
- Combined Stormwater/Sewer Pipe
- Waterbodies

Zoning

- Residential Farm/Forest (RF)
- Open Space (OS)
- General Industrial 1 (IG1)
- General Industrial 2 (IG2)
- Heavy Industrial (IH)

N W E S

SCALE
1:9,000
1 inch = 750 feet

0 0.08 0.16 0.24 0.32 Miles

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Notes:

Only main stems of major streams are mapped; tributaries are not shown.

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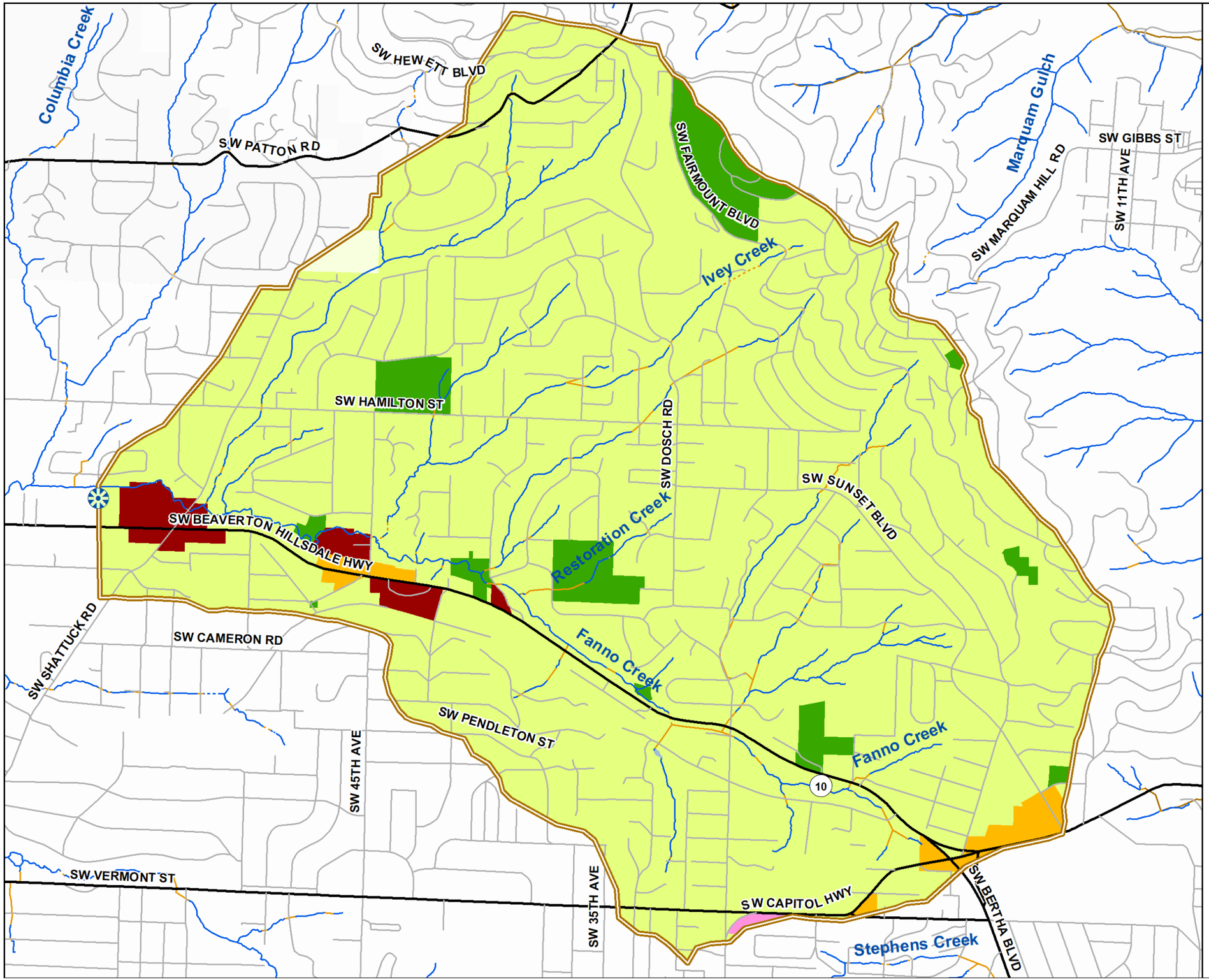
FY 2017-18 Monitoring Locations
Stormwater & Instream Sites

City of Portland NPDES MS4 Permit

Historic Fixed Land Use Drainage Area R1



Legend

- Historic Fixed Land Use
- Drainage Area

Streets

- Freeway
- Local Highway
- Arterial
- Residential & Local Streets

Waterways

- Open Channel
- Stormwater Pipe
- Stormwater Culvert
- Waterbodies

Zoning

- Open Space (OS)
- Residential (R1-R20)
- Commercial Mixed Use 1 (CM1)
- Commercial Mixed Use 2 (CM2)
- Commercial Employment (CE)

N W E S

SCALE
1:13,000
1 inch = 1,083 feet

0 0.1 0.2 0.3 0.4 Miles

ENVIRONMENTAL SERVICES
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Notes:

Only main stems of major streams are mapped; tributaries are not shown.

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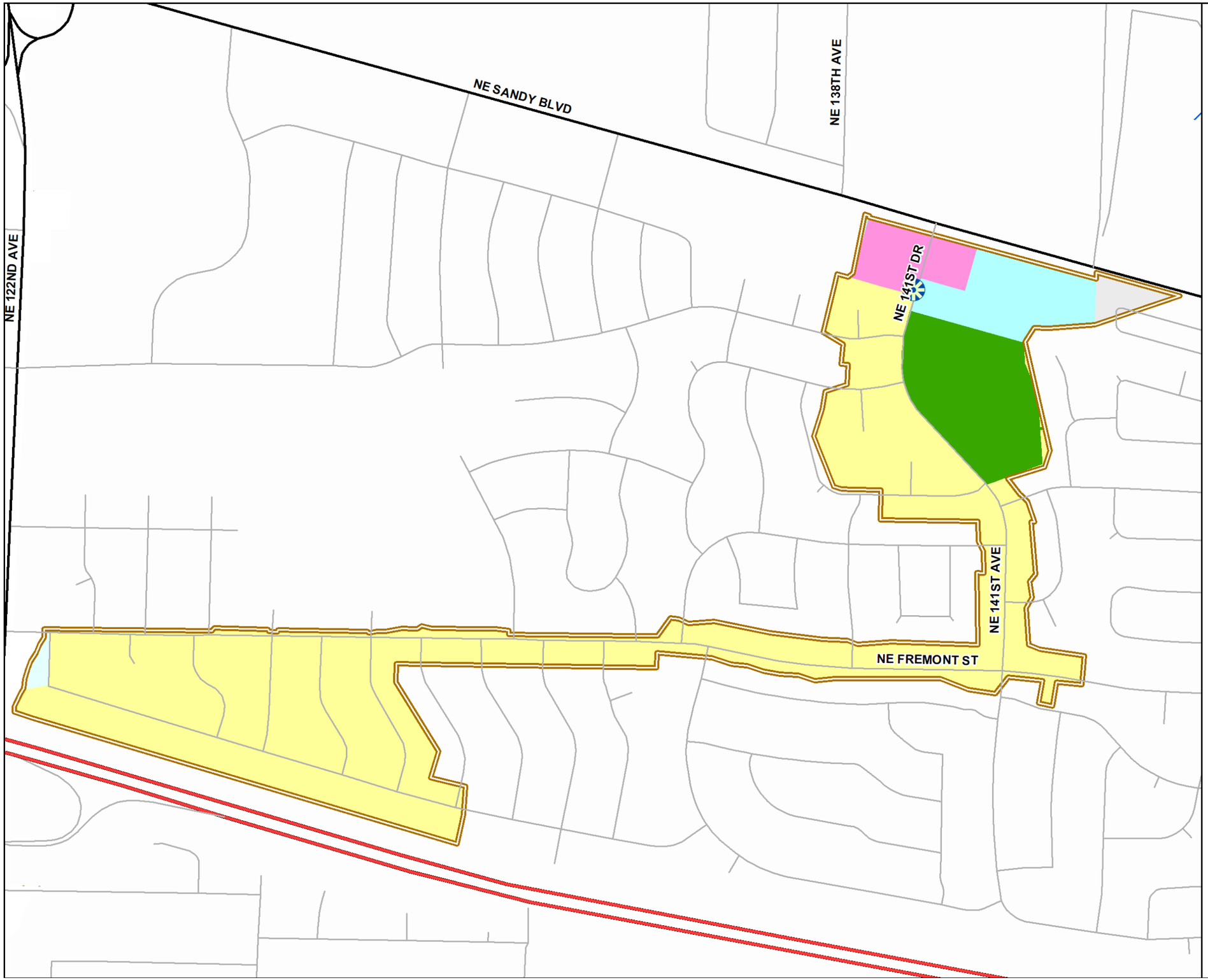

FY 2017-18 Monitoring Locations Stormwater & Instream Sites

City of Portland NPDES MS4 Permit

Historic Fixed Land Use Drainage Area R2

Legend

- Historic Fixed Land Use
- Drainage Area

Streets

- Freeway
- Local Highway
- Arterial
- Residential & Local Streets

Zoning

- Open Space (OS)
- Residential 7,000 (R7)
- Residential 3,000 (R3)
- Residential 2,000 (R2)
- Commercial Mixed Use 1 (CM1)
- Commercial Mixed Use 2 (CM2)
- Commercial Employment (CE)
- General Employment 1 (EG1)
- General Employment 2 (EG2)
- General Industrial 2 (IG2)

N W E S

SCALE
1:6,000
1 inch = 500 feet

0 0.05 0.1 0.15 0.2 Miles

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
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Notes:

Only main stems of major streams are mapped; tributaries are not shown.

