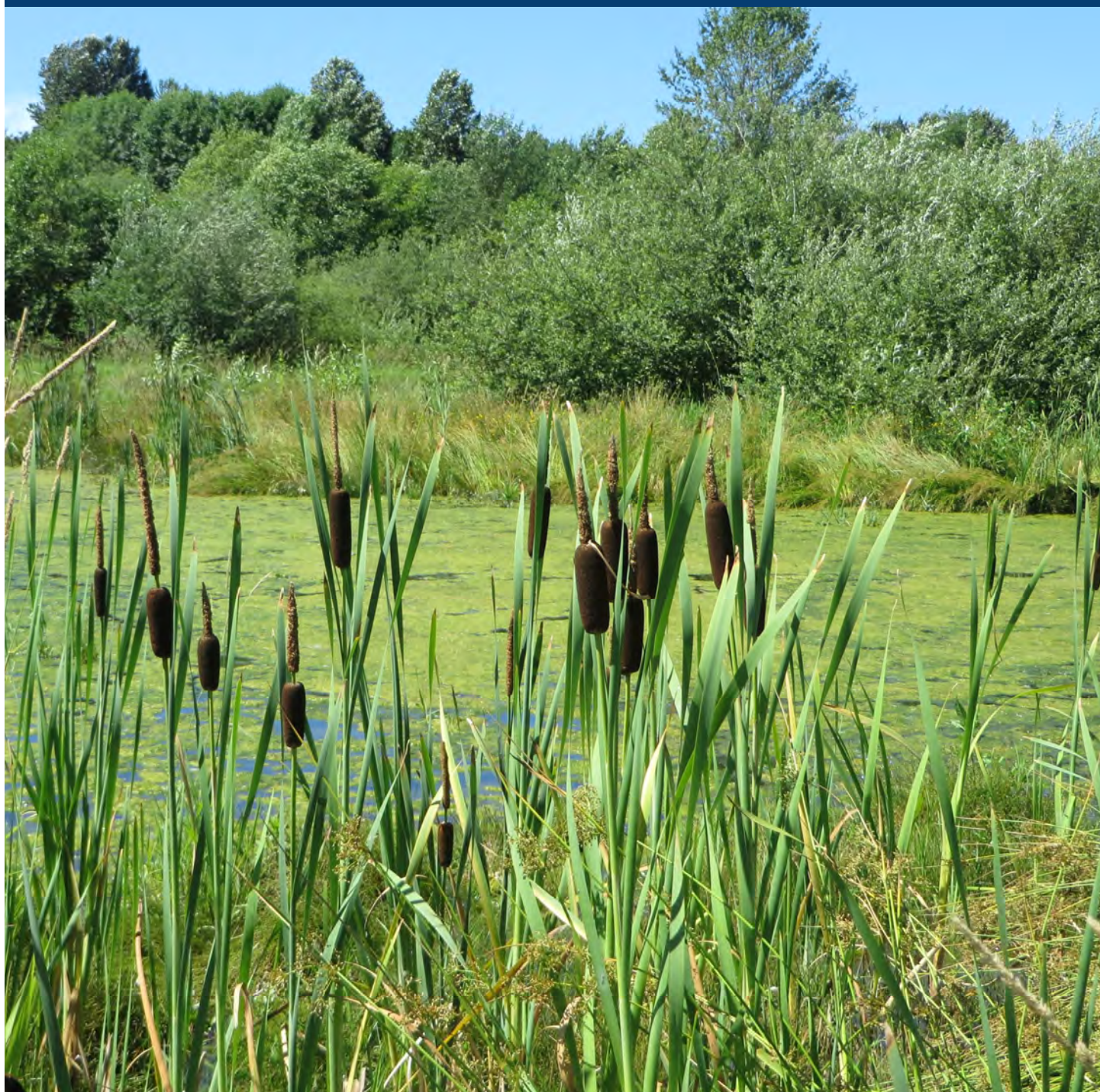


2023 Annual Report Columbia Slough Sediment Program

January 2024

Prepared by:



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2022–2023 Annual Report

Columbia Slough Sediment Cleanup Program

Published: January 2024

Prepared by:



ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers



State of Oregon
**Department of
Environmental
Quality**

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Acronyms and Abbreviations

BES	City of Portland Bureau of Environmental Services
BMP	best management practice
CCSP	Columbia Corridor Stormwater Program
CEL	Community Engagement Liaison
CIP	Capital Improvement Program
City	City of Portland
COPC	contaminant of potential concern
COVID-19	coronavirus disease 2019
CSWC	Columbia Slough Watershed Council
CWSP	Community Watershed Stewardship Program
DEQ	Oregon Department of Environmental Quality
DMR	discharge monitoring report
<i>E. coli</i>	<i>Escherichia coli</i>
ECSI	Environmental Cleanup Site Information
EPA	U.S. Environmental Protection Agency
ESPCP	Erosion, Sediment, and Pollutant Control Plan
IGA	Intergovernmental Agreement
IP	Integrated Planning
LID	local improvement district
LTMP	Columbia Slough Watershed Long-term Monitoring Plan
MIP	Maintenance Inspection Program
MS4	Municipal Separate Storm Sewer System
N	north
NE	northeast
NEC	No Exposure Certification
NPDES	National Pollutant Discharge Elimination System
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation

Acronyms and Abbreviations (continued)

OHA	Oregon Health Authority
O&M	operations and maintenance
ORANG	Oregon Air National Guard
PAH	polycyclic aromatic hydrocarbon
PBOT	Portland Bureau of Transportation
PCB	polychlorinated biphenyl
PDX	Portland International Airport
PFAS	per- and polyfluoroalkyl substances
PFOS	perfluorooctane sulfonic acid
Port	Port of Portland
PP&R	Portland Parks & Recreation
PPA	Prospective Purchaser Agreement
PrAP	Priority Area Planning Division
ROD	Record of Decision
ROW	right-of-way
SCM	Source Control Manual
SIC	Standard Industrial Classification
SIFT	screening inline flow-through
Slough	Columbia Slough
SMF	stormwater management facility
SPCR	Spill Prevention and Citizen Response
SWMM	Stormwater Management Manual
SWMP	Stormwater Management Program
SWPCP	Stormwater Pollution Control Plan
TIP	Total Maximum Daily Load (TMDL) Implementation Plan
TMDL	total maximum daily load
TSS	total suspended solids
UIC	underground injection control

2022–2023 Columbia Slough Sediment Cleanup Program Highlights

The work described in this annual report is required to comply with the 2005 Oregon Department of Environmental Quality (DEQ) Record of Decision (ROD) and the 2021 Intergovernmental Agreement (IGA) between the City of Portland (City) and DEQ for cleanup of the Columbia Slough (Slough). The DEQ and City Columbia Slough Sediment Programs have worked cooperatively over time to define the nature and extent of contamination, assess and reduce potential risks to human health and the environment, and identify and control contaminant sources. In addition, DEQ has required or implemented actions to clean up contaminants found in Slough sediment. The program is managed by DEQ in close collaboration with the City Bureau of Environmental Services (BES). This annual report details the program's key accomplishments from the 2022–2023 fiscal year and looks ahead to planned activities for the next fiscal year.



Canoeing the Slough

2022–2023 Highlights:

DEQ ACTIVITIES	Sediment Characterization and Cleanup	20	Properties (approximately) are undergoing source control evaluations and/or cleanup actions to prevent sediment recontamination.
		1	Sediment characterization evaluation is underway.
		1	Sediment remedial design is in process at Pacific Carbide.
		3	In-water sediment caps were monitored for effectiveness.
DEQ ACTIVITIES	Natural Resource Fund	2	Sites completed habitat improvements.
	Community Outreach/Education	1	Interactive Columbia Slough Story Map is available online, highlighting Slough history, source control, cleanup framework, fish advisory, and specific in-water cleanup site updates.
		1	Informational booth was provided at the Columbia Slough Watershed Council Slough Celebration.
		1	Slough Science event was held on Whitaker Pond.
CITY ACTIVITIES	Community Outreach	15	Communities representing Black, Indigenous, and People of Color (BIPOC), immigrants and refugees were surveyed by Community Engagement Liaisons to better understand communities' motivations and history of use of the Slough. Data is being used to support City equity and environmental justice goals.
	Source Control Evaluation and Management	13	Priority outfall basins are undergoing continued characterization, stormwater treatment alternative development, and treatment design to improve water quality and reduce stormwater runoff from selected City rights-of-way discharging to the Slough.
		12	Facilities were required to submit a City Code-required Stormwater Pollution Control Plan for potential discharges to the Slough via the Municipal Separate Storm Sewer System (MS4).
		157	Stormwater and 28 stormwater solids samples were collected from 32 outfall basins to identify contaminant sources and characterize City stormwater discharges.

CITY ACTIVITIES	Source Control Evaluation and Management (continued)	19	Industrial facilities were required to install stormwater treatment or volume reduction measures.
		193	National Pollutant Discharge Elimination System (NPDES) 1200-Z Stormwater Permit violations were documented for facilities that hold an NPDES 1200-Z Stormwater Permit and discharge to the Slough. This number is similar to previous years.
		96	Inspections of non-permitted industrial sites were conducted within the Columbia Slough watershed.
		13	Industrial facilities that hold an NPDES 1200-Z Stormwater Permit and discharge to the Slough were referred to DEQ for permit violations.
CITY ACTIVITIES	Long-term Monitoring and Fish Advisory Activities	1	Slough-wide fish tissue sampling event is scheduled for 2025.
		1	Slough-wide sediment sampling event is scheduled for 2026.
		1	Update to the fish advisory was issued based on recent data evaluating per- and polyfluoroalkyl substances (PFAS). Meal recommendations were updated for largescale sucker from the Slough from two, 8-ounce fillets or one whole-body meal per month to two, 8-ounce fillets per month but no whole-body meals.
CITY ACTIVITIES	Citywide Programmatic Source Control Activities		The City continued to implement a wide-range of source control actions to reduce pollutant discharges to the Slough, such as: Street sweeping, catch basin cleaning, spill response, green stormwater facility maintenance, erosion control and other best management practices. 1,972 calls were received by the City's 24-hour spill response hotline (citywide). 0 illicit discharges were identified within the Columbia Slough watershed. 729 stormwater management facilities on 222 sites were inspected on private property to ensure that they meet City maintenance requirements. 1,050 plants, 4,518 shrubs, and 2,027 trees were planted in the Columbia Slough watershed.

Looking Ahead to 2023–2024

- Initiate DEQ-led soil removal at Auto Salvage 205 on Whitaker Slough and a preliminary stormwater investigation at Golden Bear Ventures on Middle Slough.
- Continue planning of DEQ-led sediment cleanup adjacent to the former Pacific Carbide facility in the Lower Slough and DEQ oversight of sediment investigation of Elrod Ditch in the Middle Slough.
- Continue DEQ-required upland source control actions at 11 Lower Slough sites, 1 Upper Slough site, and 8 Middle Slough sites.
- The City will begin engineering design in outfall basins 59, 60, 61, 61A, 62, 62A, 63, 64, and 65A, and continue engineering design for stormwater treatment of selected City rights-of-way (Outfalls 57, 58, 65, and 73A).
- The first phase of the City Local Improvement District (new outfall) project at Northeast (NE) 46th Avenue and NE Bryant Street, and construction on the NE 42nd Avenue Bridge replacement, will commence in March 2024.
- The City and DEQ will continue stormwater and stormwater solids monitoring in priority basins to identify potential sources of contaminants discharging to the MS4 and, if necessary, refer them to appropriate regulatory enforcement programs.
- The City plans to re-engage the Community Engagement Liaisons on fish advisory outreach and education activities.



ENVIRONMENTAL SERVICES
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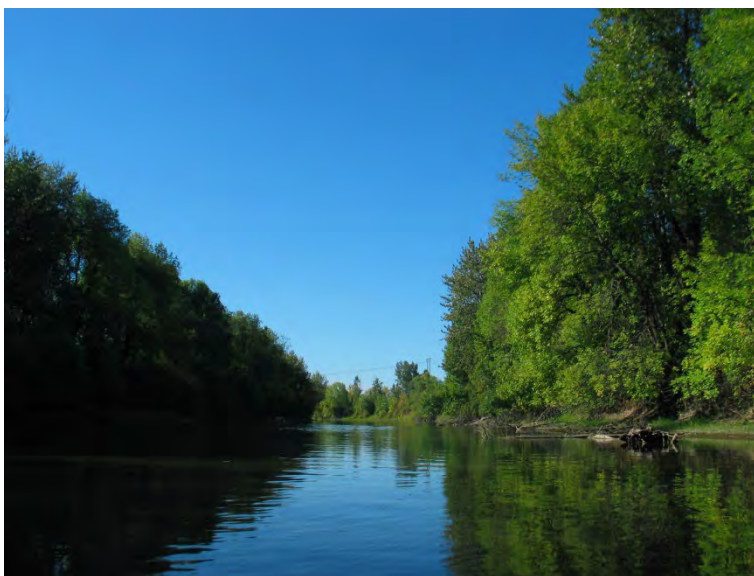
1 Introduction and Purpose

The Columbia Slough (Slough) is located south and parallel to the Columbia River and consists of approximately 31 miles of waterway extending from Fairview Lake on the east side to the Willamette River on the west. Industrial and urban development along the Slough has resulted in the accumulation of a variety of contaminants in Slough sediments and fish tissue collected from the Slough.

This 2023 report summarizes annual activities and ongoing programs implemented by the City of Portland (City) Bureau of Environmental Services (BES) and the Oregon Department of Environmental Quality (DEQ) to improve Columbia Slough sediment quality as identified under DEQ's 2005 Record of Decision (ROD) (DEQ, 2005).¹ The ROD established a program to: (1) clean up Slough sediments at individual release sites, (2) implement actions known as source control measures throughout the watershed to prevent further releases, and (3) monitor conditions over the long term to ensure continued improvement. Since 2006, DEQ and BES have implemented a watershed management approach to address Columbia Slough sediment contamination through a series of Intergovernmental Agreements (IGAs), including the *2021 Intergovernmental Agreement – Oversight of Columbia Slough Sediment Remedial Action* (effective January 1, 2021, through December 31, 2025) (BES and DEQ, 2021).

Partnership obligations under the 2021 IGA includes stormwater source control and management at private properties and City-managed properties, sediment characterization and remediation, long-term monitoring, data management, fish advisory outreach and signage, and annual report preparation.

This report emphasizes the notable accomplishments, ongoing activities to improve watershed health, and agency work products for the fiscal year. The fiscal year is July 1, 2022 to June 30, 2023. Some activities occurring outside this period are included for clarity (i.e., June to December 2023). For copies of the reports cited, please contact the following:



The Smith Bybee reach looking west.

- BES Columbia Slough Sediment Program Manager: (503) 823-7580
- DEQ Columbia Slough Sediment Project Manager: (503) 229-5040

¹ DEQ. 2005. *Record Of Decision – Remedial Action Approach For Columbia Slough Sediment - Portland, Oregon*. Prepared by Oregon Department Of Environmental Quality (DEQ), Northwest Region Office. July 2005. Available at: <https://www.deq.state.or.us/Webdocs/Controls/Output/PdfHandler.ashx?p=17b16a0b-ef61-4256-bae1-e6fb1993eae&s=CSloughROD2005scan.pdf>. July 2005.

2 DEQ Cleanup Site Activities

The DEQ Cleanup Program is currently overseeing source control and cleanup actions at approximately 20 sites in the Columbia Slough Watershed.² Site evaluations are performed to assess stormwater at upland sites to determine whether stormwater discharges are contributing to adverse impacts in the Columbia Slough and determine the appropriate upland source control actions. DEQ is also working to implement several in-water sediment cleanups. DEQ project status and information can be found in the DEQ Environmental Cleanup Site Information (ECSI) database³ for the Columbia Slough Project (ECSI #1283) or individual cleanup sites or through the DEQ Columbia Slough Sediment Program's webpage.⁴

DEQ's Water Quality Program oversees other programmatic actions that contribute to Columbia Slough improvements, such as issuing the following types of permits: industrial stormwater permits (National Pollutant Discharge Elimination System [NPDES] 1200-Z), NPDES Municipal Separate Storm Sewer System (MS4) permits, construction (NPDES 1200-C) stormwater permits, underground injection control (UIC) (i.e., dry wells) Water Pollution Control Facility permits, and wastewater permits.⁵

2.1 Source Control

Upland source control actions completed under DEQ Cleanup oversight in 2022–2023 include stormwater improvements and removal of source contamination at private properties and site investigations. DEQ-required source control evaluations and source control actions at selected upland sites discharging to the Slough are conducted in accordance with DEQ's *Guidance for Evaluating the Stormwater Pathway at Upland Sites* (DEQ, 2010). Highlights from the 2022–2023 fiscal year are summarized in the following sections. Figure 1 at the end of this section shows an area-wide view of these upland site locations.

2.1.1 Lower Slough

- Larsen South (#3337): Stormwater infrastructure maintenance and repairs for additional onsite infiltration are complete. The southern and northern stormwater swales were enlarged for additional stormwater storage.
- Hanson Pipe (#3893): The site was issued a Conditional No Further Action, under which the owner agrees to perform long-term monitoring. Operation and maintenance requirements were memorialized in an Easement and Equitable Servitudes.
- Columbia Steel (#104): A source control summary report was submitted to DEQ and is currently under review.