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Appendix B: Monitoring Data from 2017-18

Table B-1: Probabilistic Stormwater Data (30 sites)

Table B-2: Historic Fixed Land Use Stormwater Data (4 sites)

Table B-3: Fixed Instream Data (11 sites)

Table B-4: Probabilistic Instream Data (20 sites)

Table B-5: Macroinvertebrate Data (14 sites)

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Table B-1: Probabilistic Stormwater Data (2017-18 permit year)

Site ID	Location Description	Sample Date	Field Parameters				Conventional				Metals						Nutrients			
			Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	*E. coli* (MPN/100mL)	Hardness (mg $CaCO_3$/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
P3_1	2810 N Buffalo St (>1000)	11/21/2017	11.0	18	6.4	9.8	--	7.30	4.91	8	3.92	2.02	6.91	1.21	20.7	11.2	0.043	<0.10	0.063	0.026
P3_10	6310 SE Franklin St (<1000)	1/11/2018	10.9	10	6.5	10.3	--	12.1	1.16	139	8.17	0.640	6.29	<0.102	48.7	3.41	<0.020	<0.10	0.293	0.020
P3_11	315 N Holland St (<1000)	1/11/2018	10.9	10	6.6	10.3	--	5.96	<1.00	58	8.62	0.714	12.6	0.121	48.7	9.45	0.050	<0.10	0.135	<0.020
P3_12	7346 SE 46th Ave (<1000)	1/11/2018	10.8	8	6.4	10.4	--	3.48	1.25	6	1.77	0.932	0.385	<0.102	10.1	6.11	0.020	<0.10	<0.025	<0.020
P3_13	6738 NE 22nd Ave (>1000)	11/21/2017	10.7	26	6.7	10.0	--	11.1	3.96	3	3.18	1.81	1.32	0.177	13.6	7.56	<0.020	<0.10	0.083	0.050
P3_14	1600 NE Beech St (<1000)	11/21/2017	10.6	61	6.8	10.3	--	22.3	16.3	14	4.46	2.41	2.88	0.554	15.2	6.37	<0.020	<0.10	0.312	0.224
P3_15	8003 SE 11th Ave (<1000)	1/11/2018	10.6	12	6.4	10.6	--	10.7	2.80	126	13.3	2.33	8.93	0.193	73.9	11.8	<0.020	<0.10	0.289	0.037
P3_2	11759 SE Taylor St (<1000)	12/19/2017	10.8	10	6.1	10.0	--	3.39	4.09	12	4.24	1.41	3.89	0.191	22.2	8.46	0.047	<0.10	0.079	0.026
P3_3	4940 N Willis Blvd (>1000)	11/21/2017	10.3	32	6.1	9.9	--	13.6	21.6	38	6.84	2.45	3.23	0.140	32.5	10.5	<0.020	<0.10	0.190	0.064
P3_4	3150 NE Regents Dr (>1000)	1/11/2018	10.5	16	6.6	10.5	--	7.30	1.92	42	5.64	1.03	4.69	<0.102	27.9	5.17	0.031	<0.10	0.115	<0.020
P3_5	5518 N Campbell Ave (>1000)	11/21/2017	10.7	28	6.5	10.1	--	12.0	8.15	14	5.77	2.41	6.60	1.16	29.9	12.8	<0.020	<0.10	0.088	0.032
P3_6	14800 NE Halsey St (>1000)	12/19/2017	11.3	16	5.8	9.5	--	12.6	9.52	184	46.1	5.54	10.9	<0.102	203	33.7	<0.020	<0.10	0.390	<0.020
P3_7	635 SE 84th Ave (>1000)	12/19/2017	11.3	15	6.9	8.7	--	8.42	12.9	54	10.1	2.50	11.8	0.343	41.1	10.2	0.041	<0.10	0.137	0.038
P3_8	4320 SE 101st Ave (<1000)	12/19/2017	11.3	31	6.7	8.9	--	28.0	8.66	234	15.8	1.69	12.0	0.104	59.3	2.47	<0.020	<0.10	0.469	0.083
P3_9	2321 SE 122nd Ave (>1000)	12/19/2017	8.9	37	6.1	10.2	--	15.8	5.05	20	9.62	3.93	2.14	<0.102	48.3	25.4	0.344	<0.10	0.069	<0.020
SG-018	5803 SE 122nd Ave (>1000)	11/15/2017	11.3	17	6.4	9.1	--	7.50	4.92	32	7.30	2.04	2.51	0.113	41.0	13.9	0.121	<0.10	0.078	<0.020
SG-028	13515 SE Holgate Blvd (>1000)	10/19/2017	4.7	94	6.6	14.9	--	37.4	9.28	10	7.44	4.60	1.02	0.353	30.9	20.4	0.708	0.42	0.096	0.050
SG-030	10402 SE Ellis St (<1000)	10/19/2017	10.0	20	6.8	12.8	--	7.96	12.5	41	7.06	2.68	2.28	0.123	40.5	13.2	0.096	0.11	0.191	0.082
SG-034	12319 SE Ramona St (>1000)	11/15/2017	10.7	17	6.6	9.3	--	6.50	5.36	23	5.44	2.36	1.29	<0.102	24.7	12.2	<0.020	<0.10	0.070	<0.020
SG-047	4022 NE 142nd St (<1000)	10/19/2017	10.0	14	6.7	14.5	--	5.72	2.15	10	6.02	3.48	0.517	<0.102	43.4	33.7	0.049	<0.10	0.044	0.026
SG-048	4241 SE 136th Ave (>1000)	11/15/2017	10.8	29	6.4	9.1	--	18.7	21.8	151	22.7	3.40	12.1	0.239	97.6	18.5	0.231	<0.10	0.483	0.092
SG-049	5211 SE 122nd Ave (>1000)	11/15/2017	11.4	12	6.3	9.2	--	5.31	1.84	22	6.38	1.61	3.08	<0.102	30.0	9.29	0.149	<0.10	0.063	<0.020
SG-053	4919 SE 122nd Ave (>1000)	11/15/2017	11.2	18	6.0	10.1	--	7.46	3.40	18	10.4	4.03	2.17	0.141	40.5	18.0	0.190	<0.10	0.055	<0.020
SG-054	5440 SE 111th Ave (>1000)	10/19/2017	9.7	43	6.6	12.9	--	65.0	9.55	1930	113	6.64	78.8	0.157	542	13.8	0.365	0.20	1.84	0.097
SG-055	11741 SE Foster Rd (>1000)	10/19/2017	10.3	26	6.8	12.9	--	10.6	8.26	16	11.6	5.71	2.91	0.172	46.8	18.1	0.224	0.10	0.117	0.047
SG-057	5500 SE 122nd Ave (>1000)	12/19/2017	11.3	15	6.1	9.7	--	9.81	1.76	78	13.0	2.00	5.50	<0.102	67.6	8.93	0.150	<0.10	0.154	0.034
SG-059	4656 NE 188th Ave (<1000)	10/19/2017	10.2	33	6.8	13.9	--	19.6	3.29	145	15.7	1.99	9.90	<0.102	72.8	2.58	0.042	0.20	0.325	0.071
SG-060	4144 SE 132nd Ave (<1000)	10/19/2017	9.6	14	7.0	13.8	--	4.92	6.71	5	3.40	2.24	0.490	<0.102	15.3	10.2	0.083	<0.10	0.085	0.039
SG-061	12246 SE Ellis St (<1000)	10/19/2017	9.2	46	6.6	12.9	--	18.4	24.5	33	7.06	3.43	2.07	<0.102	25.5	13.3	0.027	<0.10	0.345	0.210
SG-063	13820 SE Gladstone St (<1000)	10/19/2017	9.5	29	7.1	13.7	--	8.79	9.44	10	5.33	3.64	0.613	<0.102	10.1	5.64	0.079	0.22	0.194	0.127

Table B-2: Historic Fixed Land Use Stormwater Data (2017-18 permit year)

Site ID	Location Description	Sample Date	Field Parameters				Conventional				Metals						Nutrients			
			Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	E. coli (MPN/100mL)	Hardness (mg $CaCO_3$/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
Event #1																				
M1	5241 NE 122nd Ave	10/17/2017	10.3	21	8.6	13.4	4600	--	--	--	--	--	--	--	--	--	--	--	--	--
OF19	4900 NW Kittridge Ave (OF19)	10/17-20/2017	10.2	105	8.4	13.5	11000	42.5	6.33	61	14.2	3.49	12.2	0.363	234	122	0.209	0.49	0.204	0.029
R1	4916 SW 56th Ave	10/18-20/2017	9.6	109	7.9	12.3	>24000	40	6.10	538	21.6	3.00	25.4	0.231	160	10.8	0.305	0.53	0.842	0.081
R2	NE 141st Ave & Sandy Blvd	10/17/2017	9.9	29	8.2	14.6	3300	--	--	--	--	--	--	--	--	--	--	--	--	--
Event #2																				
M1	5241 NE 122nd Ave	1/17-18/2018	11.1	116	7.1	10.3	590	14.6	3.50	113	14.8	2.59	9.54	0.170	104	22.9	0.063	0.16	0.224	0.022
OF19	4900 NW Kittridge Ave (OF19)	1/17-18/2018	10.6	137	7.4	9.7	3900	38.8	2.64	69	12.0	2.41	12.2	0.579	164	78.1	0.077	0.95	0.171	0.042
R1	4916 SW 56th Ave	1/17-18/2018	10.9	132	8.1	9.1	260	34.6	3.01	171	10.2	2.16	8.87	0.204	70.1	8.45	0.031	0.72	0.323	0.043
R2	NE 141st Ave & Sandy Blvd	1/17-18/2018	8.8	64	6.5	10.2	5000	6.25	2.22	27	4.64	1.46	1.51	<0.102	30.8	12.9	0.033	0.11	0.074	0.023
Event #3																				
M1	5241 NE 122nd Ave	2/28-3/1/2018	11.9	56	7.4	7.7	960	30.6	5.92	111	19.9	4.49	9.54	0.135	155	40.9	0.166	0.27	0.211	<0.020
OF19	4900 NW Kittridge Ave (OF19)	2/28-3/1/2018	11.4	163	7.0	8.3	780	51.4	4.53	34	9.65	3.09	8.51	0.747	164	111	0.093	1.4	0.133	0.045
R1	4916 SW 56th Ave	2/28-3/1/2018	12.0	163	7.8	6.8	75	47.8	2.50	58	5.81	1.79	3.61	0.145	48.2	14.1	0.030	0.66	0.153	0.032
R2	NE 141st Ave & Sandy Blvd	2/28/2018	11.8	17	7.3	8.0	700	7.37	3.12	22	5.48	2.28	1.63	<0.102	32.8	14.5	0.044	0.12	0.074	<0.020
Event #4																				
M1	5241 NE 122nd Ave	3/13/2018	10.6	57	6.7	11.9	4100	28.1	11.9	101	25.5	9.71	8.28	0.225	178	60.5	0.387	0.39	0.420	0.030
R2	NE 141st Ave & Sandy Blvd	3/13/2018	10.8	25	7.2	11.4	97	12.4	10.4	27	12.3	9.70	1.50	0.224	48.5	59.8	0.284	0.40	0.128	0.040

Table B-3. Fixed Instream Sites Results (2017-18 permit year)

Note: Biological oxygen demand (BOD-5) is only collected at the Columbia Slough fixed sites.

			Field Parameters				Conventional					Metals						Nutrients			
Site ID	Location Description	Sample Date	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	*E. coli* (MPN/ 100mL)	Hardness (mg $CaCO_3$/L)	BOD-5 (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
Columbia Slough																					
AWB	NE Airport Way Bridge B, Main Channel	7/11/2017	9.4	192	8.5	21.7	10	76	<2	3.09	10	1.08	0.574	0.564	<0.102	2.24	<0.502	0.062	<0.10	0.074	0.031
AWB	NE Airport Way Bridge B, Main Channel	9/5/2017	2.9	207	7.5	21.9	30	83.7	<2	4.36	7	0.644	0.428	0.285	<0.102	3.77	0.526	0.356	<0.10	0.214	0.106
AWB	NE Airport Way Bridge B, Main Channel	11/21/2017	10.4	105	7.5	9.3	360	43.1	2	2.55	26	2.96	1.38	1.09	<0.102	15.1	7.61	0.058	0.43	0.091	0.032
AWB	NE Airport Way Bridge B, Main Channel	1/4/2018	12.8	176	8.1	2.5	85	64.5	<2	1.88	14	1.51	0.684	0.601	<0.102	6.70	1.86	0.124	1.2	0.076	0.032
AWB	NE Airport Way Bridge B, Main Channel	3/23/2018	10.5	127	7.4	8.1	260	48.9	<2	2.04	8	2.70	1.31	0.600	<0.105	13.6	6.66	0.066	0.50	0.082	0.034
AWB	NE Airport Way Bridge B, Main Channel	5/10/2018	7.2	203	7.2	18.0	85	80.0	2	2.77	10	1.04	0.613	0.277	<0.105	4.55	2.08	0.045	0.15	0.083	0.041
SJB	St Johns Landfill Bridge, Main Channel	7/11/2017	14.0	232	7.8	22.7	52	94	3	1.68	24	1.89	0.603	1.38	<0.102	6.09	2.21	0.040	2.1	0.109	<0.020
SJB	St Johns Landfill Bridge, Main Channel	9/5/2017	12.2	223	7.9	22.1	120	91.7	<2	1.48	29	1.74	0.636	1.39	<0.102	5.31	<0.502	0.077	2.0	0.098	0.038
SJB	St Johns Landfill Bridge, Main Channel	11/21/2017	8.3	188	7.4	9.5	63	77.0	<2	2.11	15	2.77	1.28	1.30	0.111	9.26	3.21	0.208	1.9	0.120	0.035
SJB	St Johns Landfill Bridge, Main Channel	1/4/2018	10.5	225	7.4	6.0	41	81.1	<2	1.61	7	1.27	0.775	0.549	<0.102	6.47	3.35	0.143	2.4	0.119	0.055
SJB	St Johns Landfill Bridge, Main Channel	3/23/2018	14.4	203	7.7	9.2	10	82.3	4	1.79	27	2.55	0.803	1.43	<0.105	9.93	1.22	<0.020	1.6	0.158	<0.020
SJB	St Johns Landfill Bridge, Main Channel	5/10/2018	12.3	207	7.3	16.4	10	88.9	3	2.00	4	0.907	0.621	0.316	<0.105	4.54	<0.527	0.034	1.3	0.057	<0.020
Johnson Creek																					
JC-6	SE 158th Ave Bridge (Main Channel)	7/11/2017	10.3	157	7.9	19.6	63	44	NA	3.11	3	1.56	1.34	0.190	<0.102	2.84	1.58	0.049	0.71	0.067	0.050
JC-6	SE 158th Ave Bridge (Main Channel)	9/5/2017	10.4	149	7.8	20.6	280	53.6	NA	4.06	10	2.04	1.05	0.587	<0.102	7.82	0.778	<0.020	<0.10	0.173	0.030
JC-6	SE 158th Ave Bridge (Main Channel)	11/21/2017	11.1	77	7.3	10.0	450	25.9	NA	2.55	14	2.14	1.30	0.642	<0.102	9.94	4.43	<0.020	2.3	0.046	0.022
JC-6	SE 158th Ave Bridge (Main Channel)	1/4/2018	13.1	86	7.4	4.0	63	26.7	NA	1.27	<3	0.701	0.456	0.190	<0.102	4.16	2.58	<0.020	2.4	0.035	<0.020
JC-6	SE 158th Ave Bridge (Main Channel)	3/23/2018	12.1	68	7.3	6.6	1200	25.7	NA	2.43	68	4.73	1.38	2.19	<0.105	31.2	7.86	0.047	0.82	0.157	0.024
JC-6	SE 158th Ave Bridge (Main Channel)	5/10/2018	9.5	107	7.3	15.4	120	37.0	NA	3.20	3	1.97	1.49	0.176	<0.105	6.73	3.41	0.041	0.82	0.055	0.041
M2	SE Millport Road	7/11/2017	12.4	190	7.6	17.6	150	68.8	NA	1.44	5	0.790	0.564	0.231	<0.102	2.00	0.685	0.021	3.2	0.077	0.061
M2	SE Millport Road	9/5/2017	11.5	193	7.8	18.4	180	76.4	NA	1.22	4	0.654	0.429	0.188	<0.102	1.91	0.669	<0.020	3.7	0.090	0.073
M2	SE Millport Road	11/21/2017	11.4	95	7.3	10.3	590	32.9	NA	2.71	14	2.52	1.38	0.875	0.111	10.6	3.65	<0.020	2.5	0.073	0.035
M2	SE Millport Road	1/4/2018	13.2	126	7.6	4.9	63	41.6	NA	1.12	4	0.802	0.481	0.230	<0.102	4.25	2.15	<0.020	3.0	0.062	0.043
M2	SE Millport Road	3/23/2018	12.2	88	7.5	7.6	840	33.2	NA	2.58	125	6.28	1.43	3.49	<0.105	45.2	6.02	0.044	1.1	0.205	0.030
M2	SE Millport Road	5/10/2018	11.0	170	7.9	15.9	260	60.5	NA	1.62	5	0.856	0.671	0.161	<0.105	2.42	1.18	<0.020	2.9	0.079	0.069
Tryon Creek (Willamette River Tributary)																					
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	7/24/2017	11.5	178	7.7	16.2	86	66.3	NA	1.92	<3	0.940	0.823	<0.100	<0.102	3.60	2.78	<0.020	0.75	0.101	0.100
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	8/7/2017	9.0	186	7.8	18.5	230	68.5	NA	2.10	4	1.23	0.831	0.364	<0.102	6.10	2.40	<0.020	0.60	0.097	0.102
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	9/11/2017	9.3	197	7.8	15.5	41	79.6	NA	2.04	4	0.918	0.796	<0.100	<0.102	2.81	2.34	<0.020	0.51	0.118	0.111
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	10/2/2017	10.5	158	8.3	11.6	130	61.7	NA	3.62	<3	1.63	1.37	0.150	<0.102	8.21	6.59	<0.020	0.63	0.070	0.089
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	11/2/2017	10.5	171	8.4	9.6	10	66.2	NA	2.68	<3	1.04	0.896	<0.100	<0.102	4.62	3.97	<0.020	0.53	0.060	0.082
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	12/4/2017	11.9	137	6.2	8.2	96	49.7	NA	2.30	<3	1.44	1.20	0.250	<0.102	12.4	10.9	<0.020	1.5	0.046	0.049
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	1/2/2018	12.9	146	7.9	5.2	120	53.3	NA	1.78	<3	1.02	0.780	0.169	<0.102	10.8	7.97	<0.020	1.7	0.039	0.044
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	3/23/2018	12.4	91	7.5	6.3	1800	27.8	NA	3.75	22	5.01	2.39	2.18	0.259	41.5	19.0	<0.020	1.0	0.117	0.053
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	4/10/2018	11.0	105	7.4	11.4	530	37.2	NA	3.51	6	3.55	2.09	0.760	0.123	17.0	11.9	<0.020	1.1	0.067	0.037
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	5/1/2018	11.2	150	7.8	10.2	560	54.0	NA	1.92	<3	1.12	0.948	0.150	<0.105	8.57	6.18	<0.020	1.1	0.055	0.059

Table B-3. Fixed Instream Sites Results (2017-18 permit year)

Note: Biological oxygen demand (BOD-5) is only collected at the Columbia Slough fixed sites.