² Information provided in Section 2 was obtained from the ECSI database and communications with DEQ project managers.

³ Site-specific information and project status can be obtained from DEQ's ECSI database at <https://www.deq.state.or.us/lq/ecsi/ecsiquery.asp?listtype=lis&listtitle=Environmental+Cleanup+Site%20Information+Database>.

⁴ Visit the DEQ Columbia Slough Sediment Program webpage at <https://www.oregon.gov/deq/Hazards-and-Cleanup/CleanupSites/Pages/Columbia-Slough.aspx> for more information.

⁵ For further information, visit the DEQ Water Quality homepage at <https://www.oregon.gov/deq/wq/pages/default.aspx> and the Reducing Pollutants through DEQ Regulatory Programs page at <https://geo.maps.arcgis.com/apps/Cascade/index.html?appid=e5822d506bac40e5b05c2f8fa53909f6>.

- Kostas Scrap Metal (#6126): Roof maintenance and repairs were conducted to address elevated metal concentrations in stormwater samples. DEQ is currently reviewing roof repair results.
- Oregon Department of Transportation (ODOT) Maintenance Yard (#5023): Implemented source control measures at the yard; however, additional treatment and drainage options are being evaluated. A stormwater and infrastructure evaluation is ongoing.
- Rivergate Auto Wrecking (#2056): Performed soil removal, cap placement and groundwater evaluation. A Notice of Environmental Contamination was recorded with Multnomah County. No Further Action was issued in December 2021.
- Portland Meadows (#6343): Completed redevelopment of the northern parcels of the site; property-specific Stormwater Pollution Control plans are in development. A source control evaluation is currently underway.
- MB Terminal (#339): Performing source control evaluation on site.
- Blasen Family (#3785): Redevelopment of the southern portion of the site began during the summer 2022. Improvements to the southern portion include repaving and new stormwater infrastructure.
- Malarkey Roofing: A stormwater treatment system was installed in December 2021. A Source Control Evaluation Report is pending.
- Airport Auto Salvage (#6484): A soil and groundwater investigation was conducted in spring 2023. Based on the results of the investigation, a soil removal action to address elevated polychlorinated biphenyl (PCB) and lead concentrations onsite was completed in fall 2023.

Figure 2 at the end of this section shows these upland site locations.

2.1.2 *Middle Slough*

- McBride Slough (#5676): The Port of Portland (Port) continues to perform stormwater effectiveness monitoring at Portland International Airport (PDX) in areas that drain to McBride Slough. DEQ proposed to issue a conditional No Further Action determination for the site and is in the process of finalization.
- Elrod Ditch (#6392): DEQ has reviewed and provided feedback on a draft Remedial Investigation report for the site.
- Oregon Humane Society/Steelman Enterprise (#4017): A conditional No Further Action determination was issued for the site in October 2023.
- Diesel Cast West Portland (#6453): An additional soil and groundwater investigation was conducted in November 2022. DEQ received an investigation report and is currently under review.
- Nuway Oil (#88): Portland Bureau of Transportation (PBOT) has submitted a 50-percent Design Plan for infrastructure updates, including stormwater improvements, along Northeast (NE) 46th Ave. and adjacent to the Nuway Oil site.
- Owens Brockway (#1311) made recent improvements to the upland stormwater system including adding a sedimentation maintenance hole and a treatment vault for

outfall 2. DEQ approved the Revised Source Control Review Report on November 10, 2022. Fish tissue sampling was also performed in Johnson Lake this year. DEQ reviewed the report and provided comments in November 2023. The final Fish Tissue Sampling Report will be submitted in the first quarter of 2024.

- Atlas Towing (#5903) and Moody Property (#4581): A Source Control Evaluation Report was submitted to DEQ on November 16, 2021; however, additional supplemental information was requested and is currently under review.
- PDX Fire Pits/Oregon Air National Guard (ORANG) (#3324/1372): Per- and polyfluoroalkyl substances (PFAS) investigation at PDX continues. Multiple phases of the investigation (soil, groundwater, surface water, and stormwater) have been completed. Shallow groundwater contamination is extensive but appears confined to PDX property. Contamination is not expected to pose a risk to the City's wellfield resources; this will be confirmed with additional monitoring. PFAS-impacted shallow groundwater is discharging to stormwater ditches, which are directed to the Columbia Slough. Forthcoming investigation by the Port will determine if stormwater impacted with PFAS-containing deicing fluids discharged to the Columbia River during winter months. Under the direction of the U.S. Department of Defense, ORANG will be conducting a Remedial Investigation which will include the collection of surface water and sediment samples from areas within the Columbia Slough adjacent to and downgradient from the ORANG facility. Work is expected to begin in late 2023.

Figure 3 at the end of this section shows these upland site locations.

2.1.3 *Upper Slough*

- Gresham Fire Training Center (#6458): In May 2023, DEQ Site Assessment performed an investigation of PFAS in subsurface soil, sediment, surface water, and groundwater samples as part of an Expanded Preliminary Assessment. Based on the results, releases of PFAS have been documented in both soil, catch basin sediment, and groundwater at the site. PFAS were also detected in sediment and surface water at the associated outfall. However, the outfall accepts stormwater and groundwater from multiple sources and therefore the PFAS cannot be attributed solely to the site.

Figure 4 at the end of this section shows this upland site location.

2.2 Sediment Cleanup

Characterization and cleanup of sediment contamination are completed either by private parties or by DEQ using funds from settlements with parties that contributed to Slough sediment contamination. To date, 10 sediment cleanups have been completed in the Columbia Slough.

Sediment characterization/cleanup highlights for fiscal year 2022–2023 include the following:

2.2.1 *Lower Slough*

- Pacific Carbide, 9901 North (N) Hurst Ave (#268): DEQ completed the 90-percent Design Plan to address PCB, calcium, and polycyclic aromatic hydrocarbon (PAH) impacted Columbia Slough sediment adjacent to Pacific Carbide. Oregon Department of State Lands partnered with DEQ and received a \$1 million U.S. Environmental

Protection Agency (EPA) Brownfields grant to assist with remediation costs associated with the in-water sediment located adjacent to the site. A 2.45-acre chemical isolation cap with fish-friendly river rock armoring and sand habitat layer, and a 0.43-acre thin-granulated activated carbon amended sand cap, were selected to address the contamination. A portion of the Columbia Slough bank slope will be reduced for flood mitigation purposes; this effort further removes contaminated Pacific Carbide bank soils and improves bank habitat.

- Columbia Steel (#104): Dioxin-contaminated sediments in lowland ditches adjoining the Slough were remediated in 2018. Effectiveness monitoring continued through 2023.
- South Rivergate Pond (#5822): In 2018, EPA collected sediment samples to determine the extent of sediment contamination in South Rivergate Pond and potentially the Columbia Slough. In 2019, EPA reported that samples collected indicate the presence of PCBs, metals, pesticides, and semi-volatile organic compounds at significant concentrations in pond sediments and Columbia Slough sediments where pond water discharges to the Slough. DEQ continues to negotiate necessary cleanup work. Figure 5 at the end of this section shows the Rivergate Pond area.

2.2.2 *Whitaker Slough*

- East Whitaker Pond (#5455): Metro Metals dewatered, dredged, and capped portions of East Whitaker Pond sediments in the Summer of 2021. Effectiveness monitoring continues until 2026. The 2023 results met objectives.⁶
- Halton/Nuway (#121/#88): DEQ prepared a Presumptive Remedy Proposal Technical Memorandum in 2019. Additional action is required to meet Columbia Slough sediment objectives. As resources allow, DEQ will further design treatment.

2.2.3 *Middle Slough*

- Elrod Ditch (#6392): The Port conducted a Remedial Investigation/Feasibility Study workplan to address Elrod Ditch sediments at the western side of PDX. DEQ has reviewed the results and is engaging with the Port about addressing contaminants found in the sediment and surrounding soils.

2.3 Settlement Negotiations

In 2008, DEQ provided an alternative option for responsible parties to settle their potential liability for Columbia Slough sediment contamination. DEQ developed a settlement framework that calculates a “cash-out” payment for each facility based on estimated costs that would be incurred in a sediment investigation and cleanup. Settling parties pay that amount to a state fund dedicated to sediment investigation and cleanup of priority areas within the Columbia Slough. Settlements are announced under public notices with a public comment period. DEQ has completed 19 settlements under this approach. No settlements were signed in 2023.

⁶ More information on East Whitaker Pond is available at <http://www.ordeg.org/metrometals>.

2.4 Prospective Purchaser Agreements

Prospective Purchaser Agreements (PPAs) are tools to expedite the cleanup of contaminated property and encourage property transactions that otherwise might not occur because of the liabilities associated with purchasing a contaminated site. In the Columbia Slough area, PPAs generally require upland source control evaluation and a contribution to the Columbia Slough remedial fund. DEQ has completed nine PPAs in the Columbia Slough.

A PPA was executed for the Golden Bear Ventures PPA site (#6544) in 2023. DEQ is currently reviewing a preliminary stormwater assessment and Source Control Evaluation Work Plan for the site.

2.5 Natural Resource Fund

DEQ, in collaboration with the Oregon Department of Fish and Wildlife (ODFW), developed an option for private parties to settle for state natural resource damages associated with contaminant-related impairment of the Columbia Slough. The basic settlement amount associated with natural resource damages to the Slough remained the same from 2009–2019. In October 2019, DEQ increased the settlement amount in consideration of two factors: cost inflation and nominal ODFW oversight costs. The payments are dedicated to habitat improvements within the Slough watershed. Work was completed on the following projects in 2022:

- Portland Parks & Recreation (PP&R) improved Whitaker Ponds Nature Park. Improvements included the reduction of invasive terrestrial and aquatic plants, installation of understory plants, and conversion of a small grassy field into a forest. The ponds serve as important native turtle habitats along with excellent turtle viewing opportunities. Settlement funds contributed up to \$55,000.
- Multnomah County Drainage District reduced invasive plant species, revegetated, and improved Blue Heron Wetlands and the Columbia Children's Arboretum. Settlement funds contributed up to \$129,700.

2.6 Anticipated Cleanup Actions in 2023–2024

Sediment cleanup and upland source control actions that are anticipated to occur in 2023–2024 include:

2.6.1 Lower Slough

- Pacific Carbide (#268): DEQ will continue internal contracting process to prepare the 100-percent Design Document and install the chemical isolation cap and thin-granulated activated carbon amended sand cap to address the PCB and PAH contamination. Benthic macroinvertebrate biomonitoring will occur before and after implementation to understand the potential changes to the benthic community resulting from the remediation of the contaminated sediments. DEQ will provide additional communication on project implementation as the timeline is further refined.
- Blasen (#3785): A Remedial Action Plan detailing upland stormwater improvements and a Northern Fill Area cap was submitted and reviewed by DEQ. The Remedial Action Plan is anticipated to be implemented in 2024.

2.6.2 *Whitaker Slough*

- 205 Auto Salvage (#2087): Site owners will remove surface soils with elevated PCB concentrations from the stormwater retention pond onsite.

2.6.3 *Middle Slough*

- Elrod Ditch (#6392): The Port will finalize a Remedial Investigation/Feasibility Study Report.
- Golden Bear (#6544): Site owners will conduct a sediment investigation as part of a preliminary stormwater assessment. A Source Control Evaluation Work Plan and Report detailing the investigation will be prepared and submitted to DEQ.

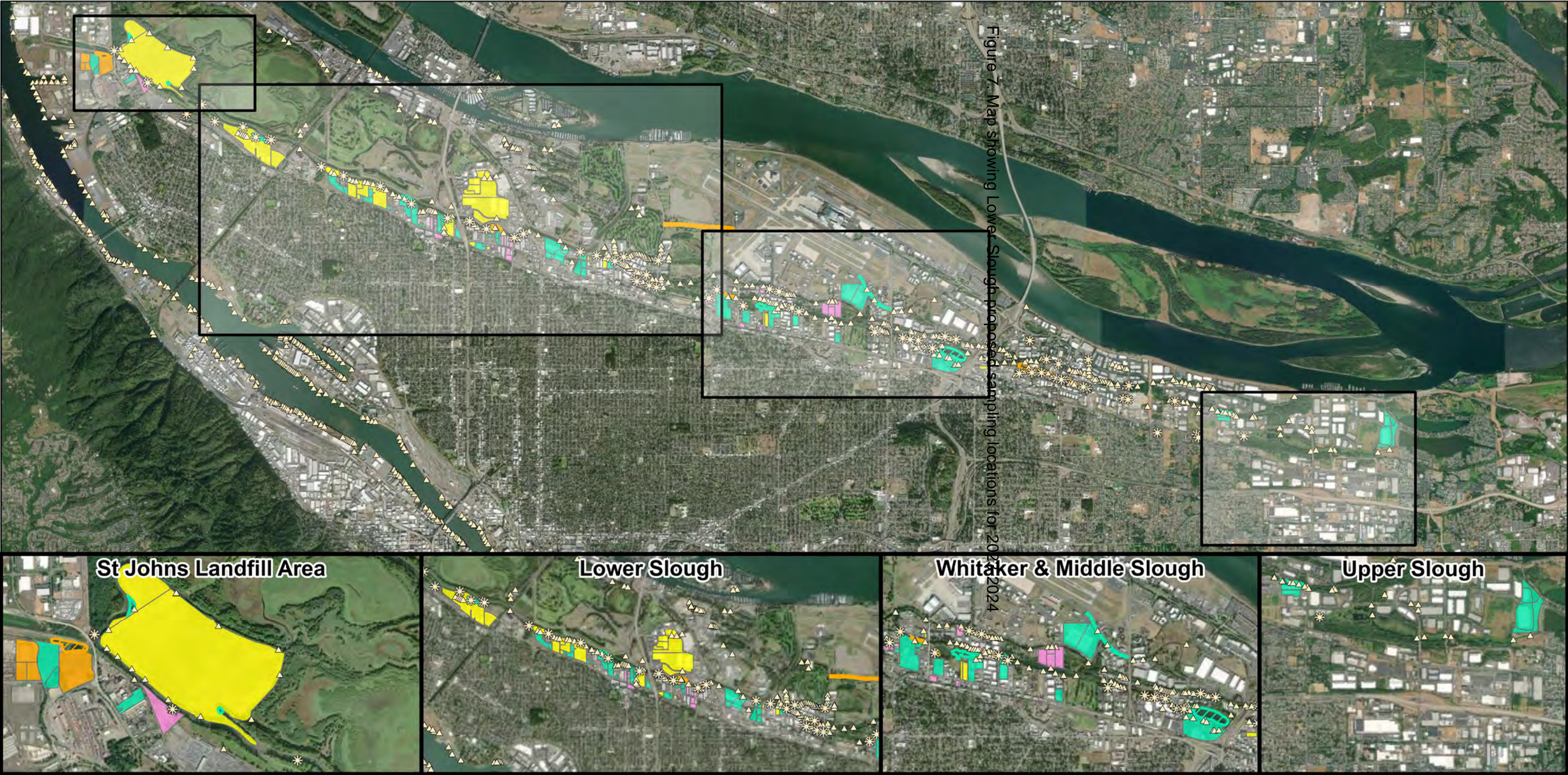
2.7 Outreach

DEQ prepared an online Story Map that is an in-depth resource for the public that covers the Columbia Slough history, source control, cleanup framework, fish advisory and specific in-water cleanup site updates. The Story Map has been updated to provide the public with information about the ongoing Pacific Carbide remediation efforts, including information on the EPA Brownfields grant.⁷

DEQ managed an informational booth at the Columbia Slough Watershed Council's (CSWC's) Slough Celebration on May 20, 2023, and participated in the "Slough Science: Whitaker Pond Walk with DEQ" on August 23, 2023. DEQ also participated in Women in Environment's Professional Development Event with the CSWC on September 14, 2023.

⁷ The Story Map can be viewed at <https://storymaps.arcgis.com/stories/e5d73ad7218c4972b2f036501879a3aa>.