			Field Parameters				Conventional					Metals						Nutrients			
Site ID	Location Description	Sample Date	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	*E. coli* (MPN/ 100mL)	Hardness (mg $CaCO_3$/L)	BOD-5 (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
TC4	10750 SW Boones Ferry Rd (Downstream of Culvert)	6/7/2018	10.2	176	7.9	13.5	310	67.9	NA	1.76	<3	0.993	0.841	0.107	<0.105	5.33	3.70	<0.020	0.89	0.087	0.077
TC5	SW 26th Way & Barbur Blvd	7/24/2017	10.4	230	7.0	14.5	4100	86.2	NA	2.91	7	1.36	0.720	1.36	0.140	17.3	10.0	0.232	0.82	0.150	0.109
TC5	SW 26th Way & Barbur Blvd	8/7/2017	7.0	255	6.9	15.8	360	85.9	NA	3.08	39	2.85	0.670	2.95	<0.102	45.4	9.21	0.107	0.74	0.227	0.096
TC5	SW 26th Way & Barbur Blvd	9/11/2017	6.7	278	7.1	15.2	2500	116	NA	3.31	17	1.15	0.581	0.673	<0.102	11.0	5.52	0.272	0.76	0.225	0.237
TC5	SW 26th Way & Barbur Blvd	10/2/2017	8.6	183	7.3	13.2	310	64.5	NA	5.53	<3	3.41	2.50	0.429	0.205	18.7	15.4	0.078	0.68	0.101	0.115
TC5	SW 26th Way & Barbur Blvd	11/2/2017	8.9	205	7.6	11.3	930	79.2	NA	4.34	<3	2.23	1.69	0.340	<0.102	21.3	18.5	0.053	0.63	0.068	0.078
TC5	SW 26th Way & Barbur Blvd	12/4/2017	10.3	174	6.8	10.0	41	65.9	NA	2.85	<3	1.98	1.73	0.290	<0.102	24.2	23.5	0.035	2.0	0.062	0.056
TC5	SW 26th Way & Barbur Blvd	1/2/2018	11.1	191	7.2	7.3	63	67.6	NA	2.22	<3	1.54	1.13	0.236	<0.102	21.3	18.1	0.030	2.1	0.043	0.053
TC5	SW 26th Way & Barbur Blvd	3/23/2018	11.4	135	7.3	7.7	610	40.0	NA	4.09	7	4.83	3.07	1.92	0.251	56.6	41.4	<0.020	1.5	0.108	0.076
TC5	SW 26th Way & Barbur Blvd	4/10/2018	9.9	53	6.8	13.6	2500	32.0	NA	9.19	325	25.5	3.30	22.9	0.122	155	22.5	0.144	0.41	0.707	0.061
TC5	SW 26th Way & Barbur Blvd	5/1/2018	9.9	190	7.4	11.1	910	67.0	NA	2.29	<3	1.54	1.28	0.220	<0.105	21.4	18.4	0.036	1.6	0.056	0.045
TC5	SW 26th Way & Barbur Blvd	6/7/2018	9.4	214	7.2	12.8	700	78.2	NA	2.71	11	1.97	1.04	1.04	<0.105	20.8	12.9	0.068	0.80	0.122	0.070
TC6	9323 SW Lancaster Rd	7/24/2017	10.3	226	7.5	16.3	10000	87.7	NA	2.50	20	1.64	0.923	0.746	<0.102	20.2	9.15	<0.020	0.92	0.080	0.064
TC6	9323 SW Lancaster Rd	8/7/2017	7.8	225	7.5	18.3	120	81.8	NA	2.63	20	1.87	0.890	1.23	<0.102	18.7	7.33	<0.020	0.65	0.081	0.065
TC6	9323 SW Lancaster Rd	9/11/2017	7.2	257	7.6	16.2	880	104	NA	6.48	<3	2.21	1.93	0.115	<0.102	15.6	13.8	<0.020	0.59	0.087	0.075
TC6	9323 SW Lancaster Rd	10/2/2017	9.1	192	7.8	12.7	400	72.7	NA	4.66	<3	2.08	1.58	0.245	0.105	59.9	47.3	0.028	0.80	0.068	0.076
TC6	9323 SW Lancaster Rd	11/2/2017	8.5	218	7.9	10.9	510	82.2	NA	3.80	<3	1.75	1.43	0.173	<0.102	25.1	21.2	<0.020	0.77	0.044	0.041
TC6	9323 SW Lancaster Rd	12/4/2017	10.9	170	6.7	9.8	270	64.8	NA	2.76	<3	1.83	1.58	0.267	<0.102	31.5	29.5	0.033	1.6	0.048	0.038
TC6	9323 SW Lancaster Rd	1/2/2018	11.8	196	7.4	6.9	230	70.4	NA	2.05	<3	1.30	0.992	0.236	<0.102	28.8	24.1	0.025	1.7	0.025	0.030
TC6	9323 SW Lancaster Rd	3/23/2018	11.7	125	7.4	7.2	4400	36.8	NA	3.81	8	4.88	2.93	1.74	0.250	52.3	39.5	<0.020	1.1	0.097	0.064
TC6	9323 SW Lancaster Rd	4/10/2018	10.2	84	7.1	13.1	2000	43.3	NA	8.42	419	28.7	3.32	27.6	0.177	206	28.0	0.108	0.68	0.733	0.036
TC6	9323 SW Lancaster Rd	5/1/2018	10.3	195	7.5	10.8	530	69.8	NA	2.25	<3	1.41	1.16	0.230	<0.105	21.1	17.1	0.036	1.3	0.050	0.042
TC6	9323 SW Lancaster Rd	6/7/2018	9.3	221	7.6	13.3	120	85.5	NA	2.32	<3	1.28	1.07	0.171	<0.105	11.1	8.32	<0.020	0.82	0.056	0.041
Fanno Creek (Tualatin River Watershed)																					
FC8	4916 SW 56th Ave (Main Channel)	7/24/2017	9.5	193	7.5	17.9	330	76.3	NA	2.65	4	1.24	0.871	0.629	0.108	3.72	1.53	0.023	0.27	0.128	0.100
FC8	4916 SW 56th Ave (Main Channel)	8/7/2017	7.5	197	7.5	20.0	460	72.1	NA	3.06	<3	1.06	0.883	0.242	<0.102	3.19	1.95	<0.020	0.19	0.120	0.105
FC8	4916 SW 56th Ave (Main Channel)	9/11/2017	7.4	205	7.5	17.1	1000	81.8	NA	3.93	7	1.45	1.09	0.284	<0.102	3.79	1.66	<0.020	0.15	0.139	0.090
FC8	4916 SW 56th Ave (Main Channel)	10/2/2017	8.8	142	7.5	12.5	5800	54.4	NA	6.34	29	4.39	2.05	2.65	0.229	18.3	3.27	0.030	0.38	0.161	0.067
FC8	4916 SW 56th Ave (Main Channel)	11/2/2017	7.2	200	7.6	10.4	550	71.2	NA	6.37	<3	2.13	1.61	0.241	<0.102	14.1	10.5	0.604	0.23	0.137	0.107
FC8	4916 SW 56th Ave (Main Channel)	12/4/2017	11.2	161	7.2	8.0	200	60.8	NA	2.60	<3	1.46	1.01	0.465	0.132	14.1	9.90	0.030	0.98	0.075	0.043
FC8	4916 SW 56th Ave (Main Channel)	1/2/2018	12.4	172	7.5	4.9	200	60.9	NA	2.04	5	1.19	0.794	0.510	0.104	10.2	5.96	0.025	1.2	0.040	0.036
FC8	4916 SW 56th Ave (Main Channel)	3/23/2018	12.0	78	7.5	5.9	730	31.2	NA	3.48	38	6.28	2.38	4.04	0.286	47.2	16.6	<0.020	0.55	0.187	0.046
FC8	4916 SW 56th Ave (Main Channel)	4/10/2018	10.2	129	7.1	11.3	1100	48.6	NA	4.81	46	6.26	2.86	4.09	0.166	53.3	35.3	0.034	0.83	0.165	0.046
FC8	4916 SW 56th Ave (Main Channel)	5/1/2018	10.2	178	7.6	10.5	120	64.6	NA	2.33	<3	1.22	1.05	0.300	<0.105	6.36	4.19	0.033	0.74	0.072	0.059
FC8	4916 SW 56th Ave (Main Channel)	6/7/2018	8.7	195	7.7	14.4	180	74.6	NA	2.80	3	1.63	1.25	0.241	<0.105	5.87	2.52	0.021	0.42	0.109	0.066

Table B-3. Fixed Instream Sites Results (2017-18 permit year)

Note: Biological oxygen demand (BOD-5) is only collected at the Columbia Slough fixed sites.

			Field Parameters				Conventional					Metals						Nutrients			
Site ID	Location Description	Sample Date	Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	*E. coli* (MPN/ 100mL)	Hardness (mg $CaCO_3$/L)	BOD-5 (mg/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
Willamette River (Mainstem)																					
BM	Morrison St Bridge - River Mile 12.7 Middle	7/12/2017	12.2	82	7.2	22.0	1	26.2	NA	1.22	8	0.722	0.383	0.109	0.016	0.964	1.15	#N/A	#N/A	#N/A	#N/A
BM	Morrison St Bridge - River Mile 12.7 Middle	8/2/2017	8.8	93	7.5	23.8	5	27.2	NA	1.42	6	0.740	0.439	0.089	0.015	1.00	<0.502	#N/A	#N/A	#N/A	#N/A
BM	Morrison St Bridge - River Mile 12.7 Middle	9/6/2017	9.4	78	7.2	21.1	4	23.9	NA	1.36	6	0.627	0.360	0.090	0.022	1.08	<0.502	#N/A	#N/A	#N/A	#N/A
BM	Morrison St Bridge - River Mile 12.7 Middle	10/3/2017	10.3	78	7.1	16.5	23	23.9	NA	1.35	<3	0.514	0.348	0.060	0.023	0.772	<0.502	#N/A	#N/A	#N/A	#N/A
BM	Morrison St Bridge - River Mile 12.7 Middle	11/14/2017	12.2	64	7.6	9.8	58	23.3	NA	1.70	15	1.26	0.550	0.213	0.032	2.05	0.511	#N/A	#N/A	#N/A	#N/A
BM	Morrison St Bridge - River Mile 12.7 Middle	12/6/2017	17.0	70	6.9	7.3	60	25.8	NA	1.51	10	1.08	0.542	0.161	0.026	1.64	<0.502	0.052	0.80	0.045	0.030
BM	Morrison St Bridge - River Mile 12.7 Middle	1/18/2018	14.2	71	7.4	8.0	34	25.1	NA	1.72	10	1.22	0.562	0.239	0.053	2.62	0.998	0.043	0.82	0.045	0.032
BM	Morrison St Bridge - River Mile 12.7 Middle	2/1/2018	16.5	63	7.4	8.0	110	22.8	NA	1.98	20	1.78	0.603	0.350	0.049	3.18	0.752	0.042	0.72	0.061	0.025
BM	Morrison St Bridge - River Mile 12.7 Middle	3/15/2018	13.6	70	7.2	9.1	20	25.4	NA	1.23	6	0.830	0.373	0.126	0.015	1.78	0.671	0.056	0.53	0.052	0.031
BM	Morrison St Bridge - River Mile 12.7 Middle	4/12/2018	12.6	64	7.4	10.1	120	24.6	NA	1.71	15	2.05	0.640	0.313	0.033	3.03	0.573	0.076	0.69	0.067	0.028
BM	Morrison St Bridge - River Mile 12.7 Middle	5/10/2018	13.8	80	7.5	15.5	15	28.4	NA	1.26	4	0.482	0.365	0.040	0.019	0.839	0.698	0.049	0.42	0.046	0.026
BM	Morrison St Bridge - River Mile 12.7 Middle	6/6/2018	10.4	79	7.3	17.1	10	24.1	NA	1.16	<3	0.562	0.380	0.052	0.016	0.799	<0.527	0.054	0.21	0.030	0.031
CM	St John's RR Bridge - River Mile 6.8 Middle	7/12/2017	12.3	86	7.2	22.2	6	27.2	NA	1.36	6	0.793	0.422	0.112	0.017	1.03	<0.502	0.021	0.37	0.053	<0.020
CM	St John's RR Bridge - River Mile 6.8 Middle	8/2/2017	8.6	100	7.4	23.6	1	28.3	NA	1.32	6	0.782	0.464	0.099	0.014	1.03	<0.502	0.027	0.36	0.040	0.026
CM	St John's RR Bridge - River Mile 6.8 Middle	9/6/2017	9.1	80	7.2	21.6	6	24.8	NA	1.33	6	0.710	0.420	0.102	0.015	1.14	<0.502	0.067	0.30	0.050	0.029
CM	St John's RR Bridge - River Mile 6.8 Middle	10/3/2017	10.3	86	7.1	16.5	26	25.5	NA	1.52	<3	0.587	0.402	0.083	0.014	0.923	<0.502	0.096	0.28	0.038	0.040
CM	St John's RR Bridge - River Mile 6.8 Middle	11/14/2017	12.0	65	7.4	9.9	56	21.6	NA	1.66	8	1.09	0.579	0.157	0.033	1.66	0.641	0.052	0.46	0.058	0.032
CM	St John's RR Bridge - River Mile 6.8 Middle	12/6/2017	17.0	69	6.9	7.6	71	24.8	NA	1.57	7	1.03	0.541	0.142	0.024	1.46	<0.502	0.053	0.80	0.042	0.030
CM	St John's RR Bridge - River Mile 6.8 Middle	1/18/2018	14.0	71	7.4	7.9	33	24.8	NA	2.08	6	1.12	0.529	0.186	0.051	2.15	0.982	0.041	0.85	0.046	0.038
CM	St John's RR Bridge - River Mile 6.8 Middle	2/1/2018	16.4	62	7.4	8.0	100	22.7	NA	1.55	14	1.52	0.566	0.279	0.033	2.48	0.606	0.042	0.72	0.052	0.027
CM	St John's RR Bridge - River Mile 6.8 Middle	3/15/2018	13.6	70	7.1	9.0	17	25.5	NA	1.26	7	0.869	0.390	0.134	0.020	1.91	0.762	0.065	0.54	0.044	0.027
CM	St John's RR Bridge - River Mile 6.8 Middle	4/12/2018	12.5	64	7.4	10.2	180	24.9	NA	1.93	10	1.58	0.714	0.268	0.038	2.59	0.685	0.101	0.70	0.066	0.029
CM	St John's RR Bridge - River Mile 6.8 Middle	5/10/2018	13.3	81	7.5	15.3	5	27.6	NA	1.36	4	0.503	0.398	0.036	0.017	0.884	0.637	0.033	0.42	0.043	0.025
CM	St John's RR Bridge - River Mile 6.8 Middle	6/6/2018	10.8	78	7.5	17.3	2	25.9	NA	1.21	<3	0.559	0.441	0.055	0.012	0.745	<0.527	<0.020	0.20	0.037	0.024
FM	Waverly Country Club - River Mile 17.4 Middle	7/12/2017	12.1	84	7.2	21.7	8	25.8	NA	1.28	4	0.587	0.400	0.071	0.015	0.753	<0.502	0.074	0.36	0.048	0.029
FM	Waverly Country Club - River Mile 17.4 Middle	8/2/2017	8.5	94	7.5	23.7	23	28.1	NA	1.23	4	0.763	0.439	0.092	0.012	1.10	<0.502	0.041	0.41	0.056	0.043
FM	Waverly Country Club - River Mile 17.4 Middle	9/6/2017	9.6	79	7.2	21.0	25	24.1	NA	1.43	<3	0.495	0.392	0.050	0.018	0.810	0.516	0.088	0.32	0.049	0.041
FM	Waverly Country Club - River Mile 17.4 Middle	10/3/2017	10.2	79	7.2	16.5	15	24.6	NA	1.36	<3	0.472	0.341	0.046	0.019	0.686	0.523	0.096	0.30	0.038	0.041
FM	Waverly Country Club - River Mile 17.4 Middle	11/14/2017	12.4	64	7.4	9.8	66	22.3	NA	1.68	11	1.14	0.538	0.180	0.035	1.83	0.514	0.039	0.45	0.063	0.033
FM	Waverly Country Club - River Mile 17.4 Middle	12/6/2017	16.5	70	6.9	7.3	48	25.3	NA	1.63	10	1.10	0.565	0.158	0.025	1.66	0.509	0.045	0.81	0.043	0.028
FM	Waverly Country Club - River Mile 17.4 Middle	1/18/2018	14.2	71	7.6	8.0	43	24.9	NA	1.47	11	1.32	0.545	0.263	0.038	2.80	0.920	0.042	0.81	0.053	0.026
FM	Waverly Country Club - River Mile 17.4 Middle	2/1/2018	16.0	135	7.4	8.0	130	22.1	NA	1.58	20	1.70	0.574	0.309	0.038	3.03	0.668	0.034	0.72	0.052	0.022
FM	Waverly Country Club - River Mile 17.4 Middle	3/15/2018	13.6	70	7.4	9.1	29	25.2	NA	1.31	6	0.870	0.383	0.133	0.016	1.94	0.726	0.071	0.53	0.052	0.029
FM	Waverly Country Club - River Mile 17.4 Middle	4/12/2018	12.6	64	7.5	10.2	140	25.2	NA	1.72	15	1.60	0.636	0.300	0.034	2.93	0.678	0.066	0.67	0.068	0.030
FM	Waverly Country Club - River Mile 17.4 Middle	5/10/2018	11.1	79	7.5	15.7	22	26.8	NA	1.18	<3	0.483	1.24	0.036	0.017	0.804	0.603	0.039	0.40	0.039	0.027
FM	Waverly Country Club - River Mile 17.4 Middle	6/6/2018	10.6	79	7.4	17.1	3	24.7	NA	1.28	<3	0.521	0.351	0.043	0.018	0.760	1.08	0.055	0.22	0.033	0.033

Table B-4. Probabilistic Instream Sites Results (2017-18 permit year)