Figure 1. Map showing area-wide view of upland site locations along Columbia Slough



**Area-Wide Columbia Slough Watershed
Source Control Measures and In-water Cleanup**



In-water Cleanup Site Status

- Cleanup Completed
- Cleanup Planned
- Cleanup Need Identified

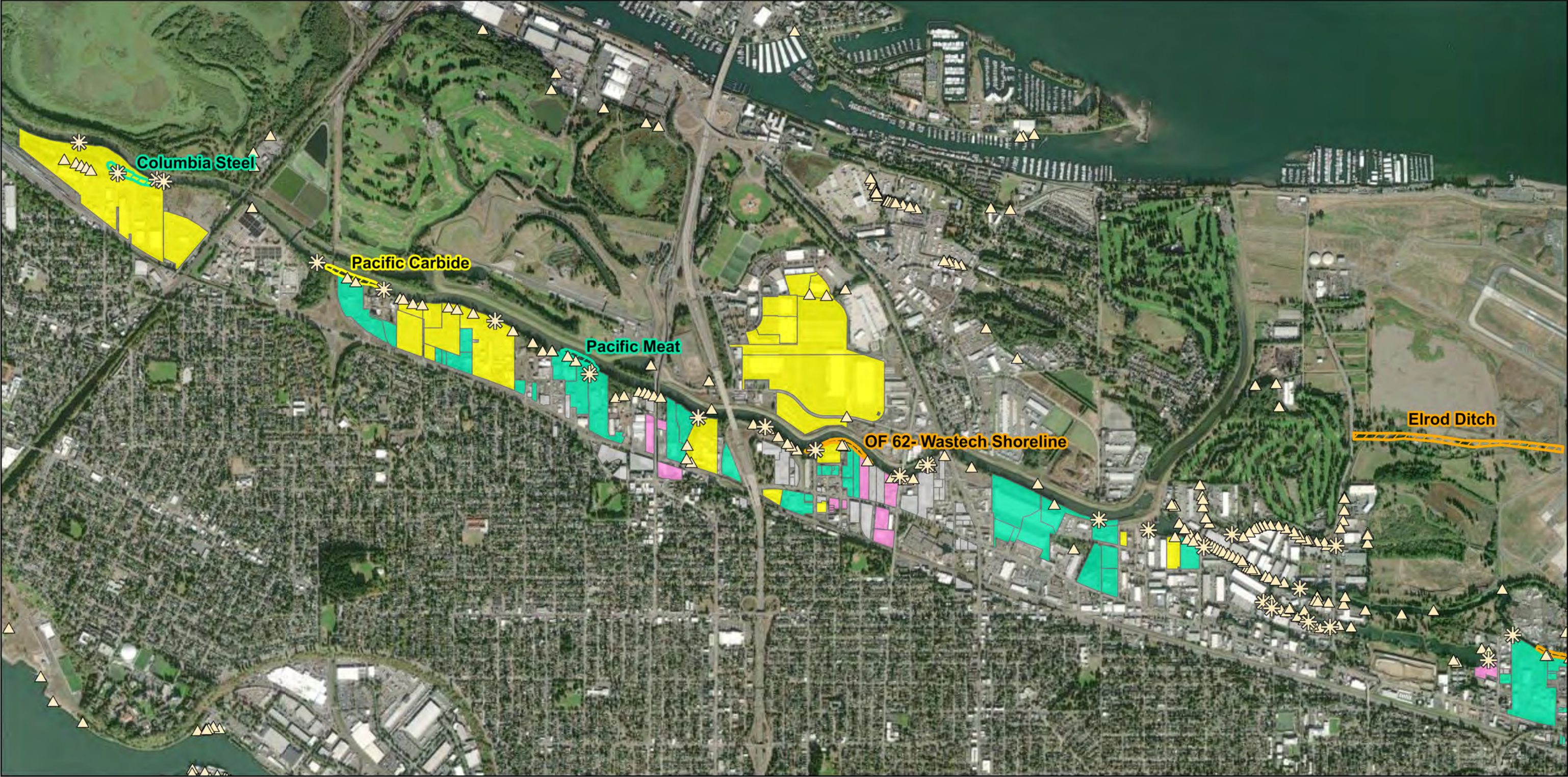
Source Control Status

- Need Identified- High Priority
- Need Identified- Medium Priority
- Need Identified- Low Priority

- Source Control Measure Underway
- Source Control Complete
- City of Portland Outfalls
- Non-City Outfalls



Figure 2. Map showing Lower Slough upland site locations



**Lower Slough, Columbia Slough Watershed
Source Control Measures and In-water Cleanup**

In-water Cleanup Site Status

- Cleanup Completed
- Cleanup Planned
- Cleanup Need Identified

Source Control Status

- Need Identified- High Priority
- Need Identified- Medium Priority
- Need Identified- Low Priority

- Source Control Measure Underway
- Source Control Complete
- City of Portland Outfalls
- Non-City Outfalls

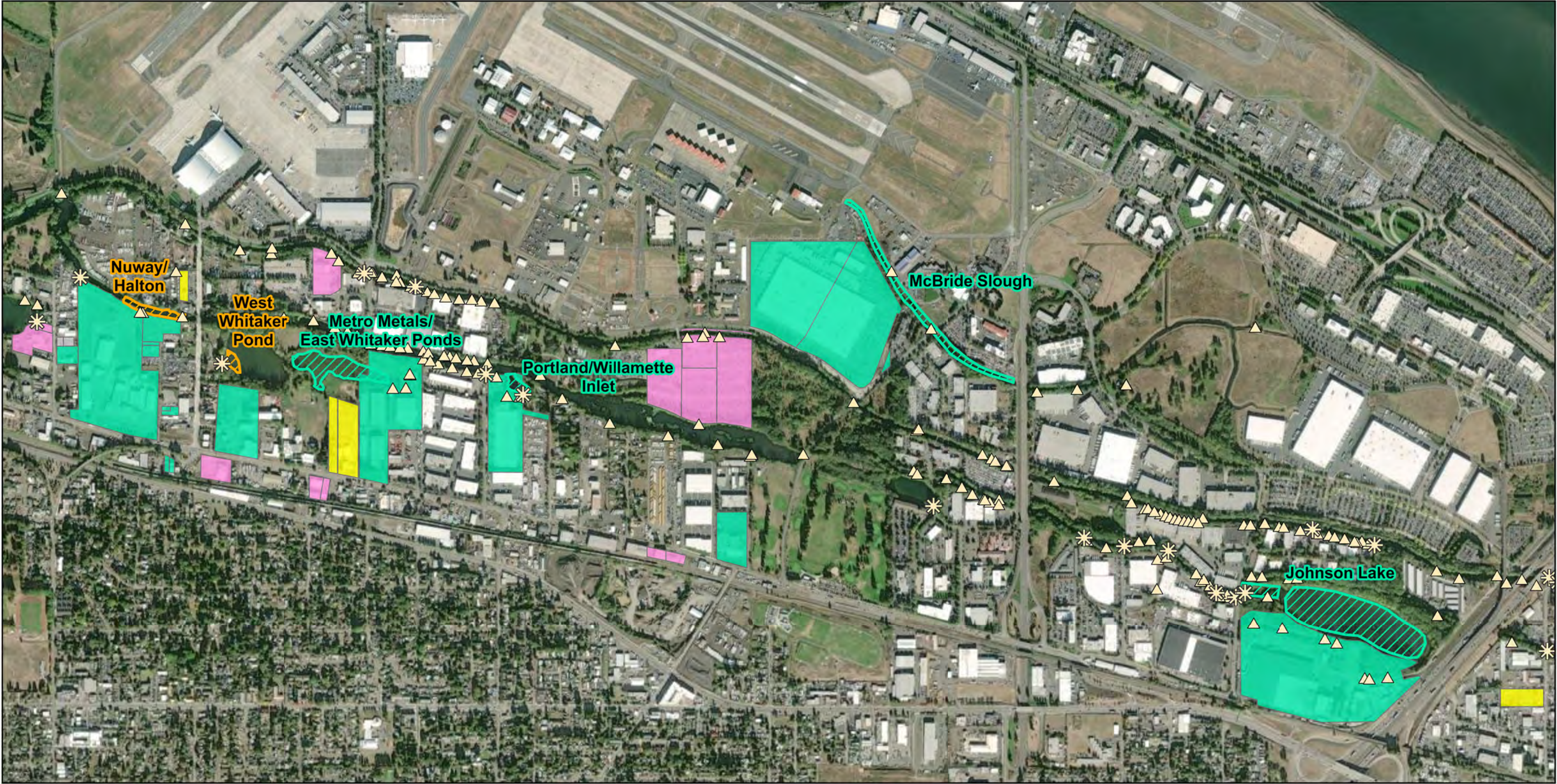


0 0.6 1.2 Miles



Date: 1/23/2024

Figure 3. Map showing Middle Slough upland site locations



Whitaker & Middle Slough, Columbia Slough Watershed Source Control Measures and In-water Cleanup



0 0.5 1 Miles

In-water Cleanup Site Status

- Cleanup Completed
- Cleanup Planned
- Cleanup Need Identified

Source Control Status

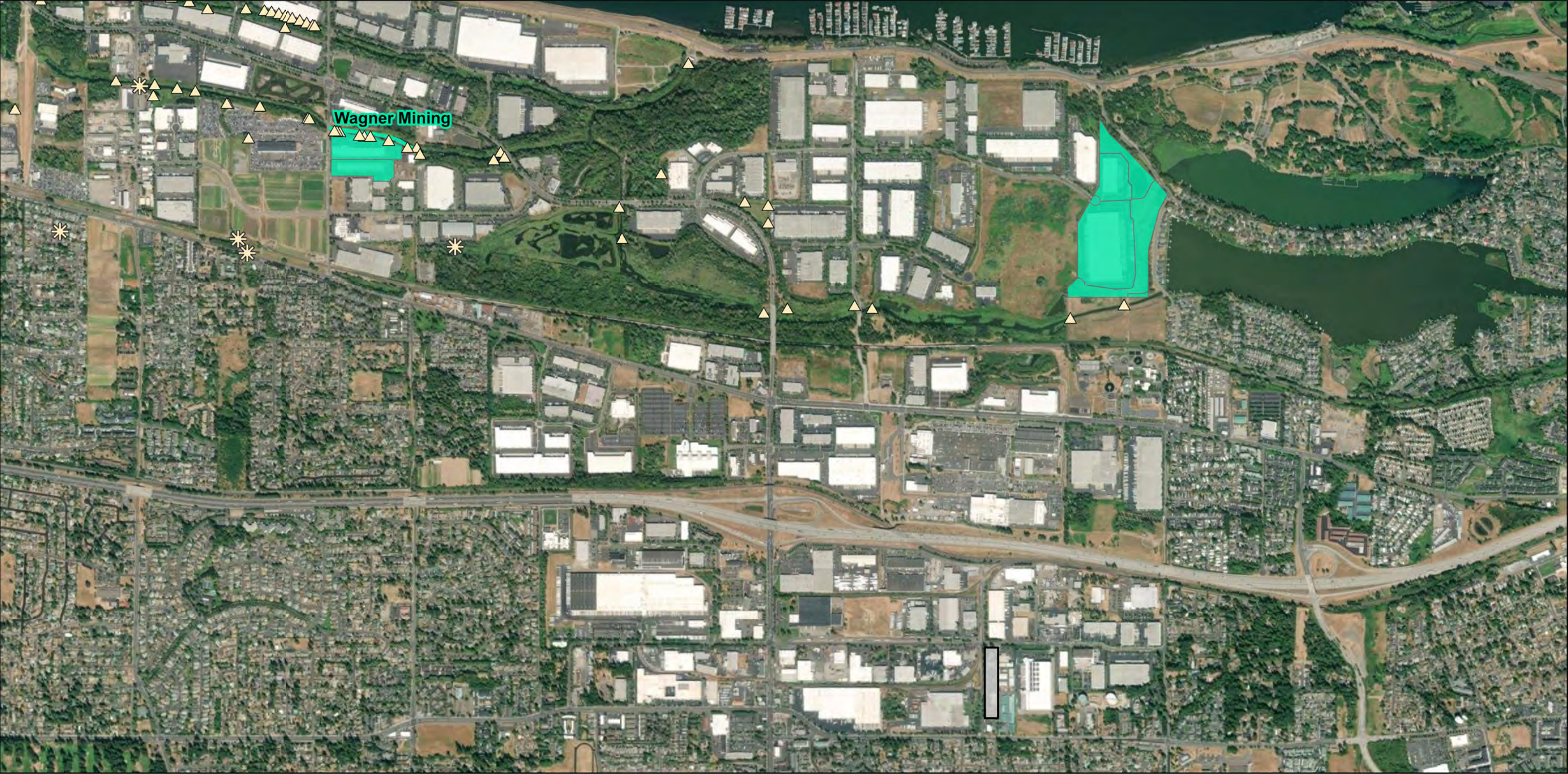
- Need Identified- High Priority
- Need Identified- Medium Priority
- Need Identified- Low Priority

- Source Control Measure Underway
- Source Control Complete
- City of Portland Outfalls
- Non-City Outfalls













Date: 1/23/2024

Figure 4. Map showing Upper Slough upland site locations



**Upper Slough, Columbia Slough Watershed
Source Control Measures and In-water Cleanup**

In-water Cleanup Site Status		Source Control Status	
	Cleanup Completed		Need Identified- High Priority
	Cleanup Planned		Need Identified- Medium Priority
	Cleanup Need Identified		Need Identified- Low Priority
			Source Control Measure Underway
			Source Control Complete
			City of Portland Outfalls
			Non-City Outfalls

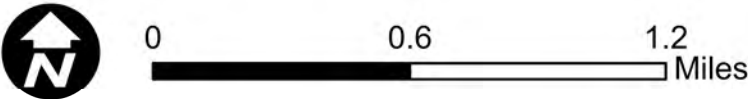


Figure 5. Map showing Rivergate Pond cleanup location



St Johns Landfill Area Lower Slough, Columbia Slough Watershed Source Control Measures and In-water Cleanup

00.250.5Miles

In-water Cleanup Site Status	
	Cleanup Completed
	Cleanup Planned
	Cleanup Need Identified

Source Control Status	
	Need Identified- High Priority
	Need Identified- Medium Priority
	Need Identified- Low Priority

	Source Control Measure Underway
	Source Control Complete
	City of Portland Outfalls
	Non-City Outfalls

Date: 1/23/2024

3 City Columbia Slough Sediment Cleanup Program Activities

The City of Portland implements activities to fulfill the requirements of the 2005 DEQ Columbia Slough Sediment ROD through a series of IGAs entered into by DEQ and BES in 2006, 2011, 2016, and 2021.⁸ The activities described in this section directly or indirectly reduce pollutant discharges via the stormwater pathway to the Columbia Slough and contribute to improving sediment and fish tissue quality and watershed health. Additional City actions performed to comply with other DEQ citywide permits or IGAs that contribute to reductions in pollutant discharges to the Slough are described in Section 4.

This section provides an overview of the activities performed to fulfill the requirements of the 2021 IGA and conducted in accordance with the *Columbia Slough Sediment Program Watershed Action Plan* (BES and DEQ, 2011) and the *Columbia Slough Watershed Long-term Monitoring Plan* (BES, 2007).

The activities completed in fiscal year 2022–2023 (July 1, 2022, to June 30, 2023) and planned activities for fiscal year 2023–2024 (July 1, 2023, to June 30, 2024) are described in the following sections. Some activities occurring after June 2023 are included for clarity.

3.1 BES Stormwater Source Control Evaluation and Management

BES upland stormwater source control evaluation and management activities conducted in the 2022–2023 fiscal year are described in the following sections.

3.1.1 City Roadways/City Stormwater Outfall Projects

The City is working to treat stormwater runoff from selected City roadways in accordance with the ROD, IGA, and Watershed Action Plan in selected City stormwater basins. BES is currently working on numerous stormwater outfall basin Capital Improvement Program (CIP) projects to improve water quality, and, where possible, reduce the volume of stormwater runoff flowing into the Slough via the City's stormwater conveyance system. Figure 6 at the end of this section shows the locations of active stormwater treatment design and planning projects.

The City's approach to stormwater management emphasizes the use of vegetated surface facilities to treat and infiltrate stormwater. Infiltrating stormwater with vegetated surface facilities is a multi-objective strategy that provides several benefits, including but not limited to pollution reduction, volume and peak-flow reduction, and groundwater recharge. These benefits play a critical role in protecting stormwater infrastructure and improving watershed health.

The following sections describe highlights of the City's work performed in 2022–2023 for the City Roadways/City Stormwater Outfalls projects.

3.1.1.1 Stormwater Treatment of City Rights-of-Way – Engineering Pre-Design/Design

Basin delineation refinement and preliminary stormwater subcatchment modeling were completed in each basin and pre-design activities have been initiated as described below. Design and construction of the stormwater treatment systems will be phased over time to accommodate the scale, complexities, and significant costs of these actions. Planning, pre-

⁸ 2021 *Intergovernmental Agreement – Oversight of Columbia Slough Sediment Remedial Action* (effective January 1, 2021, through December 31, 2025)

design, and engineering design activities were performed in 2022–2023 and will continue in 2023–2024.

The status of current BES right-of-way (ROW) stormwater treatment projects is described below:

Outfall 57: This basin drains approximately 115 acres (35 acres of City ROWs) and discharges to the Lower Slough. It comprises mostly residential properties in the Portsmouth neighborhood and City roadways, including an approximate 0.8-mile section of Columbia Boulevard (i.e., high traffic, freight corridor). BES is actively involved in community outreach.

The 30-percent design was completed and reviewed by the interdisciplinary project team and approved by an internal management team to proceed with the 60-percent design. The 90-percent design is underway and is anticipated to be completed in January 2024. Construction, including a stormwater filter vault, green streets and stormwater UIC facilities, is currently targeted for fall 2024.

Basin stormwater monitoring was conducted in 2022–2023 and will continue in 2023–2024.