Site ID	Location Description	Sample Date	Field Parameters				Conventional				Metals						Nutrients			
			Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	*E. coli* (MPN/100mL)	Hardness (mg $CaCO_3$/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
Columbia Slough																				
1793	Middle Slough - 10652 NE Holman St	9/26/2017	4.8	183	6.6	14.7	85	69.8	2.08	<3	0.577	0.435	0.109	<0.102	4.06	3.49	0.100	2.1	0.109	0.095
1793	Middle Slough - 10652 NE Holman St	12/8/2017	9.3	185	7.0	7.8	20	73.1	<1.00	<3	0.437	0.321	0.113	<0.102	3.30	2.85	0.084	2.8	0.114	0.096
1793	Middle Slough - 10652 NE Holman St	2/13/2018	9.8	186	7.1	9.2	220	73.5	<1.00	4	0.494	0.314	0.218	<0.102	2.47	1.37	0.050	2.1	0.120	0.090
1793	Middle Slough - 10652 NE Holman St	4/26/2018	8.7	184	6.8	14.7	10	70.1	1.20	3	0.452	0.299	0.157	<0.105	2.22	2.11	0.061	1.7	0.120	0.092
1793	Middle Slough - 10652 NE Holman St	6/11/2018	11.7	157	7.0	14.6	110	66.4	1.92	<3	1.31	0.799	0.158	<0.105	8.66	8.36	0.053	2.3	0.127	0.094
1809	Middle Slough Tributary - 2210 NE Riverside Way	9/6/2017	1.9	306	7.1	21.2	36	143	7.92	24	0.729	0.320	0.269	<0.102	2.76	<0.502	<0.020	<0.10	0.230	0.029
1809	Middle Slough Tributary - 2210 NE Riverside Way	12/8/2017	4.8	274	7.0	4.7	20	114	5.21	10	2.54	1.65	0.329	<0.102	4.31	2.32	0.569	0.51	0.230	0.059
1809	Middle Slough Tributary - 2210 NE Riverside Way	3/21/2018	9.5	305	6.8	9.7	52	139	5.20	13	2.63	1.73	0.253	<0.105	3.66	1.64	0.138	0.13	0.274	0.023
1809	Middle Slough Tributary - 2210 NE Riverside Way	4/16/2018	9.3	245	7.0	10.9	150	117	4.68	8	3.10	2.08	0.415	<0.105	7.09	4.18	0.198	0.32	0.181	0.049
1809	Middle Slough Tributary - 2210 NE Riverside Way	4/26/2018	5.9	292	7.0	18.3	97	128	4.06	12	1.08	0.686	0.123	<0.105	2.72	1.10	0.459	0.19	0.194	0.021
1857	Columbia Slough - 16811 NE Mason Ct	9/6/2017	0.9	209	7.0	21.0	44	88.8	4.24	6	0.528	0.260	0.190	<0.102	0.988	<0.502	0.223	0.12	0.190	0.098
1857	Columbia Slough - 16811 NE Mason Ct	12/8/2017	11.7	157	7.2	4.0	31	66.7	1.81	19	1.64	0.688	0.780	<0.102	7.24	2.08	0.134	1.0	0.084	0.039
1857	Columbia Slough - 16811 NE Mason Ct	2/13/2018	10.7	173	7.3	5.6	<10	68.4	1.63	5	0.798	0.541	0.206	<0.102	3.03	1.58	0.030	0.85	0.063	0.028
1857	Columbia Slough - 16811 NE Mason Ct	4/26/2018	10.2	174	7.3	17.8	<10	72.5	2.56	12	0.994	0.687	0.253	<0.105	2.47	0.643	<0.020	0.22	0.084	0.022
1857	Columbia Slough - 16811 NE Mason Ct	6/11/2018	7.3	153	7.1	16.6	73	68.7	3.76	4	1.69	0.994	0.239	<0.105	2.27	1.39	0.038	0.12	0.081	0.050
1865	Columbia Slough - 9645 N Columbia Blvd	8/10/2017	9.5	135	7.9	23.2	10	52.4	1.62	14	1.33	0.570	0.576	<0.102	3.20	<0.502	0.024	0.15	0.047	<0.020
1865	Columbia Slough - 9645 N Columbia Blvd	10/16/2017	11.9	212	6.9	11.6	120	83.2	1.34	7	0.875	0.494	0.385	<0.102	2.72	1.14	0.133	2.6	0.098	0.052
1865	Columbia Slough - 9645 N Columbia Blvd	2/9/2018	9.2	221	7.1	10.4	<10	88.1	1.52	9	1.13	0.677	0.476	<0.102	5.14	2.73	0.073	2.4	0.099	0.036
1865	Columbia Slough - 9645 N Columbia Blvd	4/16/2018	12.2	194	7.4	12.8	10	82.2	2.09	10	1.91	0.946	0.447	<0.105	5.88	2.73	<0.020	1.5	0.085	0.024
1865	Columbia Slough - 9645 N Columbia Blvd	4/26/2018	19.4	215	8.6	18.3	<10	86.8	2.21	11	1.01	0.666	0.251	<0.105	2.30	<0.527	<0.020	1.4	0.075	<0.020
2113	Whitaker Slough - 6031 NE 92nd Dr	9/21/2017	7.2	197	6.9	13.5	170	77.3	1.23	<3	0.276	<0.201	0.104	<0.102	1.44	0.858	0.281	2.6	0.140	0.115
2113	Whitaker Slough - 6031 NE 92nd Dr	10/9/2017	10.0	214	6.9	13.1	63	84	<1.00	<3	0.284	<0.201	<0.100	<0.102	0.865	0.573	0.021	2.7	0.134	0.112
2113	Whitaker Slough - 6031 NE 92nd Dr	2/13/2018	12.0	207	7.1	8.1	20	81.3	<1.00	<3	0.313	0.210	<0.100	<0.102	1.37	0.838	0.074	3.2	0.124	0.117
2113	Whitaker Slough - 6031 NE 92nd Dr	4/16/2018	13.8	194	7.3	12.3	41	81.9	1.02	4	1.37	0.327	0.151	<0.105	3.92	2.23	0.059	2.6	0.128	0.079
2113	Whitaker Slough - 6031 NE 92nd Dr	4/26/2018	18.0	205	7.6	17.1	20	80.1	1.32	5	0.382	0.255	<0.100	<0.105	1.27	<0.527	0.034	1.8	0.116	0.046
2377	Columbia Slough - 10425 N Bloss Ave	9/7/2017	10.0	218	7.5	21.3	260	91.4	1.43	16	1.26	0.560	0.930	<0.102	4.02	0.674	0.055	1.9	0.083	0.030
2377	Columbia Slough - 10425 N Bloss Ave	10/16/2017	11.9	215	6.6	12.6	84	84.6	1.15	25	1.58	0.450	1.17	<0.102	7.35	0.967	0.130	2.9	0.123	0.059
2377	Columbia Slough - 10425 N Bloss Ave	2/9/2018	8.6	229	7.0	10.3	<10	88.1	1.41	10	1.10	0.515	0.462	<0.102	5.23	2.53	0.082	2.6	0.104	0.047
2377	Columbia Slough - 10425 N Bloss Ave	4/16/2018	12.2	200	7.4	12.3	10	87.1	2.14	8	1.30	0.888	0.321	<0.105	6.10	3.79	<0.020	1.6	0.099	0.028
2377	Columbia Slough - 10425 N Bloss Ave	4/26/2018	17.2	219	8.3	18.9	20	88.4	1.99	9	0.904	0.671	0.177	<0.105	2.11	<0.527	<0.020	1.6	0.076	<0.020
Johnson Creek																				
1612	Johnson Creek - 4305 SE Harney St	9/27/2017	9.8	160	7.5	15.3	420	54.5	2.69	5	1.47	1.07	0.293	<0.102	3.78	1.75	0.021	2.8	0.048	0.048
1612	Johnson Creek - 4305 SE Harney St	10/9/2017	10.7	203	7.6	13.1	250	74.4	2.07	8	1.21	0.791	0.754	<0.102	3.09	1.12	0.025	3.2	0.077	0.063
1612	Johnson Creek - 4305 SE Harney St	1/24/2018	12.2	79	7.5	8.2	560	28.2	2.26	52	3.44	1.20	1.78	0.125	22.5	5.83	0.052	1.5	0.135	0.029
1612	Johnson Creek - 4305 SE Harney St	2/7/2018	11.9	126	7.2	8.8	440	44.3	1.50	9	1.03	0.560	0.661	<0.102	4.02	1.64	<0.020	2.6	0.065	0.044
1612	Johnson Creek - 4305 SE Harney St	4/23/2018	12.7	97	8.1	12.1	41	33.6	1.55	<3	0.746	0.574	0.129	<0.105	2.13	0.729	<0.020	1.4	0.028	<0.020
2208	Johnson Creek - 4938 SE Johnson Creek Blvd	9/28/2017	9.5	174	7.3	15.2	300	61.3	2.40	3	1.32	0.983	0.267	<0.102	3.25	1.96	<0.020	3.3	0.040	0.047
2208	Johnson Creek - 4938 SE Johnson Creek Blvd	10/9/2017	11.1	175	7.4	12.5	390	65.9	2.62	<3	2.03	1.08	0.184	<0.102	2.63	1.78	0.033	2.4	0.055	0.051
2208	Johnson Creek - 4938 SE Johnson Creek Blvd	1/24/2018	12.6	72	7.5	8.2	410	25.3	2.28	56	3.57	1.22	1.91	0.130	20.9	4.71	0.048	1.4	0.132	0.022
2208	Johnson Creek - 4938 SE Johnson Creek Blvd	2/7/2018	12.5	94	7.5	8.6	340	32.6	1.39	<3	0.847	0.557	0.201	<0.102	3.12	1.53	<0.020	1.9	0.043	<0.020

Table B-4. Probabilistic Instream Sites Results (2017-18 permit year)

Site ID	Location Description	Sample Date	Field Parameters				Conventional				Metals						Nutrients			
			Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	*E. coli* (MPN/100mL)	Hardness (mg $CaCO_3$/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
2208	Johnson Creek - 4938 SE Johnson Creek Blvd	4/23/2018	12.6	97	7.9	11.9	41	33.3	1.54	<3	0.781	0.591	0.175	<0.105	2.31	0.909	<0.020	1.5	0.029	0.021
2320	Johnson Creek - 5509 SE Circle Rd	9/12/2017	7.7	157	7.3	17.5	260	52.9	3.55	3	1.41	1.06	0.220	<0.102	3.32	1.86	0.039	0.54	0.064	0.048
2320	Johnson Creek - 5509 SE Circle Rd	10/9/2017	10.4	131	7.4	10.9	160	44.5	3.19	<3	1.42	1.20	0.192	0.120	3.62	2.25	0.072	0.74	0.059	0.054
2320	Johnson Creek - 5509 SE Circle Rd	2/7/2018	11.5	83	7.0	8.0	52	27.3	1.22	4	0.709	0.462	0.210	<0.102	3.67	2.40	<0.020	2.1	0.033	<0.020
2320	Johnson Creek - 5509 SE Circle Rd	4/16/2018	11.3	68	6.9	8.9	320	25.9	2.05	34	2.63	0.933	1.25	<0.105	14.1	4.21	<0.020	1.2	0.100	0.029
2320	Johnson Creek - 5509 SE Circle Rd	4/23/2018	11.2	85	7.0	11.9	97	28.0	#N/A	<3	0.708	0.565	0.151	<0.105	3.60	2.43	<0.020	1.7	0.029	<0.020
2400	Johnson Creek upstream of SE Bell Ave	9/14/2017	9.3	158	7.3	16.4	650	56.5	3.92	13	1.73	1.17	0.336	<0.102	3.38	0.593	<0.020	0.11	0.072	0.040
2400	Johnson Creek upstream of SE Bell Ave	10/9/2017	12.4	121	8.0	13.1	370	42.4	3.46	<3	1.56	1.33	0.213	0.129	2.01	1.09	0.048	0.47	0.052	0.048
2400	Johnson Creek upstream of SE Bell Ave	1/24/2018	12.6	70	7.5	8.1	420	24.1	2.25	54	3.37	1.12	1.82	0.108	20.4	4.49	0.054	1.4	0.130	0.028
2400	Johnson Creek upstream of SE Bell Ave	2/7/2018	12.2	89	7.2	8.3	30	29.8	1.39	4	0.840	0.578	0.199	<0.102	3.41	1.90	<0.020	1.8	0.031	<0.020
2400	Johnson Creek upstream of SE Bell Ave	4/23/2018	12.5	91	8.1	12.6	41	31.8	1.55	<3	0.774	0.549	0.124	<0.105	2.51	1.03	<0.020	1.3	0.029	<0.020
Tualatin River Tributaries																				
1194	Columbia Creek - 3608 SW 60th Pl	8/29/2017	9.3	261	7.8	16.6	260	113	3.90	20	1.80	0.797	0.681	<0.102	7.86	1.10	<0.020	0.50	0.138	0.057
1194	Columbia Creek - 3608 SW 60th Pl	12/6/2017	11.6	197	7.6	7.4	75	76.6	2.66	16	1.18	0.789	0.271	<0.102	5.98	2.98	0.022	0.76	0.050	0.033
1194	Columbia Creek - 3608 SW 60th Pl	1/24/2018	11.7	108	7.3	8.1	150	44.6	5.24	106	7.44	2.87	3.55	0.266	30.2	5.85	0.024	0.64	0.228	0.082
1194	Columbia Creek - 3608 SW 60th Pl	2/8/2018	13.7	175	7.8	8.8	470	65.1	2.04	21	1.17	0.616	0.334	<0.102	4.54	1.49	<0.020	0.90	0.063	0.029
1194	Columbia Creek - 3608 SW 60th Pl	4/19/2018	11.6	171	7.8	9.6	98	65.4	2.13	6	1.43	0.677	0.345	<0.105	4.43	1.77	<0.020	0.76	0.054	0.037
1778	Woods Creek - 9715 SW 43rd Ave	8/24/2017	9.4	316	7.8	14.9	770	139	3.09	5	1.16	0.793	0.402	<0.102	4.13	1.71	0.096	1.1	0.067	0.029
1778	Woods Creek - 9715 SW 43rd Ave	10/31/2017	10.4	343	7.9	10.4	2300	139	2.94	<3	0.835	0.641	0.198	<0.102	4.10	2.37	0.206	1.4	0.034	0.032
1778	Woods Creek - 9715 SW 43rd Ave	1/24/2018	11.5	112	7.1	8.4	2100	42.5	3.76	28	5.49	2.63	3.93	0.477	37.8	18.1	0.078	1.6	0.123	0.062
1778	Woods Creek - 9715 SW 43rd Ave	2/8/2018	14.4	258	7.7	10.0	41	105	1.86	4	0.904	0.509	0.520	<0.102	6.55	2.60	0.140	1.7	0.058	<0.020
1778	Woods Creek - 9715 SW 43rd Ave	4/19/2018	11.1	235	7.6	10.3	63	88.1	1.74	3	0.948	0.576	0.587	<0.105	7.56	4.39	0.106	1.7	0.052	0.031
1834	Cedar Mill Creek Tributary - 2317 NW Birkendene St	8/15/2017	10.2	196	7.8	13.2	300	79.2	1.39	<3	0.697	0.556	<0.100	<0.102	3.29	2.11	<0.020	0.28	0.120	0.112
1834	Cedar Mill Creek Tributary - 2317 NW Birkendene St	10/5/2017	10.7	203	7.9	11.7	63	83.7	1.25	13	0.743	0.330	1.42	<0.102	27.3	15.7	<0.020	0.33	0.123	0.107
1834	Cedar Mill Creek Tributary - 2317 NW Birkendene St	1/24/2018	11.7	83	7.5	8.0	110	37.0	5.68	150	5.92	1.79	2.67	0.184	30.9	5.33	<0.020	0.75	0.233	0.061
1834	Cedar Mill Creek Tributary - 2317 NW Birkendene St	2/7/2018	12.1	152	7.7	8.6	<10	56.9	1.59	<3	0.804	0.507	0.182	<0.102	8.18	4.72	<0.020	0.52	0.085	0.059
1834	Cedar Mill Creek Tributary - 2317 NW Birkendene St	4/19/2018	11.4	141	7.7	10.4	540	53.0	1.71	7	1.06	0.582	0.268	<0.105	6.13	2.42	0.022	0.46	0.089	0.064
2154	Cedar Mill Creek Tributary - 2708 NW Mill Pond Rd	9/22/2017	9.8	155	7.2	11.3	810	56.3	3.99	4	2.28	1.53	0.272	<0.102	3.34	1.29	0.037	0.77	0.072	0.039
2154	Cedar Mill Creek Tributary - 2708 NW Mill Pond Rd	10/5/2017	9.7	194	7.5	11.4	85	69.5	3.17	10	1.25	0.747	0.329	<0.102	2.34	0.613	0.052	0.58	0.081	0.055
2154	Cedar Mill Creek Tributary - 2708 NW Mill Pond Rd	1/25/2018	11.7	108	7.3	7.3	52	42.2	3.80	48	5.02	1.84	1.53	0.191	16.6	3.56	<0.020	0.78	0.150	0.045
2154	Cedar Mill Creek Tributary - 2708 NW Mill Pond Rd	2/7/2018	11.7	154	7.6	8.6	41	55.0	2.21	4	1.25	0.703	0.254	<0.102	3.38	1.39	0.020	0.89	0.069	0.034
2154	Cedar Mill Creek Tributary - 2708 NW Mill Pond Rd	4/19/2018	10.9	143	7.5	11.1	110	51.3	2.28	25	2.21	0.712	0.745	<0.105	8.25	1.24	<0.020	0.69	0.085	0.038
2290	South Ash Creek - 6433 SW Dickinson St	8/31/2017	9.6	240	8.0	14.4	1000	113	<1.00	6	0.537	0.281	0.717	0.106	2.89	0.995	<0.020	0.67	0.102	0.097
2290	South Ash Creek - 6433 SW Dickinson St	10/31/2017	10.5	248	8.0	9.5	31	108	1.44	<3	0.513	0.365	0.349	0.106	4.72	3.39	<0.020	0.57	0.056	0.074
2290	South Ash Creek - 6433 SW Dickinson St	1/24/2018	11.6	85	7.1	8.2	1600	34.8	4.23	44	5.78	2.73	4.06	0.448	44.2	18.5	0.074	1.0	0.181	0.077
2290	South Ash Creek - 6433 SW Dickinson St	2/8/2018	14.2	201	7.6	8.9	10	83.4	1.26	<3	0.770	0.477	0.443	<0.102	6.38	3.38	<0.020	0.93	0.057	0.039
2290	South Ash Creek - 6433 SW Dickinson St	4/19/2018	11.2	183	7.7	9.9	20	74.3	1.60	5	1.11	0.676	0.720	<0.105	11.3	6.76	0.021	1.0	0.052	0.038

Table B-4. Probabilistic Instream Sites Results (2017-18 permit year)