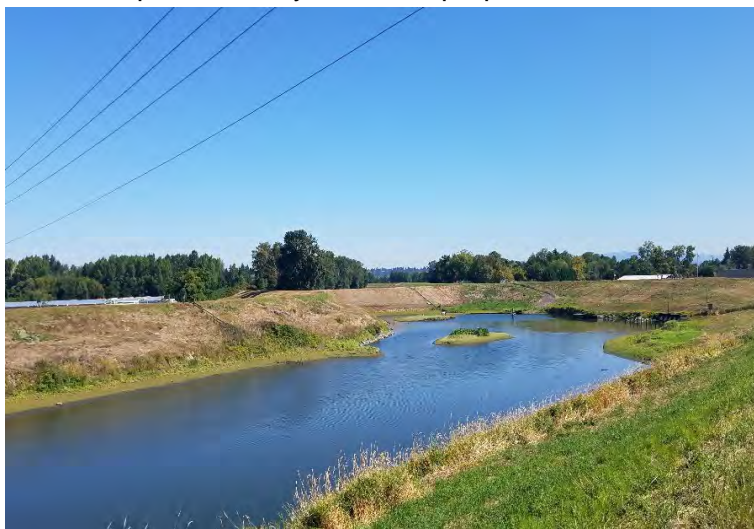
Outfall 58: This basin drains approximately 13 acres (3.5 acres of City ROWs) and discharges to the Lower Slough. The basin comprises mostly industrial properties in the Kenton neighborhood and City roadways, including an approximate 0.3-mile section of Columbia Boulevard (i.e., high traffic, freight corridor). BES is actively involved in community outreach.

The 90-percent design was completed in late 2023, and a final design package is scheduled for submittal in February 2024. BES has worked with the property owner (Pacific Carbide) at 9901 N Hurst Avenue to secure temporary and permanent easements to construct a manufactured stormwater treatment technology (i.e., StormFilter Vault). Construction is currently targeted for Summer 2024.

Basin stormwater monitoring was conducted in 2022–2023 and will continue in 2023–2024.

Outfall 65: This basin drains approximately 26.7 acres (7.2 acres of City ROWs) and discharges to the Lower Slough. The basin comprises mostly industrial properties in the Woodlawn and Sunderland neighborhoods and City roadways, including an approximate 0.4-mile section of Columbia Boulevard (i.e., high traffic, freight corridor). BES is actively involved in community outreach.

The 90-percent design was completed in December 2023, and a final design package is scheduled for submittal in early 2024. Construction of a stormwater filter vault is currently targeted for Summer 2024.



The Lower Slough looking east from near Outfall 65.

Outfall basin 65 stormwater monitoring was conducted in 2022–2023 and will continue in 2023–2024.

Outfall 73A: This basin drains approximately 20.8 acres (4.9 acres of City ROWs) and discharges to the Whitaker Slough. Preliminary design has been completed and indicates that manufactured stormwater treatment technologies (i.e., filter vaults) are feasible in this basin. Survey work and additional design work is currently being performed and the formation of a Local Improvement District⁹ (LID) was approved by City Council in September to help address the significant stormwater volume entering this system from overland flow from private properties. Design is anticipated to begin in early 2024.

Basin stormwater monitoring was conducted in 2022–2023 and will continue in 2023–2024.

Outfalls 59, 60, 61, and 61A (Kenton Priority Outfalls): Basin project management was assigned to the BES Integrated Planning (IP) Group/Priority Area Planning Division (PrAP) to develop and analyze stormwater treatment project alternatives. In 2021-2022, IP initiated planning to identify tasks, budget, schedule, and staff. IP has documented known information about the outfall basins, water quality, Slough habitat, etc., and is working through recommended solutions to treat stormwater and achieve other City goals in each of the four basins. The recommended alternative(s) will be passed on to other BES groups for engineering design and planning in early 2024.

Basin stormwater monitoring was conducted in 2022–2023 and will continue in 2023–2024.



Outfall 59, one of the Lower Slough basins included in the Kenton Priority Outfalls Plan.

Outfalls 62, 62A, 63, 64, and 65A (Piedmont Priority Outfalls Plan): Like the Kenton Priority outfalls, basin project management for the Piedmont Priority outfalls was assigned to the IP/PrAP to develop and analyze stormwater treatment alternatives. IP is currently collecting pertinent information and data to adequately characterize and document these five basins for the purpose of developing and evaluating stormwater treatment alternatives. Alternatives for Piedmont Priority outfalls are anticipated to be passed on to other BES groups for engineering design and planning in the fall 2024.

⁹ A LID is a method by which a group of property owners can share in the cost of infrastructure improvements, most commonly for street improvements, including sidewalk and stormwater infrastructure. The City then manages the design and construction of the project. PBOT is the lead bureau in establishing LIDs.

Basin stormwater monitoring was conducted in 2022–2023 and will continue in 2023–2024.

3.1.1.2 Constructed City ROW Treatment Systems

Outfall 100: Construction was completed in December 2020. Stormwater from approximately 15 acres of City ROW is treated before discharge to the eastern end of Whitaker Slough. The project includes 10 UIC structures, 12 maintenance holes with manufactured stormwater treatment systems, 22 sedimentation maintenance holes, and two green streets. Effectiveness monitoring is in progress and will continue in 2023–2024.



The Outfall 104B Green Street treatment facility.

Outfall 104B:

Construction was completed in March 2019. Stormwater from approximately 26 acres of City ROW is treated before discharging to the eastern end of Whitaker Slough. The treatment system consists of more than 50 curb-extension-style vegetated stormwater facilities along the higher-traffic roadways (Shaver Street, Prescott Drive, 125th Place, 131st Place, and 133rd Avenue). Effectiveness monitoring is in progress and will continue in 2023–2024.



Manufactured stormwater treatment system (filters).

Outfall 77A:

Construction was completed in 2016. Stormwater from approximately 2.5 acres of City Columbia Boulevard ROW is treated before discharging to the Willamette inlet on Whitaker Slough. The treatment facility

consists of a sediment maintenance hole and a stormwater filter vault. Effectiveness monitoring is in progress and will continue in 2023–2024.

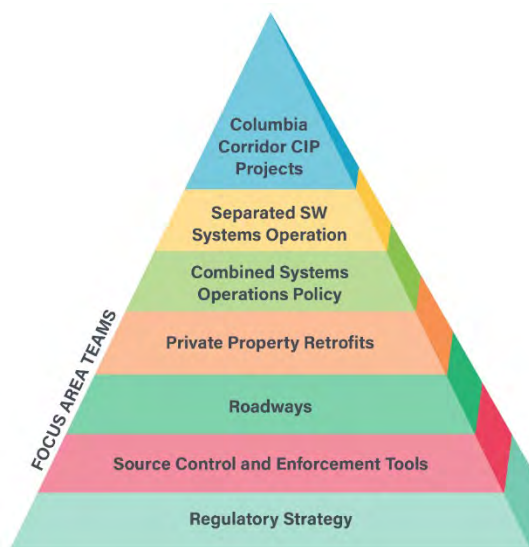
3.1.1.3 Columbia Corridor Stormwater Program

The Columbia Corridor Stormwater Program (CCSP) was initiated under the BES Columbia Slough Sediment Program in 2018 to develop investment strategies and innovative tools to reduce stormwater pollutant discharges from City ROWs to the Slough. Numerous challenges for controlling pollutant discharges to the City stormwater system or for constructing treatment facilities in selected outfall basins were identified in the Columbia Corridor. City basins often have one or more of the following source control challenges:

- Constrained ROWs
- Unimproved roadways/properties
- Heavy industrial land use
- Sediment/contaminant tracking from private properties into the City ROW

- Industrial activity being performed in City ROW
- Stormwater run-on from private property into the City ROW
- Unpermitted sources
- Uncontrolled upland sources (i.e., sources have not performed or completed stormwater source control under the DEQ Cleanup Program or other regulatory programs)
- Other

Six focus area teams composed of staff across BES and other City bureaus collaborated to develop solutions to address stormwater management challenges, primarily focusing on non-capital solutions (concurrent capital projects are focusing on capital engineered solutions). The focus teams worked together over several years to identify and vet potential solutions that could be applied to reduce stormwater pollutant discharges to the Columbia Slough. The CCSP was completed in Summer 2022 and the teams developed solutions, policy changes, and BES operational recommendations for reducing pollutant discharges to the Slough. Recommendations were vetted by BES management and are being implemented through various BES divisions and considered during the integrated planning and predesign/design processes for the City ROW stormwater treatment projects described above. Examples of solutions, policy changes and recommendations being implemented include the following:



- Working with DEQ to prioritize the use of DEQ's cleanup authority to control contaminants at upland sources within City outfall basins with approved BES funding for design and construction of stormwater treatment systems.
- Implemented changes to the City's 2021 Stormwater Management Manual (SWMM) and 2021 Source Control Manual (SCM) to facilitate approval of onsite stormwater management (i.e., upland pollutant source control in the Slough) at facilities where stormwater would infiltrate through fill and/or contaminated soil.
- Negotiated and currently implementing a 2021 IGA with DEQ's Cleanup Program to allow surface infiltration of stormwater at upland sites with contaminated soils. This IGA is supported by the process added to the SWMM and SCM for protection of the City storm system and groundwater quality.
- Staff were added to the BES Industrial Stormwater Program to support stormwater basin investigations, inspections, and No Exposure Certificate renewal and outreach in the Slough Watershed.
- Continue policies and programs to identify and enforce (as needed) actions needed to control sediment transported into the City ROW via overland flow or vehicular drag out

from upland private properties. BES Spill Protection & Citizen Response has developed guidance to identify and enforce violations and has provided training to staff.

- Continue to develop and implement focused inspections, outreach, and enforcement (as needed) to address sediment/solid discharges to the City stormwater basins with planned or installed stormwater treatment systems to reduce long-term operation and maintenance costs.
- Explore and facilitate the use of pervious pavement for stormwater management and pollutant source control. Pervious pavement overlay is being considered as a potential solution in current planning efforts to reduce pollutants in priority Columbia Slough outfall basins.
- Continue efforts of the BES Private Property Retrofit section to support implementation of stormwater controls on private property to reduce stormwater flow or improve water quality discharged to the City system and reduce CIP construction costs and/or long-term operations and maintenance (O&M) costs. Private property retrofit projects are being considered as potential solutions in current planning efforts to reduce pollutants in priority Columbia Slough outfall basins.
- Develop O&M guidance and check lists for vegetated stormwater facilities installed on private properties to ensure long-term system effectiveness in managing stormwater onsite, reducing flow and/or pollutant discharges to the City's storm system and the Slough.
- Coordinate with external and internal partners to develop and implement training for landscapers on proper maintenance techniques for stormwater management facilities.
- Continue to integrate equity and environmental justice goals into BES Integrated Planning and CIP stormwater source control work. Priority City basins for stormwater treatment drain portions of residential neighborhoods in North Portland that are home to historically disadvantaged people and communities. These residents and communities have most likely been impacted by both the heavy industrial uses to the north of Columbia Boulevard, as well as the freight arterial of the boulevard itself. Current planning efforts to reduce pollutants in priority Columbia Slough outfall basins have assessed some equity and environmental justice opportunities in the basins and are looking for opportunities to provide community benefits in recommended solutions.
- Continue to explore the potential to route stormwater from selected industrial/high traffic areas to the Columbia Boulevard Wastewater Treatment Plant. This potential solution is being considered in current planning efforts to reduce pollutants in priority Columbia Slough outfall basins.

3.1.2 Local Improvement District and Other BES Projects

This section describes LID and other projects planned by BES that improve stormwater discharges from City ROWs and/or improve watershed health.

3.1.2.1 NE 46th Avenue & NE Bryant Street LID (new planned outfall)

The Portland City Council formed a LID to pave and provide stormwater treatment on NE 46th Avenue and regrade the land that will be developed as NE Bryant Street. The new street will connect NE 47th Avenue with NE 46th Avenue. The street improvements and installation of the new street will require BES to install a new City outfall that will drain to Whitaker Slough

downstream of the NE 47th Avenue bridge. The LID was expanded in September 2023 to include NE 42nd and will install a new stormwater treatment vault within existing Outfall Basin 73A. Construction will be divided into two phases with the first phase scheduled to start in March 2024 and the entire project is anticipated to be completed in 2026.

3.1.2.2 N Suttle Road LID Green Street

The N Suttle Road LID is currently under construction and is anticipated to be complete in February 2025.

3.1.2.3 NE Sunderland Road Bridge Replacement

The NE Sunderland Road Bridge replacement design is complete. However, PBOT only has a portion of the required funding for the project. Therefore, this project will be on hold until funding is complete, at which time they will start the environmental permitting process.

3.1.2.4 NE Columbia & Alderwood Green Street Drywells

The NE Columbia and Alderwood Green Street drywells are at 60-percent design. The project scope has doubled and now includes the Columbia Boulevard and Cully Street intersection. Construction is anticipated to occur between October 2024 and March 2025.

3.1.2.5 NE 42nd Avenue Bridge Replacement

NE 42nd Avenue Bridge replacement plans have been signed, and the project is out for bid. The project will construct a large regional stormwater facility to treat the runoff from the newly constructed 42nd Avenue bridge. Construction is anticipated to start March 2024 and be completed in September 2025.

3.1.3 Commercial/Industrial Facilities

The City's source investigation and control efforts (1) help identify significant upland sources discharging to City stormwater pipes or directly to the Slough, and (2) facilitate required actions under DEQ or City Code to improve stormwater management at identified sites.

These actions include:

- **Industrial Stormwater Permit Administration** (see Section 4): The City continues to work under DEQ authority to administer the NPDES 1200-Z Industrial Stormwater Permits¹⁰ Program citywide. The City identifies permitted and unpermitted upland discharges to the City's stormwater system and makes recommendations regarding source control measures as appropriate to reduce pollutants entering the City's system from permitted and unpermitted sites in the Slough.
- **Technical Assistance** (see Section 4): BES conducts stormwater inspections for permitted and unpermitted facilities, issues No Exposure Certifications, and provides technical assistance to upland property owners.

¹⁰ Formerly called the NPDES Columbia Slough (NPDES-COLS) permit until 2017.

- **Stormwater Pathway Evaluations:** DEQ and the City work together to assess sites that require stormwater pathway evaluations to identify contaminants entering the City stormwater system.
- **BES Stormwater Basin Characterization and Source Tracing Investigations:** BES performs stormwater sampling and analyses to assess stormwater quality discharging to the Slough and to identify potential contaminant sources (see Section 3.1.4, below).

3.1.4 *BES Stormwater Basin Characterization and Source Tracing Investigations*

The City and DEQ continue to collaborate on stormwater basin-specific source investigations and control efforts to identify the actions and timelines needed to control any known or suspected significant pollutant sources. This work includes City sampling of solids and stormwater in priority basins and using the resulting data to focus source identification and control efforts. BES collects samples from City outfall basins to meet the following objectives:

- Characterize City stormwater basin discharges
- Identify potential upland sources (e.g., upland facilities) of contaminants discharging to the City's stormwater system in order to refer sites to an appropriate regulatory enforcement program (e.g., DEQ's Environmental Cleanup Program for source control actions or the City's industrial stormwater program for permitting)
- Prioritize basins for further source tracing investigations or source control action
- Support DEQ cleanup actions in the Columbia Slough



A barrel with unknown liquid “pending analysis.”

3.1.4.1 2021-2022 Sampling Results

BES continued source tracing sampling of stormwater and stormwater solids to identify areas or upland facilities that may discharge pollutants at elevated concentrations to the City stormwater conveyance system and to characterize City outfall stormwater discharges. A total of 32 City outfall basins were selected for the collection of stormwater samples, as described in the 2021 *Sampling and Analysis Plan* (BES and GSI, 2021e) submitted to DEQ in August 2021.

A total of 157 stormwater and duplicate samples were collected between September 2021 and May 2022 from 32 outfall basins. Twenty-eight stormwater solids samples were collected from nine outfall basins, representing screened inline flow-through (SIFT) samples, catch basin and maintenance hole samples, as well as street sweepings. The locations of the outfall basins

sampled are shown in the figures below. Stormwater and stormwater solids results were evaluated and the *Source Tracing Investigation and Basin Characterization: 2021-2022* report was submitted to DEQ in February 2023 (BES and GSI, 2023a).

Findings and conclusions of the basin assessment and source tracing categorization activities include the following:

- Many analyte concentrations detected in City outfall basins are lower than DEQ screening-level values and/or NPDES 1200-Z benchmarks.
- Of the 32 City outfall basins included in the 2021-2022 stormwater data evaluation, 17 basins are recommended for further evaluation and source tracing investigations. In these basins, PCBs, metals, pesticides, and other analytes were identified that indicate the potential for uncontrolled upland sources discharging to the City's system and may require additional source tracing.



Stormwater sampling at a City outfall.

3.1.4.2 2023–2024 Sampling Plan

A total of 35 City outfall basins were selected for the collection of stormwater samples between September 2023 and June 2024. The planned basin sampling is described in the *2023 Sampling and Analysis Plan* (BES and GSI, 2023b) submitted to DEQ in August 2023. Figures 7 through 9 show the outfall basins that were proposed for sampling. Stormwater sampling results will be submitted to DEQ in Winter 2024.

3.2 Columbia Slough Sediment Program Data Management Tool

Numerous environmental investigations have been conducted by BES, DEQ, the Multnomah County Drainage District, and other parties to assess contaminant levels in the Slough. The abundance of environmental data and various storage methods resulted in a need for a single data management tool to assist with data access, evaluation, and mapping. BES developed and maintains the Columbia Slough Database to facilitate access, analysis, and mapping of data from more than 25 years of environmental monitoring in the Columbia Slough. Analytical sampling results from soil, sediment, stormwater, stormwater sediment, fish tissue, surface water, and other media are included in the database.

BES 2021-2022 stormwater data were added to the database in 2022. In March 2023, BES submitted an updated *Columbia Slough Data Management Framework* to DEQ¹¹ (BES and GSI, 2022). Refinements and improvements are made to the database on an ongoing basis as new data are uploaded. The City will continue database refinements and upload the 2022–2023 stormwater data. An updated version of the database will be submitted to DEQ in early 2024.

3.3 Long-term Monitoring and Fish Advisory Activities

The 2007 *Columbia Slough Long Term Monitoring Plan* (LTMP) (BES, 2007) and IGA describe actions the City implements to measure the long-term health of the Slough and to assess the effectiveness of actions being implemented to reduce sediment contamination levels. The LTMP describes the long-term fish tissue and sediment monitoring performed by the City. Data generated by this monitoring provides the basis for adaptive management of the Slough. The last Slough-wide fish tissue sampling event was completed in 2015, and the last Slough-wide sediment event was completed in 2017. The results are summarized below.

In addition, the LTMP and IGA describe actions the City performs to identify angler activity in the Slough. The City's actions on the Columbia Slough fish advisory in 2022–2023 are described in Section 3.3.3, below.

3.3.1 Slough-wide Fish Tissue Monitoring

BES completed the third round of Slough-wide fish tissue sampling in 2015. As described in the LTMP, fish tissue is collected every 10 years. The tissue samples were analyzed for PCBs, pesticides, metals, and dioxins/furans. The final Fish Tissue Data Report was submitted to DEQ in June 2018 (BES and GSI, 2018a).

Fish tissue results suggest that metals and pesticide concentrations in fish tissue are declining, while PCB concentrations have remained consistent over time. Fish data were submitted to the Oregon Health Advisory (OHA) to update the Columbia Slough Fish Advisory. The most recent update to the advisory was issued by OHA on November 2022 (see Section 3.3.3). A slough-wide fish tissue sampling event is scheduled in 2025.

3.3.2 Slough-wide Sediment Monitoring

BES completed the third round of Slough-wide sediment sampling in 2017. As described in the LTMP, sediment samples are collected every 10 years. Sediment samples were analyzed for PCB Aroclors, pesticides, PAHs, phthalates, and metals. A subset of 20 sediment samples was analyzed for PCB congeners, and a subset of 10 samples was analyzed for dioxins/furans. The 2017 *Columbia Slough Sediment Data Report* was submitted to DEQ in June 2018 (BES and GSI, 2018b). Key findings of the 2017 sediment sampling event include:

- Contaminants of potential concern (COPCs) (defined based on the protection of human health [i.e., fish consumption] and the environment [e.g., toxicity]), have remained consistent over time.
- Sediment concentration patterns in 2017 sediment data are consistent with 1994 and 2006 data and confirm widespread low-level contamination throughout the Slough.

¹¹ BES and GSI. 2022. *Columbia Slough Data Management Framework Columbia Slough Database (Version 5.0) – ECSI No. 1283*. Prepared by Environmental Services, GSI Water Solutions, Inc., and Wildrose Consulting, LLC. January 2022.

- Contaminant concentrations were generally similar or lower in 2017 than they were in 1994 and 2006.
- 2017 sediment results identified several areas with elevated concentrations of COPCs and several areas with consistently low concentrations of COPCs.

A slough-wide sediment sampling event is scheduled in 2026.

3.3.3 2022–2023 Fish Advisory Activities

The City provides education and outreach regarding the fish advisory under the IGA between the City and DEQ. Fish consumption was identified in the 2005 DEQ Columbia Slough Sediment ROD as the most significant source of human exposure to contaminants in the Columbia Slough. The OHA issued a Fish Advisory for consumption of fish from the Slough based upon concentrations of PCBs and pesticides observed in fish tissue samples.

In November 2022, OHA changed its recommended limit on the number of whole-body largescale sucker from the Columbia Slough that people could eat. This update is based on recent data evaluating PFAS observed in fish

tissue collected from the Slough. In July of 2019 and July of 2020, the U.S. Geological Survey collected fish tissue from focused segments of the Slough, including near two DEQ cleanup sites being investigated for PFAS contamination; the Port's historical fire training grounds at PDX and the Portland Air National Guard Base. The analysis found concentrations of one type of PFAS, perfluorooctane sulfonic acid (PFOS), above levels of concern for health. As a result, OHA adjusted meal recommendations for whole-body largescale sucker from the Columbia Slough from one meal per month to zero meals per month. All other meal recommendations currently in place in the Columbia Slough for other resident fish and for largescale sucker fillet remain unchanged.¹²

After any OHA update the City and OHA updates their fish advisory websites, and the City updates its Columbia Slough fish advisory fact sheet. The fact sheet has been translated into 15 languages (see Section 3.3.3.1, below, for more on City outreach).¹³



Kayakers on the Columbia Slough.

¹² More information on meal allowances is available at <https://content.govdelivery.com/accounts/ORDHS/bulletins/33a92a4>.

¹³ The fact sheet can be found on the City's website at <http://www.portlandoregon.gov/bes/FishAdvisory>.

3.3.3.1 *Fish Advisory Outreach*

The neighborhoods along the Slough have some of the highest percentages of recent immigrants in the state, and members of many immigrant communities catch or consume fish from the Slough. In 2018, the City began identifying members of refugee, immigrant, houseless, and other communities that may catch and consume fish from the Slough to better inform the City's education and outreach efforts for the Fish Advisory. Using this preliminary information, BES initiated work with the City's Community Engagement Liaison (CEL) Program to survey and perform outreach with immigrant and refugee communities. The CELs are a group of bilingual City-trained civic activists who are available to assist with public involvement programs that require interpretation and facilitation services.¹⁴

In December 2020 and January 2021, the City worked with the CELs program to conduct a survey to identify people and communities fishing in the Columbia Slough and collect information regarding fish consumption practices (BES, 2021c). Information collected from the survey has and will continue to be used to inform future OHA risk assessment activities, as well as BES education and outreach activities to help individuals reduce their potential health risks from eating fish caught in the Slough. Although outreach activities were limited in 2021-2022 due to the coronavirus disease 2019 (COVID-19) pandemic, the City was able to work with the CELs program to perform some outreach regarding best fish consumption practices in-line with the most recent Slough Fish Advisory.

In 2022–2023, the City began education and outreach efforts with the CELs program to discuss impacts from PFAS and review best fish consumption practices. The City plans to re-engage fish advisory outreach and education activities with the CELs in 2023–2024.

3.3.4 *Fish Advisory Signs*

In the 2018–2019 fiscal year, the City installed 24 fish advisory signs in the Lower Slough and conducted a comprehensive survey for the second phase of sign installations. In June 2020, the City installed 64 additional signs, which are dispersed throughout the entire Columbia Slough Watershed.



Advisory signs like this one are posted at many locations along the Columbia Slough.

¹⁴ See <https://www.portlandoregon.gov/civic/article/482264> for more information on the CELs program.

In 2021, 2022 and 2023, the City's contractor inspected and replaced signs as needed and performed maintenance activities (e.g., removed graffiti and trimmed branches away from signs).

Figures 10 through 12 show the general locations of the Columbia Slough fish advisory signs.

Figure 6. Map showing locations of active stormwater treatment projects along Columbia Slough

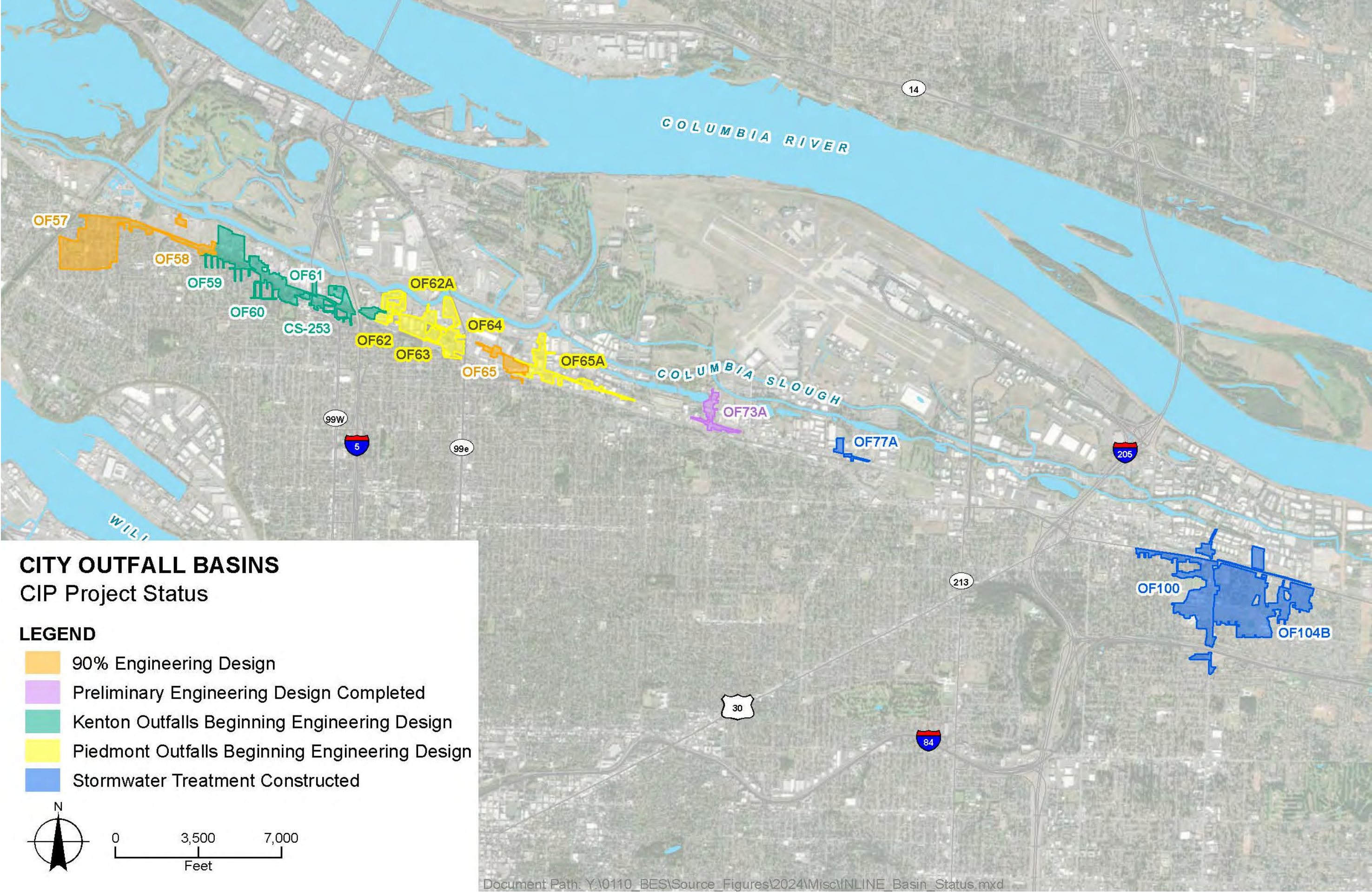
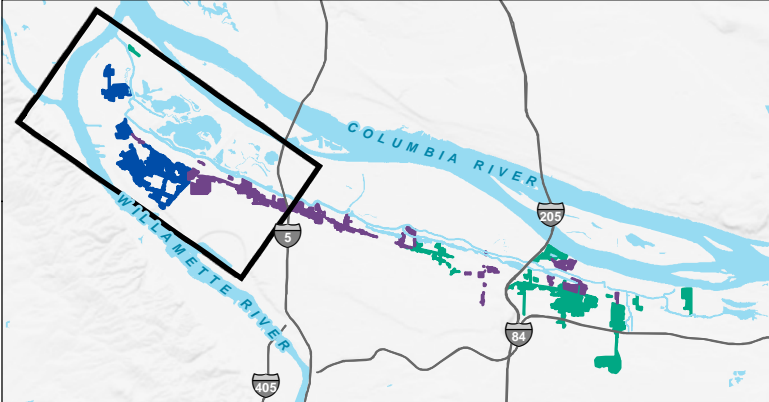
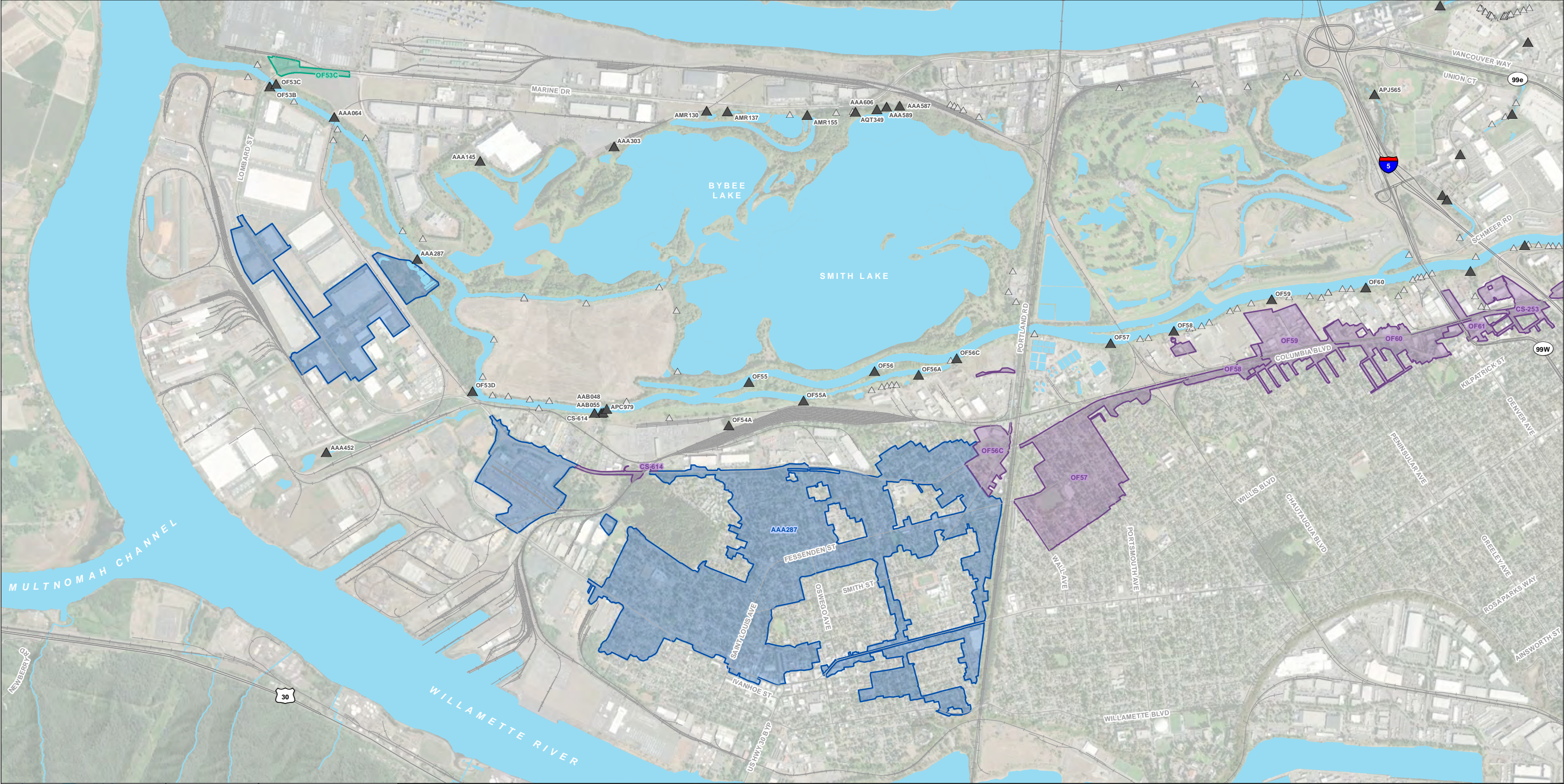


Figure 7. Map showing Lower Slough proposed sampling locations for 2023-2024



LEGEND

- Outfall Basin Proposed for Sampling, Untreated
- Outfall Basin Proposed for Sampling, Treated
- Outfall Basin, Treated
- Outfall, City
- Outfall, Non-City

All Other Features

- Railroad
- Major Road
- Watercourse
- Waterbody

FIGURE 4

**City Stormwater Outfall Basin Overview:
Proposed Basin Sampling**

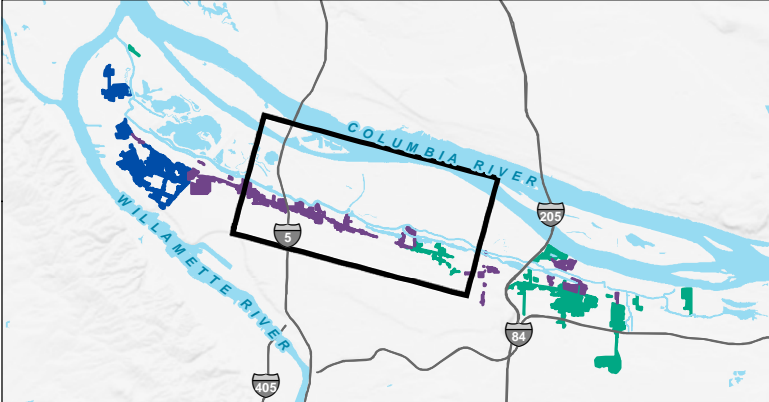
2023 Sampling and Analysis Plan
Source Tracing and Stormwater Monitoring