Site ID	Location Description	Sample Date	Field Parameters				Conventional				Metals						Nutrients			
			Dissolved Oxygen (mg/L)	Conductivity (umhos/cm)	pH	Temp (C)	*E. coli* (MPN/100mL)	Hardness (mg $CaCO_3$/L)	Total Organic Carbon (mg/L)	Total Suspended Solids (mg/L)	Total Copper (ug/L)	Dissolved Copper (ug/L)	Total Lead (ug/L)	Dissolved Lead (ug/L)	Total Zinc (ug/L)	Dissolved Zinc (ug/L)	Nitrogen - Ammonia (mg/L)	Nitrogen - Nitrate (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)
Willamette River Tributaries																				
1744	Willamette River Tributary - 8421 SW Macadam Ave	8/17/2017	9.9	159	7.8	16.1	1800	54.9	2.16	17	1.31	0.577	0.777	<0.102	4.18	0.576	<0.020	0.79	0.139	0.096
1744	Willamette River Tributary - 8421 SW Macadam Ave	12/6/2017	12.2	147	7.7	6.6	<10	52.0	1.59	22	0.695	0.408	0.343	<0.102	2.16	0.688	<0.020	1.2	0.069	0.052
1744	Willamette River Tributary - 8421 SW Macadam Ave	1/25/2018	12.0	89	7.3	7.3	110	36.7	2.32	20	2.04	1.03	1.27	0.265	7.68	2.19	<0.020	0.79	0.109	0.060
1744	Willamette River Tributary - 8421 SW Macadam Ave	2/13/2018	12.6	146	7.9	5.5	<10	49.8	<1.00	16	0.721	0.230	0.484	<0.102	3.09	0.506	<0.020	1.4	0.071	0.050
1744	Willamette River Tributary - 8421 SW Macadam Ave	4/19/2018	11.6	135	7.8	9.5	<10	48.3	1.08	10	0.703	0.303	0.484	<0.105	3.06	11.9	<0.020	1.1	0.063	0.049
1769	Miller Creek - 12928 NW Newberry Rd	8/16/2017	9.3	104	7.3	14.0	30	35.3	1.68	4	0.489	0.386	<0.100	<0.102	0.630	<0.502	<0.020	0.55	0.060	0.059
1769	Miller Creek - 12928 NW Newberry Rd	10/5/2017	10.5	97	7.2	10.4	10	32.1	1.84	<3	0.453	0.402	<0.100	<0.102	<0.500	<0.502	<0.020	0.44	0.047	0.050
1769	Miller Creek - 12928 NW Newberry Rd	1/24/2018	12.0	57	7.2	7.9	41	20.5	4.38	135	2.93	0.859	1.87	0.172	10.9	1.49	<0.020	2.3	0.135	0.029
1769	Miller Creek - 12928 NW Newberry Rd	2/8/2018	12.3	70	8.0	7.0	10	20.7	2.05	<3	0.814	0.461	0.245	<0.102	1.92	0.637	<0.020	1.8	0.045	0.030
1769	Miller Creek - 12928 NW Newberry Rd	4/19/2018	12.1	67	7.0	7.2	<10	20.2	1.86	5	0.766	0.363	0.283	<0.105	2.00	<0.527	<0.020	1.5	0.039	0.025
1936	Tryon Creek Tributary - 10719 SW Boones Ferry Rd	8/30/2017	9.8	155	6.5	15.3	660	58.9	1.36	4	1.10	0.508	0.607	<0.102	2.47	0.687	<0.020	1.5	0.100	0.099
1936	Tryon Creek Tributary - 10719 SW Boones Ferry Rd	10/31/2017	11.6	156	8.8	7.9	10	55.3	1.76	4	0.714	0.588	0.149	<0.102	1.05	<0.502	<0.020	1.2	0.077	0.091
1936	Tryon Creek Tributary - 10719 SW Boones Ferry Rd	1/24/2018	11.6	94	7.3	8.7	160	36.6	3.83	31	4.88	2.76	2.74	0.586	14.8	5.51	0.026	1.2	0.153	0.075
1936	Tryon Creek Tributary - 10719 SW Boones Ferry Rd	2/8/2018	14.3	147	7.9	9.1	<10	51.0	<1.00	7	0.670	0.383	0.273	<0.102	2.12	0.792	<0.020	1.9	0.054	0.041
1936	Tryon Creek Tributary - 10719 SW Boones Ferry Rd	4/19/2018	11.4	145	7.8	10.3	52	52.2	1.06	6	0.859	0.500	0.359	<0.105	2.62	1.06	0.028	1.7	0.055	0.051
2185	Saltzman Creek Trib - Forest Park, 2nd order stream	8/9/2017	8.8	130	7.4	15.6	10	40.2	2.40	4	0.823	0.733	0.101	<0.102	0.759	0.749	<0.020	0.33	0.063	0.069
2185	Saltzman Creek Trib - Forest Park, 2nd order stream	12/7/2017	12.5	90	7.4	5.5	<10	31.3	2.73	<3	1.07	0.844	0.258	0.139	1.46	0.851	<0.020	1.7	0.057	0.051
2185	Saltzman Creek Trib - Forest Park, 2nd order stream	2/8/2018	12.3	84	7.6	7.2	<10	28.4	2.22	6	1.11	0.598	0.340	<0.102	2.09	0.526	<0.020	1.5	0.060	0.036
2185	Saltzman Creek Trib - Forest Park, 2nd order stream	4/19/2018	12.1	80	7.3	7.3	<10	26.6	2.07	9	1.16	0.484	0.464	<0.105	2.50	<0.527	<0.020	1.3	0.062	0.039
2185	Saltzman Creek Trib - Forest Park, 2nd order stream	6/11/2018	10.9	121	7.4	11.0	<10	48.4	2.56	4	1.35	0.576	0.171	<0.105	0.931	<0.527	<0.020	0.58	0.075	0.060
2318	Balch Creek - 5410 NW Cornell Rd	8/1/2017	9.4	198	7.6	15.8	300	65.2	2.45	<3	0.871	0.733	<0.100	<0.102	0.658	<0.502	<0.020	0.53	0.069	0.085
2318	Balch Creek - 5410 NW Cornell Rd	10/5/2017	11.2	199	7.7	9.1	63	72.9	2.52	<3	0.763	0.592	0.142	<0.102	0.905	<0.502	<0.020	0.44	0.086	0.081
2318	Balch Creek - 5410 NW Cornell Rd	1/24/2018	12.0	74	7.3	7.4	150	38.1	7.51	486	11.6	1.55	8.41	0.169	41.0	1.69	0.025	2.3	0.467	0.046
2318	Balch Creek - 5410 NW Cornell Rd	2/7/2018	12.0	110	7.5	6.9	75	37.1	2.27	5	1.44	0.699	0.509	0.115	3.27	0.978	<0.020	1.7	0.074	0.030
2318	Balch Creek - 5410 NW Cornell Rd	4/19/2018	11.5	103	7.5	8.6	63	34.5	2.17	12	1.41	0.617	0.601	0.112	3.77	0.819	<0.020	1.4	0.063	0.032

Table B-5. Macroinvertebrate Results (2017-18 permit year)

Sample Information			Raw Metrics										Standardized Scores										
Site ID	Collection Date	Fraction Sorted	Richness	Mayfly Richness	Stonefly Richness	Caddisfly Richness	Number Sensitive Taxa	# Sediment Sensitive Taxa	Modified HBI	% Tolerant Taxa	% Sediment Tolerant Taxa	% Dominant	Richness	Mayfly Richness	Stonefly Richness	Caddisfly Richness	Number Sensitive Taxa	# Sediment Sensitive Taxa	Modified HBI	% Tolerant Taxa	% Sediment Tolerant Taxa	% Dominant	TOTAL SCORE
2318	8/1/2017	14/30	40	5	4	6	2	2	4.4	7.1	2.3	21.3	5	3	3	3	3	5	3	5	5	3	38
2185	8/9/2017	18/30	41	6	6	7	4	2	4.4	0.6	0.6	51.5	5	3	5	3	3	5	3	5	5	1	38
1834	8/15/2017	11/30	24	2	0	2	1	1	5.6	9.8	9.6	33.5	3	1	1	1	1	3	1	5	5	3	24
1769	8/16/2017	10/30	39	5	7	4	3	1	4.5	4.5	2.0	30.0	5	3	5	3	3	3	3	5	5	3	38
1744	8/17/2017	30/30	28	6	5	3	3	1	3.2	4.4	4.4	19.8	3	3	3	1	3	3	5	5	5	5	36
1778	8/24/2017	27/30	23	3	2	1	1	0	6.1	22.9	23.6	41.0	3	1	1	1	1	1	1	3	3	1	16
1194	8/29/2017	13/30	18	4	0	0	1	0	4.5	3.4	3.6	73.1	1	3	1	1	1	1	3	5	5	1	22
1936	8/30/2017	15/30	32	4	3	3	2	0	4.2	2.6	3.4	25.7	3	3	3	1	3	1	3	5	5	3	30
2290	8/31/2017	22/30	25	3	1	2	2	1	4.6	12.9	12.7	48.1	3	1	1	1	3	3	3	5	3	1	24
2320	9/12/2017	30/30	17	1	0	0	0	0	6.6	52.9	65.0	35.7	1	1	1	1	1	1	1	1	1	3	12
2400	9/14/2017	19/30	25	3	0	4	0	0	6.2	55.5	52.2	50.9	3	1	1	3	1	1	1	1	1	1	14
2154	9/22/2017	30/30	24	4	0	0	1	0	5.7	20.8	20.4	19.4	3	3	1	1	1	1	1	3	3	5	22
1612	9/27/2017	16/30	31	6	0	2	0	0	5.7	58.3	47.3	45.3	3	3	1	1	1	1	1	1	1	1	14
2208	9/28/2017	14/30	23	4	0	3	0	0	5.6	75.6	44.7	38.6	3	3	1	1	1	1	1	1	1	3	16

Table B-5. Macroinvertebrate Results (2017-18 permit year) (continued)

Sample Information			Functional Feeding Composition										Density	Taxonomic Composition							
Site ID	Collection Date	Fraction Sorted	Collector-Filterers	Collector-Gatherers	Macrophyte-Herbivore	Omnivores	Parasites	Piercing Herbivores	Predators	Scrapers	Shredders	Unknown	TOTAL DENSITY (#/m2)	EPT Taxa Richness	Predator Richness	Scraper Richness	% Intolerant Taxa	Number Tolerant Taxa	% Oligochaeta	% Simuliidae	% Chironomidae
2318	8/1/2017	14/30	10%	47%	0%	4%	1%	0%	16%	7%	14%	1%	1505	15	16	5	1.1	6	0.6	0.0	37.2
2185	8/9/2017	18/30	1%	66%	0%	1%	1%	0%	15%	7%	6%	3%	1220	19	13	7	6.8	2	0.4	0.2	20.2
1834	8/15/2017	11/30	13%	52%	0%	18%	1%	0%	9%	3%	5%	1%	1904	4	11	2	0.2	3	9.2	8.3	64.0
1769	8/16/2017	10/30	14%	57%	0%	4%	1%	0%	11%	3%	11%	1%	2232	16	13	4	3.1	4	1.4	0.5	32.7
1744	8/17/2017	30/30	1%	40%	0%	1%	0%	0%	8%	17%	32%	0%	463	14	7	3	15.1	2	4.1	0.9	7.0
1778	8/24/2017	27/30	0%	49%	1%	1%	0%	0%	43%	0%	5%	0%	818	6	12	2	0.2	2	22.1	0.0	62.5
1194	8/29/2017	13/30	0%	93%	0%	3%	0%	0%	3%	0%	0%	0%	1717	4	2	1	0.4	1	3.4	0.0	17.2
1936	8/30/2017	15/30	2%	58%	0%	5%	0%	0%	8%	6%	22%	0%	1434	10	7	3	5.4	2	2.4	0.2	21.2
2290	8/31/2017	22/30	9%	81%	0%	1%	0%	0%	2%	5%	1%	0%	980	6	4	1	6.0	2	12.2	8.4	2.4
2320	9/12/2017	30/30	13%	23%	0%	6%	1%	0%	6%	50%	0%	2%	211	1	3	4	0.0	4	13.4	0.0	19.1
2400	9/14/2017	19/30	1%	69%	0%	1%	0%	0%	7%	7%	0%	15%	1245	7	4	5	0.0	9	50.9	0.0	10.1
2154	9/22/2017	30/30	1%	61%	0%	10%	1%	0%	22%	4%	0%	0%	291	4	6	3	2.3	3	19.4	0.5	27.8
1612	9/27/2017	16/30	12%	66%	0%	8%	2%	0%	6%	3%	0%	2%	1375	8	6	4	0.0	9	45.3	0.0	23.5
2208	9/28/2017	14/30	33%	51%	0%	1%	5%	0%	2%	9%	0%	0%	1652	7	3	5	0.0	6	38.6	0.0	10.5

Part IV
CONTACT INFORMATION

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