0 1,000 2,000 3,000
Feet



Figure 8. Map showing proposed sampling locations for 2023-2024



LEGEND

- Outfall Basin Proposed for Sampling, Untreated
- Outfall Basin Proposed for Sampling, Treated
- Outfall Basin, Treated
- Outfall, City
- Outfall, Non-City

All Other Features

- Railroad
- Major Road
- Watercourse
- Waterbody

FIGURE 5

**City Stormwater Outfall Basin Overview:
Proposed Basin Sampling**
2023 Sampling and Analysis Plan
Source Tracing and Stormwater Monitoring

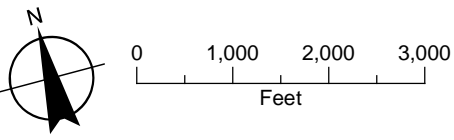
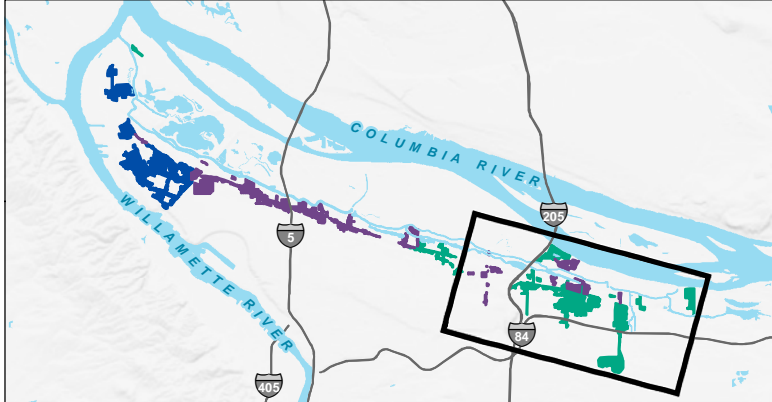
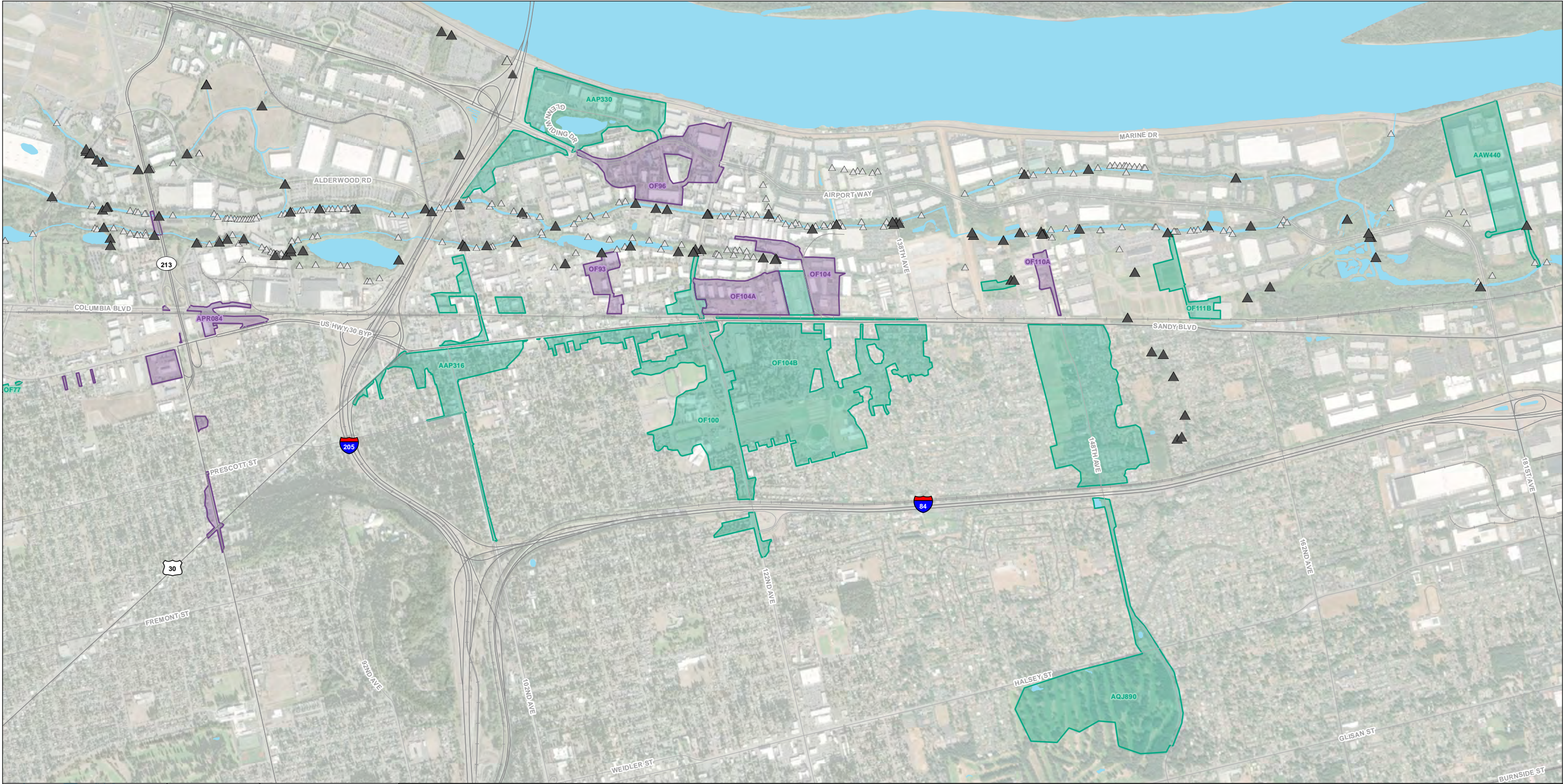


Figure 9. Map showing proposed sampling locations for 2023-2024



LEGEND

- | | |
|--|---------------------------|
| Outfall Basin Proposed for Sampling, Untreated | All Other Features |
| Outfall Basin Proposed for Sampling, Treated | Railroad |
| Outfall Basin, Treated | Major Road |
| Outfall, City | Watercourse |
| Outfall, Non-City | Waterbody |

FIGURE 6

**City Stormwater Outfall Basin Overview:
Proposed Basin Sampling**

2023 Sampling and Analysis Plan
Source Tracing and Stormwater Monitoring

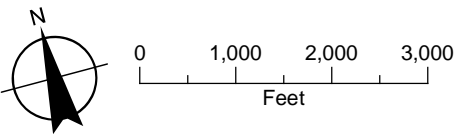


Figure 10. Map showing general locations of fish advisory signs installed along Columbia Slough

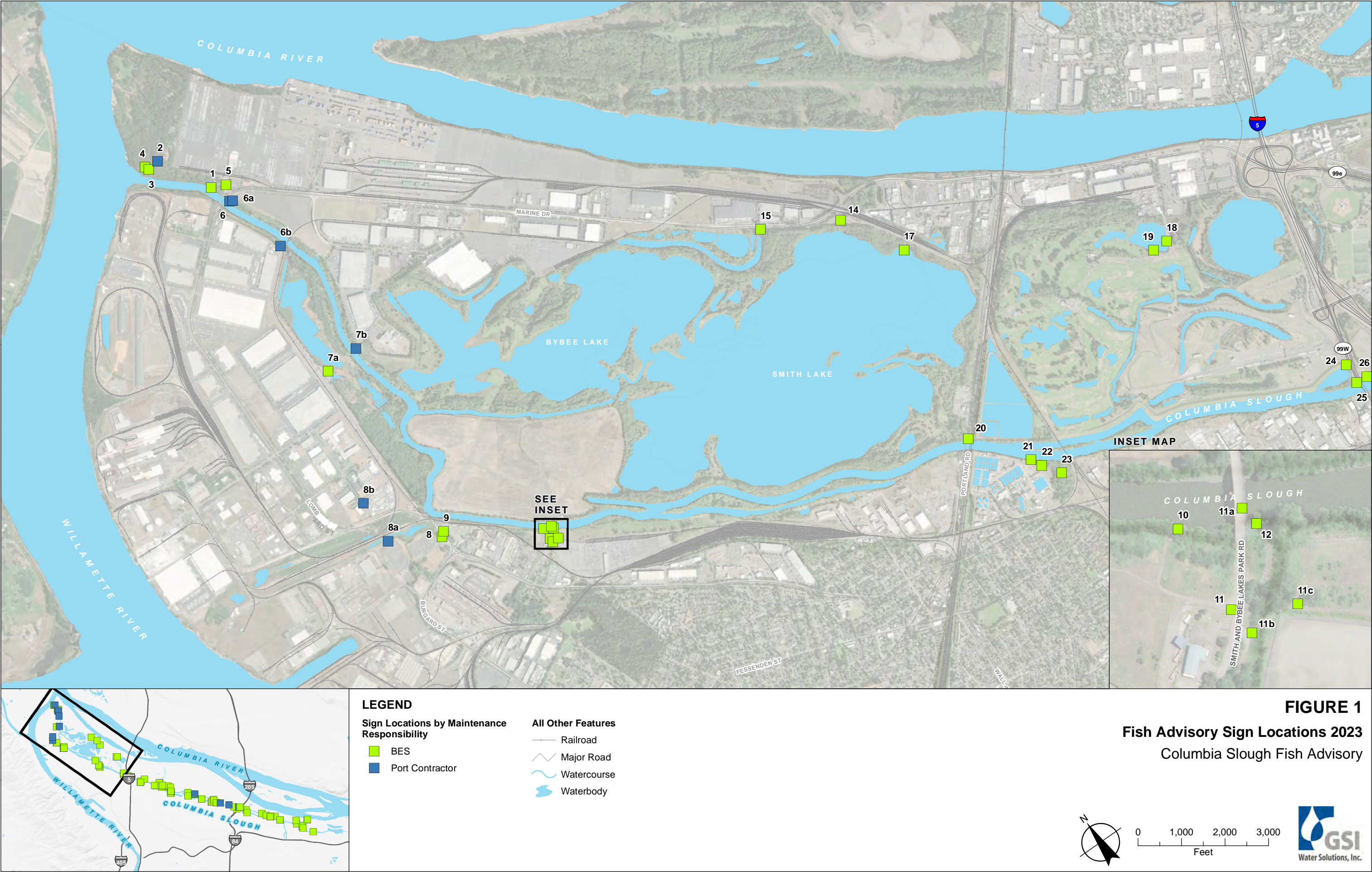
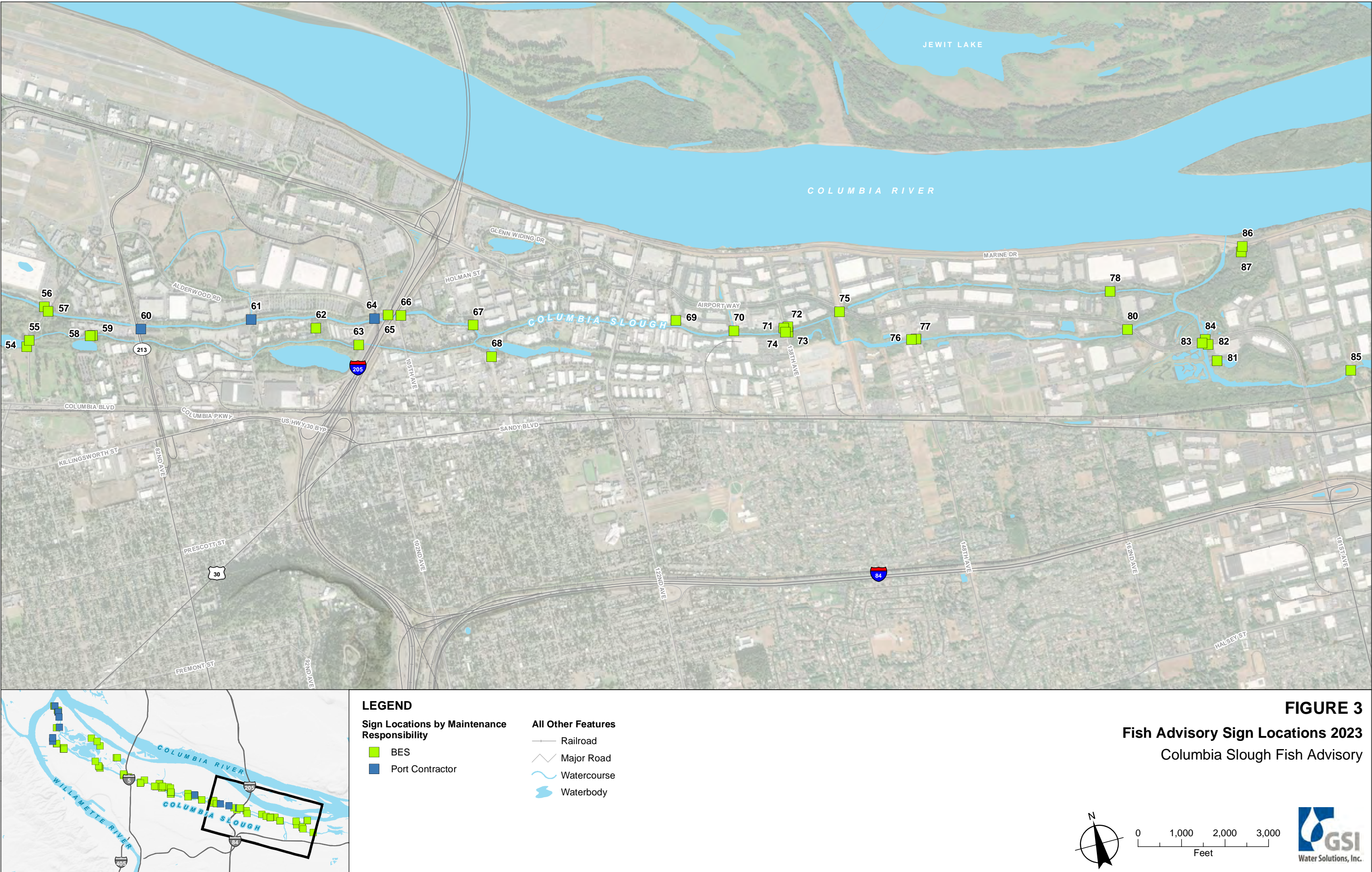


Figure 11. Map showing general locations of fish advisory signs installed along Columbia Slough



Figure 12. Map showing general locations of fish advisory signs installed along Columbia Slough



4 Citywide Upland Programmatic Source Control Activities

As acknowledged in the ROD and the IGA, the City implements a wide-range of upland source control actions aimed at addressing pervasive source contributions to the Slough. Numerous activities are performed independent of the specific actions identified in the IGA, in accordance with other DEQ programs or DEQ-issued permits or agreements, that directly or indirectly reduce pollutant discharges to the Columbia Slough, including the following:

- MS4 permit issued to the City by DEQ¹⁵
- Water Pollution Control Facility Permit (i.e., UIC permit) issued to the City by DEQ
- NPDES permit issued to the City by DEQ for the Columbia Boulevard Wastewater Treatment Plant
- Total Maximum Daily Load (TMDL) Program
- IGA between DEQ and the City for the Administration of NPDES 1200-Z and 1200-A General Permits for stormwater discharges from industrial activities (DEQ agreement number 30001293)

Activities conducted under the City's stormwater permits or programs provide mechanisms to implement and maintain source control and address potential new and future sources discharging to the City's stormwater system. These procedures, such as industrial/commercial controls, illicit discharge controls, new development standards, structural controls, and O&M, directly or indirectly reduce pollutant discharges via the stormwater pathway to the Columbia Slough and contribute to improving sediment and fish tissue quality throughout the Slough.

The City and its co-permittee, the Port, implement citywide stormwater management programs under the DEQ-issued MS4 permit. This section specifically provides an overview of the citywide activities performed to fulfill the requirements of the City's MS4 permit, during the fiscal year 2022–2023 and the City's *TMDL Implementation Plan* (TIP).¹⁶

Specific City activities completed to meet the requirements of the 2005 DEQ Columbia Slough ROD and the 2021 IGA between DEQ and the City are described in Section 3.

4.1 MS4 Discharge Permit

The City's stormwater basins and outfalls discharging to Columbia Slough Watershed are managed in accordance with the MS4 permit. Under the MS4 permit, the City implements a DEQ-approved Stormwater Management Program (SWMP) Document, which was updated in November 2022.¹⁷ The SWMP Document describes management strategies to control potential pollutant discharges to the City's stormwater system. These strategies include but are not limited to the following:

1. Pollution Prevention and Good Housekeeping for Municipal Operations

¹⁵ DEQ issued the first Portland permit in 1995 and renewed it for a second term in 2004 (with modifications in 2005). DEQ issued the final third-term permit on January 31, 2011. The permit expired on January 30, 2016 and was administratively extended by DEQ. The fourth-term permit was reissued by DEQ on September 15, 2021, with an effective date of October 1, 2021.

¹⁶ The TIP is available at <https://www.portland.gov/sites/default/files/2022/tmdl-implementation-plan-2022.pdf>.

¹⁷ The MS4 SWMP Document is available at <https://www.portland.gov/bes/stormwater/documents/ms4-stormwater-management-plan-document-2022/download>.

2. Industrial and Commercial Facilities Strategy
3. Illicit Discharge Detection and Elimination
4. Erosion Control Strategy for Construction Site Runoff
5. Post-Construction Site Runoff Strategy for New and Re-Development
6. Post-Construction Long-Term Operation and Maintenance
7. Public Education and Outreach
8. Public Involvement and Participation

Under the MS4 permit, citywide strategies and programs were developed to improve stormwater quality and to inform subsequent revisions to City Code that incorporate stormwater controls into citywide development standards. Annual MS4 reports are submitted to DEQ and summarize MS4 Program activities. Annual reports from 1995 to the present are available online.¹⁸

The MS4 Program provides the primary structure of the City's stormwater source control activities in the Columbia Slough Watershed. The MS4 Program's accomplishments, both citywide and, where available, specific to the Columbia Slough Watershed, are described below (BES, 2023).

4.1.1 Pollution Prevention and Good Housekeeping for Municipal Operations

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.

4.1.1.1 City Storm and Drainage System Operations and Maintenance

The BES Stormwater 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.

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 and maintenance is prescribed based largely on inspection results, with the goal of keeping the assets functioning as designed. For all water quality facilities, urgent problems and needed repairs are remedied as soon as possible and routine system maintenance is scheduled to optimize efficiency and facility function.

4.1.1.2 City Roadways Operations and Maintenance

The City implements practices in and around ROWs to prevent and limit pollutant discharges to the MS4 outfall basins, including street sweeping, spill control, erosion control, material testing,

¹⁸ Visit <https://www.portland.gov/bes/stormwater/ms4> to view the annual reports.

and other best management practices (BMPs) related to the 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 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. Arterial roadways were swept 5-6 times and residential roadways were swept 1-2 times during the reporting period. In 2022–2023, 14,053 cubic yards of material was removed from roadway street sweeping, and 4,459 cubic yards of material was removed from cleaning of storm inlets and catch basins. Additional BMPs that the City uses for roadways include the following:

- Following 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

4.1.1.3 City Facilities Operations and Maintenance

Maintenance Facilities. In addition to maintaining the City's roadways and transportation facilities, PBOT operates critical City maintenance facilities. 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.

Parks Operations. PP&R implements many BMPs that prevent or minimize the potential for pollutants in stormwater runoff from the City's diverse parks system and public golf courses and athletic fields. This includes implementing an integrated pest management program to manage pests that are harmful to the health, function, or aesthetic value of park landscapes in an efficient, effective, and environmentally responsible manner while paying careful attention to public and employee safety. This reduces pesticide, water and fertilizer inputs on park properties. Pesticide applicators attended recertification training in the spring and fall. A few examples of the City's integrated pest management activities include the following:

- Using 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 the establishment of weeds
- Application of selected herbicides to control invasive weeds and prevent their spread
- Release of natural biological control insects

PP&R became the City's first bureau to achieve Salmon-Safe Certification (see below). The certification was renewed in 2012 and again in 2018.

4.1.1.4 Salmon-Safe Certification

The City holds a Salmon-Safe certification and continues to comply with practices for Salmon-Safe certification, including integrated pest management, reduction of water and fertilizer inputs on park properties, riparian and upland habitat restoration, and use of pesticide alternatives. Facility managers are committed to additional actions to limit water pollution, conserve water use, and restore habitat. BES and PP&R will partner on PP&R's 2023 recertification to help improve stormwater and salmon habitat throughout their shared assets portfolios. BES is also coordinating with the Bureau of Planning and Sustainability to strengthen the City's salmon recovery efforts through more landscape-level and zoning code improvements. Environmental and floodplain zoning code updates will protect critical habitat function in the City and require stricter environmental mitigation regulations on E-, P-, and C-zoned parcels slated for development.

4.1.2 Industrial and Commercial Facilities Strategy

4.1.2.1 Industrial Stormwater Permitting (NPDES 1200-Z Permits)

The Industrial Stormwater Program administers NPDES 1200-Z General Industrial Stormwater Discharge Permits in Portland through an IGA with DEQ. Program staff conduct annual compliance inspections of permitted sites, provide technical assistance on BMP implementation, and issue enforcement referrals for instances of noncompliance. The Industrial Stormwater Program also performs inspections of nonpermitted sites to assess the need for permit coverage, evaluates sites with No Exposure Certifications to verify that the permit exemption is valid, and locates and maps private outfalls throughout riparian areas that discharge directly to receiving streams and identifies the sources that drain to these outfalls.

Industries that exceed the geometric mean concentration for specific pollutant benchmarks (e.g., copper, lead, zinc, *Escherichia coli* [*E. coli*]) are required to install stormwater treatment (i.e., Tier II Corrective Action).

Fiscal year 2022–2023 included the following accomplishments:

- The City managed 128 NPDES 1200-Z General Industrial Stormwater Permits for facilities that discharge to the Columbia Slough. All permitted sites but one (Amazon SOR3) were inspected.



Facility traffic causing material track out onto roadway.

- The City issued 3 new NPDES 1200-Z General Industrial Stormwater Permits to facilities that discharge to the Columbia Slough:
 1. Amazon SOR3 – 515 N Schmeer Road
 2. Conco – 7025 N Leadbetter Road
 3. Standard Steel Companies – 1745 NE Columbia Boulevard
- The City terminated 5 NPDES 1200-Z permits for facilities that discharged to the Columbia Slough:
 1. 205 Auto Salvage Inc. - 5605 NE 105th Avenue (vacated facility, no longer in business)
 2. Terminal Transfer - 15745 N Columbia Boulevard (granted a No Exposure Certification [NEC])
 3. Container Management - 10103 NE Marx Street (vacated facility at this location)
 4. Hydro-Fabricated Component - 7320 NE 55th Avenue (vacated facility at this location)
 5. FXI Inc - 3900 NE 158th Avenue (granted an NEC)
- The City issued 14 new NECs to facilities that discharge to the Columbia Slough:
 1. Dart Aerospace - 13340 NE Whitaker Way
 2. F & F Grinding Inc - 9442 N Ramsey Boulevard
 3. Hansen & Adkins Auto Transport Inc - 901 NE Gertz Road
 4. Savoy Studios - 13908 N Lombard
 5. Fulcrum Logistics Inc - 6229 N Marine Drive
 6. Fulcrum Logistics Inc - 7825 N Leadbetter Road
 7. Terminal Transfer Inc. - 15745 N Columbia Boulevard (had 1200-Z)
 8. Premier Finishes Inc. - 17890 NE Airport Way
 9. Wagner Logistics LLC - 701 NE Columbia Boulevard
 10. Evergreen Machine Works - 5317 NE 105th Avenue
 11. POLY FLOW - 2668 NE Riverside Way
 12. FXI Inc - 3900 NE 158th Avenue (had 1200-Z)
 13. NQ Industries LLC - 5400 NE Columbia Boulevard
 14. Javelin Logistics - 5545 NE 148th Avenue Suite B
- The City documented 3 facilities with NECs up for renewal that were no longer operating. The City renews NECs every 5 years.
- The City required 12 facilities to submit a City Code-required Stormwater Pollution Control Plan (SWPCP) for discharges to the Columbia Slough via MS4. City Code 17.39.060.D.1 authorizes the City to require businesses that do not have a Standard Industrial Classification (SIC) code that triggers 1200-Z stormwater permit to submit a SWPCP if the site has shown evidence of the potential to discharge pollutants into the MS4.¹⁹
 1. Onies Auto LLC - 5325 N Columbia Boulevard

¹⁹ City Code 17.39.060.D.1 is available at <https://www.portland.gov/code/17/39#toc--17-39-060-discharge-permits-and-other-authorizations->.

2. Wood Waste Management LLC - 7315 NE 47th Avenue
 3. Began Tank Truck - 7605 NE 21st Avenue
 4. Safe Transportation Inc - 8443 N Kerby Avenue
 5. Basic Fire Protection Inc - 8135 NE Martin Luther King Jr Boulevard
 6. Kova Motor Company LLC - 5838 NE Columbia Boulevard
 7. Reviva Inc - 11618 NE Sumner
 8. Premier Finishes Inc. - 17890 NE Airport Way
 9. Willscot - 13132 N Woodrush Way
 10. Fulcrum Logistics Inc - 6229 N Marine Drive
 11. Fulcrum Logistics Inc - 7825 N Leadbetter Road
 12. Schneider National - 12986 NE Whitaker Way
- The City conducted 96 inspections of non-permitted sites within the Columbia Slough watershed.
 - To date, the City has completed stormwater inspections or is near completion within 49 prioritized City outfall basins. Sites are revisited as operators change as needed.
 - The City focused inspections of unpermitted sites in 18 Columbia Slough priority City outfall basins.
 - The City documented 193 permit violations for facilities that hold a NPDES 1200-Z General Industrial Stormwater Permit and discharge to the Columbia Slough.
 - The City referred 13 facilities that hold a NPDES 1200-Z Stormwater Permit and discharge to the Columbia Slough to the DEQ Office of Compliance and Enforcement for stormwater permit violations.
 1. Willamette Construction Services Inc - 8823 N Harborage Street (Failure to Implement SWPCP and Inadequate Record Keeping)
 2. TForce Freight, Inc. – 11818 NE Marx Street [Failure to Timely Submit Discharge Monitoring Report (DMR)]
 3. TForce Freight, Inc. – 1025 NE Columbia Boulevard (Failure to Timely Submit DMR)
 4. Northwest Cascade Inc - 9609 N Rivergate Boulevard (Failure to Meet Narrative Technology Based Effluent Limits)
 5. Forklift Services of Oregon Inc - 7001 NE Columbia Boulevard (Failure to Conduct Monitoring and Inadequate Record Keeping)
 6. A & N Transport LLC – 12001 N Portland Road (Failure to Meet Narrative Technology Based Effluent Limits and Inadequate SWPCP)
 7. Amazon PDX6 – 15000 N Columbia Boulevard (Failure to Conduct Monitoring)
 8. Container Management Services - Marx Street – 10103 NE Marx Street (Failure to Implement SWPCP)
 9. Seaport Steel – 7227 N Leadbetter Road (Inadequate SWPCP)
 10. Airgas USA, LLC – 3405 N Columbia Boulevard (Failure to Conduct Monitoring and Inadequate SWPCP)
 11. C-2 Utility Contractors LLC – 11618 NE Sumner Street A (Failure to Meet Monitoring Frequency)
 12. Morgan Logistics LLC - 7098 N Marine Drive (Failure to Meet Monitoring Frequency)

13. Silver Eagle Manufacturing Company - 5825 NE Skyport Way (Failure to Conduct Monitoring and Failure to Meet Monitoring Frequency)

- The City issued 3 City Code 17.39 violations for prohibited discharges to the MS4. One facility holds a NPDES 1200-Z Stormwater Permit and discharges to the Columbia Slough, and two facilities hold NECs and discharge to the Columbia Slough.
 1. Leatherman Tool Group Inc – 12106 NE Ainsworth Circle (1200-Z Permit)
 2. Schneider National - 12986 NE Whitaker Way
 3. Morasch Meats - 4050 NE 158th Avenue
- The City documented 19 facilities that hold NPDES 1200-Z Stormwater Permits, discharge to the Columbia Slough, and triggered Tier II corrective action requirements. These businesses will be required to install stormwater treatment or volume reduction measures. Tier II treatment is triggered when the geometric mean of 4 qualifying samples exceeds the permit benchmark for a particular pollutant parameter. The new stormwater permit requires Tier II evaluations every year.
 1. A & N Transport LLC - 12001 N Portland Road [copper, *E. coli*, phosphorus, total suspended solids (TSS)]
 2. Airgas USA, LLC - 3405 N Columbia Boulevard (phosphorus)
 3. Amazon DPD2 - 9475 N Horseshoe Avenue (phosphorus)
 4. Amazon EUG5 - 401 N Schmeer Road (phosphorus)
 5. Amazon PDX6 - 15000 N Columbia Boulevard (TSS)
 6. Baker Commodities Inc - 9901 N Hurst Avenue (*E. coli*, phosphorus)
 7. C-2 Utility Contractors LLC - 11618 NE Sumner Street A (phosphorus)
 8. ConGlobal Industries Inc - 9639 N Rivergate Boulevard (copper)
 9. Forklift Services of Oregon Inc - 13805 NE Sandy Boulevard (phosphorus)
 10. Gutterman's Supply - 1620 NE Argyle Drive (copper, phosphorus, TSS, zinc)
 11. Hydro Extrusion Portland Inc – Skyport - 5325 NE Skyport Way (phosphorus)
 12. Insurance Auto Auctions Inc - 10498 N Vancouver Way (copper, *E. coli*, lead, TSS)
 13. Ness and Campbell Crane Inc - 5730 NE 138th Avenue (copper, zinc)
 14. Northwest Cascade Inc - 9609 N Rivergate Boulevard (copper)
 15. Pierce Pacific Manufacturing Inc - 4424 NE 158th Avenue (phosphorus)
 16. Portland Disposal and Recycling - 7202 NE 42nd Avenue (phosphorus)
 17. Republic Services of Portland - 10239 NE Marx Street (zinc)
 18. Rodda Paint - 6123 N Marine Drive (zinc)
 19. Supreme Perlite Co. - 4600 N Suttle Road (TSS)

4.1.2.2 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 2022–2023 included the following:

- Maintained a multi-lingual, website version of the Aquifer Adventure environmental education event²⁰
- Maintained the Columbia Corridor Association and City of Portland webpages on the
- Groundwater Protection Program with information for businesses and residents
- Held 2 groundwater protection workshops, including pollution prevention and spill control content, attended by roughly 24 businesses
- Provided technical assistance to 67 businesses
- Distributed 6 free spill kits, and approximately 8 spill response signs
- Conducted 158 site inspections for compliance with the City's Wellhead Protection Area Reference Manual²¹
- Produced Spanish and Russian translations of spill response signs

4.1.3 Illicit Discharge Detection and Elimination Activities

4.1.3.1 Spill Prevention

The Industrial Stormwater Program (discussed in Section 4.1.2.1) ensures that BMPs relating to spill prevention and reporting are properly implemented at industrial facilities covered by a NPDES 1200-Z permit. During the reporting year, the program administered 128 permits in the Slough with requirements to maintain spill prevention and response procedures.

4.1.3.2 Dry-Weather Field Screening

BES inspects major outfalls during dry weather to identify and eliminate illicit or non-stormwater discharges of concern. During the 2022–2023 fiscal year, 130 major outfall and 2 priority outfall inspections were performed citywide. No illicit discharges were identified within the Columbia Slough watershed.²²

4.1.3.3 Pollution Complaint Response

The City's Spill Prevention 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 2022–2023 fiscal year, SPCR received and responded to roughly 1,972 calls citywide regarding pollution complaints, spills, sewer overflows, dye tests, and other pollution-related inquiries.

²⁰ The Aquifer Adventure website is available at <https://www.columbiaslough.org/aquifer-adventure>.

²¹ The Columbia South Shore Well Field Wellhead Protection Area Reference Manual is available at <https://www.portlandoregon.gov/citycode/article/24624>.

²² Many City outfalls convey flow from background sources, such as hillside streams.

4.1.3.4 Investigation and Enforcement

The Illicit Discharge Detection and Elimination 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. During the fiscal year 2022–2023, 52 enforcement actions were issued citywide; a total of \$79,223 was collected from penalties and costs.

4.1.4 Erosion Control for Construction Site Runoff

4.1.4.1 Erosion Control Activities

The City's erosion control program applies to both public and private construction projects. Portland City Code Title 10 and the City's *Erosion and Sediment Control Manual* outline requirements and provide 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.

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 as needed for problem and complaint-related sites. City inspectors note deficiencies related to BMP implementation, effectiveness, and maintenance, and require site operators to implement corrective action when needed.

The public works bureaus (BES, PBOT, Water Bureau, and PP&R) 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.

The City requires an Erosion, Sediment, and Pollutant Control Plan (ESPCP) for ground-disturbing activity that requires a City building, public works, or development permit (Portland City Code Title 10.40) and when the disturbance area exceeds 500



Sediment migrating from a facility onto a roadway.



Facility investigation determining a permit is needed.

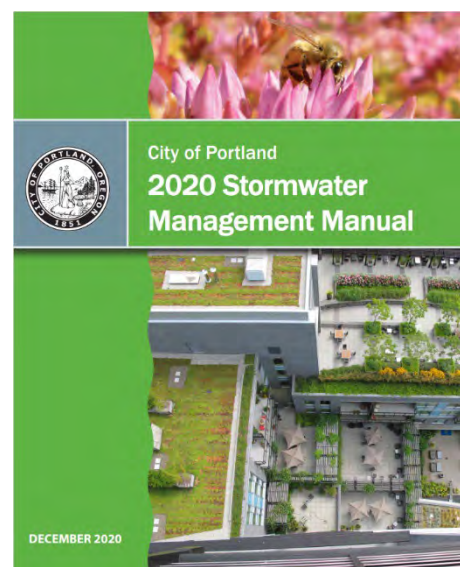
square feet or the site meets the criteria for a special site (Portland City Code Title 10.30.030.A). BMP requirements are identified in the 2022 City of Portland Erosion and Sediment Control Manual. The City has the authority to issue citations and other financial penalties for violation of the Erosion Control Code. During fiscal year 2022–2023, 2,675 permits were issued for “ground-disturbing activities” citywide, 4,230 inspections were performed, and 667 enforcement actions were issued.

4.1.5 Post-Construction Site Runoff for New and Re-Development

4.1.5.1 2020 Stormwater Management Manual Revision

The City’s SWMM provides policy and design requirements for stormwater management throughout the City. The requirements in the manual apply to all development, redevelopment, and improvement projects within the City on private and public property and in the public ROW. 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.

In 2020–2021, the City completed revisions to the 2016 SWMM and the 2020 version of the SWMM became effective on December 14, 2020. Progress is underway and on schedule for SWMM revisions targeted for 2024. The primary change is incorporation of a Numeric Stormwater Retention Requirement in the 2021 MS4 permit.



4.1.5.2 Stormwater Management Manual Implementation

BES has several teams tasked with SWMM implementation, 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 O&M requirements for SMFs in the long term.

In 2019, the Maintenance Inspection Program (MIP) changed the method of retrieving new O&M agreements to more accurately track the number of SMFs installed on private property. In the past, MIP pulled a quarterly report of all O&M agreements from the City’s permit database to identify new SMFs. The O&M agreements were often uploaded prior to construction. Sometimes the associated SMFs were not installed or the facility type changed between submission and construction. In September 2019, the process was revised to pull O&M agreements only from finalized permits to ensure that properties and facilities entered into the City’s permit database reflect built instead of proposed conditions. The number of O&M agreements is reduced from previous years due to this refined approach. In 2022–2023, 101 new SMFs reached the final permit status, representing 34 new O&Ms located in the Columbia Slough Watershed.

The MIP ensures that SMFs constructed on private property are operated and maintained in accordance with City requirements. The facilities—which include but are not limited to vegetated stormwater facilities and subsurface infiltration facilities—are built as part of new development standards under the City’s SWMM. All sites are inspected at least once per 5-year cycle for industrial, commercial, and multi-family properties. MIP confirms that new development and

ongoing system management on private property is done in a way that reduces pollutant loads to the stormwater system and the Columbia Slough. In the fiscal year 2022–2023, 729 SMFs were inspected in the Slough Watershed for compliance with O&M agreements at 222 unique sites. There are currently 3,387 total MIP assets in the Columbia Slough watershed.

4.1.5.3 Pollution Prevention and Source Control

BES's Development Review team conducts land use and pollution source control reviews associated with commercial and industrial properties subject to requirements in the City's SCM. The SCM specifies pollution control requirements for development and post-development activities that are considered 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.

4.1.6 Post-Construction Long-Term Operations and Maintenance

4.1.6.1 Stormwater System Plan

The BES *Stormwater System Plan* is a comprehensive citywide 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, and water quality and stream impacts. Activities conducted during the fiscal year 2022–2023 include, but were not limited to, the following:

- Updates to the stormwater service categories using the best available data. Service categories assessed included:
 - Water quality degradation (added additional parameters to be assessed)
 - Habitat degradation
 - Stormwater system deficiencies that impede community development
 - In-stream erosion due to development activities
 - Landslide hazards
 - Localized nuisance flooding
- Development of integrated stormwater system planning tools and approaches into broader BES stormwater and watershed planning, monitoring, analysis, and decision-making.
- Coordination with the Asset Inventory and Condition Assessment program to gather information and data to evaluate risks and opportunities associated with the existing stormwater system.
- Incorporated hydromodification studies to support stormwater system planning, including consideration of resilient streams to support functions.

4.1.6.2 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 the construction of standalone 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).

BES Columbia Slough stormwater treatment projects for City ROWs that were in design or construction during the fiscal year 2022–2023 to provide stormwater treatment for City ROWs in the Columbia Slough Watershed are discussed in Section 3.1.

4.1.7 Public Involvement Education and Outreach and Public Involvement and Participation

4.1.7.1 BES Clean Rivers Education Program

BES' Clean Rivers Education program offers free classroom and field science programs that focus on watershed health, water quality, stormwater, riparian plants, wildlife, and related environmental issues. Clean Rivers Education offered in-person classroom and field science programming during fiscal year 2022–2023 in the Columbia Slough watershed to the following:

1. 23 schools/organizations
2. 1,689 students
3. 82 classroom and field programs

In addition, Clean Rivers Education continued to offer expanded digital resources, including:

1. The Clean Rivers Resources for Educators webpage has curated videos, articles, and activities, including career spotlight videos about BES staff.²³ The webpage received more than 2,998 external hits in fiscal year 2022–2023.
2. A virtual field trip to Whitaker Ponds Nature Park (located in the Columbia Slough watershed) is available on YouTube.²⁴ The virtual trip focuses on riparian habitats and watershed health. The video has been incorporated into a district-wide science curriculum unit for second and third grade students in Portland Public Schools. To date, the video has received more than 680 additional public views on YouTube.
3. A video on wastewater treatment, *After the Flush: Recovering Energy and Nutrients in Portland's Wastewater*, is available on YouTube.²⁵ The video, filmed in the Columbia



A second grader observes macroinvertebrates at Whitaker Ponds Nature Park.

²³ The Clean Rivers Education Resources for Teachers webpage is available at <https://www.portland.gov/bes/clean-rivers-education/teacher-resources>

²⁴ Watch the Explore Whitaker Ponds with Clean Rivers Education video at <https://www.youtube.com/watch?v=o9LiN5M7dKg>

²⁵ Watch the *After the Flush: Recovering energy and nutrients from Portland's wastewater* video at <https://www.youtube.com/watch?v=WHtNdTS032E>

Slough watershed, was released at the beginning of fiscal year 2022–2023 and has received more than 1,900 views.

4. Support for Portland State University's *Science Inquiry in the Outdoor Classroom* capstone classes to update and enhance virtual field experiences for Whitaker Ponds and Kelley Point Park (as well as Errol Heights Park, Marshall Park, Lower Macleay Park and Oaks Bottom Wildlife Refuge).²⁶

4.1.7.2 [BES Community Watershed Stewardship Program](#)

The Community Watershed Stewardship Program (CWSP) helps Portlanders make improvements in their neighborhoods and communities while also improving the health of our watersheds. In the fiscal year 2022–2023, CWSP focused outreach to:

- Building community connection opportunities, such as with coffee talks with emerging leaders in Portland's African American community.
- Providing communications to the Numberz FM radio station to invite Black Portlanders in east Portland to participate in culturally-specific programs to this community.
- Providing online workshops, and sending email invitations to nearly 100 community organizations

During fiscal year 2022–2023, the CWSP provided approximately \$46,000 in grants to projects within the Columbia Slough Watershed that spurred volunteer contributions and increased interest in the historical and cultural resources it provides.

Below are brief descriptions of projects funded by CWSP in the Columbia Slough Watershed:

- **ELSO Inc (\$12,000 award):** Camp ELSO is a community based environmental education focused nonprofit that uses the natural world to connect children from Black and Brown communities to STEM. ELSO brought youth outside to create garden pots and learn about the plants of the Columbia Slough Watershed.
- **Growing Gardens (\$12,000 Award):** Growing Gardens brought incarcerated individuals and correctional officers at the Columbia River Correctional Institution to build a garden and a bioswale. The project teaches healthy watershed gardening practices, providing individuals who are in a recovery program with an increased sense of environmental knowledge and awareness, job credentials, self-agency and healing.



High school students test water quality at Columbia Children's Arboretum.

²⁶ The Virtual Field Environments are available here: <https://sites.google.com/pdx.edu/rickhugo/vfes>

- **Gather: Make: Shelter (GMS) (\$10,000 Award):** In partnership with the CSWC, GMS brought exploration and learning opportunities in the Columbia Slough Watershed's natural areas to unhoused community members who participate in GMS services. Paddling the Columbia Slough was a new enriching experience to encourage a connection to the natural world and a stewardship ethos.



ELSO planting Vanport wetlands.

- **Lower Columbia Estuary Partnership (LCEP) (\$12,000 Award):** LCEP's Connecting Students with Science project provided Vernon Elementary fourth and fifth grade students with hands-on, place-based science education. These Portland Public School students were brought outdoors to help foster a connection to nature, stewardship, and environmental restoration.

4.1.7.3 Columbia Slough Watershed Council

BES contracts with the CSWC, a nonprofit organization that provides environmental education, community stewardship, and stream/wetland restoration in the Slough Watershed. CSWC provides a crucial link to citizens, students, and businesses throughout the watershed. The CSWC's staff is knowledgeable about Slough-related water and sediment quality, a variety of endangered species issues, watershed restoration efforts, and waterway and natural area recreational opportunities.

In fiscal year 2022–2023, CSWC:

- Installed 1,050 bareroot and container plants and 38 ball and burlap trees, using BES contracted funds. Four hundred of the bareroot/containers and all burlap were mulched.
- Publicized events, bringing attendees to both culturally-specific and open-attendance options in support of Slough Watershed education and stewardship. Events included plantings, clean-ups, and nature walks.



The Columbia Slough Watershed Council paddle.

- Held 69 events, bringing out over 1,500 participants and over 400 volunteers to support and participate in programming.

4.2 Total Maximum Daily Loads

DEQ established TMDLs for local rivers that specify the maximum amounts of pollutants that do not meet water quality standards that various entities can contribute to the Willamette River, Columbia Slough, and tributaries. The City's TIP identifies key management strategies and BMPs to reduce TMDL pollutants from nonpoint sources and improve water quality for the Willamette River and its tributaries, including the Columbia Slough. Many of these strategies or BMPs are similar to those used to reduce the discharge of pollutants under the City's MS4 permit (see Section 4.1).

In February 2021, EPA released a new TMDL for mercury in the Willamette Basin. The City updated the TIP in 2022 to address the new mercury load allocations. This TIP update was approved by DEQ on November 3, 2022. The City's 5-year TIP cycle concluded in 2023, requiring the City to draft and submit a new TIP after completing a sufficiency evaluation, and to submit responses to DEQ's Year Five Survey. Through the survey review, the City found that the strategies included in the TIP are making steady progress towards meeting load allocations within Portland. The City successfully met all but one of the temperature goals in the City's previous TIP. Given the findings from the evaluation, the City's new TIP continues to employ many of the same management strategies, along with updated goals and timelines, and was submitted to DEQ for review and approval on November 1, 2023.

The City implements many different programs that address TMDL pollutants, many of these management strategies are implemented through the City's SWMP. DEQ implements TMDL requirements through NPDES permit conditions, including the City's MS4 permit. The City's SWMP Document describes in detail the stormwater management strategies the City employs to meet MS4 permit conditions. Although the SWMP addresses discharges from the MS4, most of the SWMP strategies are applied citywide and reduce TMDL pollution from nonpoint sources as well.

4.2.1 Natural Systems

Trees, shrubs, and groundcover protect the Slough by preventing erosion, intercepting rainfall, and reducing stormwater flow to the Slough. Trees along the riparian area help to shade the Slough and reduce water temperatures while providing habitat to native birds and wildlife. The City also pursues opportunities for land acquisition to protect and restore watershed functions, such as stormwater filtration, groundwater recharge, storage and retention of flood waters, and sediment delivery.

4.2.1.1 Watershed Revegetation Program

Through partnerships with other government agencies, businesses, and private



A frog encounter during a vegetation inventory.

landowners, the BES Watershed Revegetation Program works to restore vegetation citywide. The program’s fiscal year 2022–2023 accomplishments are highlighted in the table below.

Watershed Revegetation Program Fiscal Year 2022–2023 Accomplishments	
Accomplishment	Columbia Slough
Deciduous and Coniferous Trees Planted:	1,989
Shrubs Planted:	4,518
Acres of New Revegetation:	0
Linear Feet of New Revegetated Stream Bank Managed:	0

4.2.1.2 Tree Program

Through partnerships with nonprofits, community members, businesses, and schools, the City works with volunteers to enhance watershed health by planting trees throughout the City’s watersheds. In fiscal year 2022–2023, 740 trees were planted citywide through these partnerships.

5 References

- BES. 2007. Columbia Slough Watershed Long-term Monitoring Plan. City of Portland, Bureau of Environmental Services (BES). August 2007.
- BES. 2020a. *Annual Compliance Report No. 25 – Fiscal Year 2019–2020 – National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314*. Prepared for Oregon Department of Environmental Quality (DEQ). Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ November 2020.
- BES. 2020b. *Total Maximum Daily Load (TMDL) Implementation Plan – Annual Status Report No. 11 – Fiscal Year 2019–2020 (July 1, 2019, to June 30, 2020)*. Report is presented as Appendix A of the City of Portland NPDES MS4 Annual Report (Permit No. 101314) for Fiscal Year 2019–2020. Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ November 2020.
- BES. 2020c. 2020 Sampling and Analysis Plan – Amendment 1 – Source Tracing and Stormwater Monitoring – Columbia Slough ECSI No. 1283. Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ on December 17, 2020.
- BES. 2021a. 2020–2021 PFAS Sampling Results – Columbia Slough ECSI No. 1283. Technical Memorandum prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ on July 29, 2021.
- BES. 2021b. *Annual Compliance Report No. 26 – Fiscal Year 2020–2021 – National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314*. Prepared for Oregon Department of Environmental Quality (DEQ). Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ November 2021.
- BES. 2021c. *Data Summary. Community Engagement Liaison (CEL) Fish Consumption Questionnaire – Columbia Slough Fish Advisory. Columbia Slough Sediment Program* Internal Memorandum Prepared by the City of Portland Bureau of Environmental Services. February 22, 2021.
- BES. 2021d. *Total Maximum Daily Load (TMDL) Implementation Plan – Annual Status Report No. 11 – Fiscal Year 2020–2021 (July 1, 2020, to June 30, 2021)*. Report is presented as Appendix A of the City of Portland NPDES MS4 Annual Report (Permit No. 101314) for Fiscal Year 2020–2021. Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ November 2021.
- BES. 2022a. *Annual Compliance Report No. 27 – Fiscal Year 2021–2022 – National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314*. Prepared for Oregon Department of Environmental Quality (DEQ). Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ November 2022.

- BES. 2022b. *Total Maximum Daily Load (TMDL) Implementation Plan – Annual Status Report No. 12 – Fiscal Year 2021–2022 (July 1, 2021, to June 30, 2022)*. Report is presented as Appendix A of the City of Portland NPDES MS4 Annual Report (Permit No. 101314) for Fiscal Year 2021–2022. Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ November 2022.
- BES. 2023. *Annual Compliance Report No. 28 – Fiscal Year 2022–2023 – National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314*. Prepared for Oregon Department of Environmental Quality (DEQ). Prepared by the City of Portland Bureau of Environmental Services. Submitted to DEQ November 2023.
- BES and DEQ. 2011. *Columbia Slough Sediment Program Watershed Action Plan*. Prepared by City of Portland, Bureau of Environmental Services and Oregon Department of Environmental Quality.
- BES and DEQ. 2016. *2016 Intergovernmental Agreement, Oversight of Columbia Slough Sediment Remedial Action*. City of Portland, by and through its Bureau of Environmental Services, and Oregon Department of Environmental Quality, Multnomah County, Oregon. Effective Date: January 1, 2016.
- BES and DEQ. 2021. *2021 Intergovernmental Agreement, Oversight of Columbia Slough Sediment Remedial Action*. City of Portland, by and through its Bureau of Environmental Services, and Oregon Department of Environmental Quality, Multnomah County, Oregon. Effective Date: January 1, 2021.
- BES and GSI. 2018a. *Columbia Slough Fish Tissue Report – 2015 Sampling*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc, for Oregon Department of Environmental Quality. Submitted September 2017; revised June 2018.
- BES and GSI. 2018b. *Columbia Slough Sediment Data Analysis Report – 2017 Sampling*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc, for Oregon Department of Environmental Quality. Submitted June 2018.
- BES and GSI. 2018c. *Technical Memorandum: Results of the City of Portland 2016–2018 Columbia Slough Stormwater and Stormwater Sediment Source Investigation Sampling Activities*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc, for Oregon Department of Environmental Quality. Submitted June 21, 2018.
- BES and GSI. 2019a. *Source Tracing Investigation and Basin Characterization 2016–2017 and 2017–2018, Evaluation of Stormwater and Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc, for Oregon Department of Environmental Quality. Submitted May 2019.

- BES and GSI. 2019b. *2020 Sampling and Analysis Plan – Source Tracing and Stormwater Monitoring for Stormwater Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted August 2019.
- BES and GSI. 2020a. *Source Tracing Investigation and Basin Characterization 2018–2019, Evaluation of Stormwater and Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted June 2020.
- BES and GSI. 2020b. *Columbia Slough Stormwater Basin Atlas*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ June 2020.
- BES and GSI. 2020c. *2021 Sampling and Analysis Plan – Source Tracing and Stormwater Monitoring for Stormwater Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ August 2020.
- BES and GSI. 2020d. *2021 Sampling and Analysis Plan – Amendment 1 – Source Tracing and Stormwater Monitoring*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ December 2020.
- BES and GSI. 2021a. *Source Tracing Investigation and Basin Characterization 2019–2020, Evaluation of Stormwater and Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ June 2021.
- BES and GSI. 2021b. *Columbia Slough Stormwater Basin Atlas*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ September 2021.
- BES and GSI. 2021c. *Columbia Slough Data Management Tool, Version 5*. Prepared by the City of Portland Bureau of Environmental Services (BES), GSI Water Solutions, and Wildrose Consulting for Oregon Department of Environmental Quality. Submitted to DEQ January 2022.
- BES and GSI. 2021d. *Source Tracing Investigation and Basin Characterization 2020–2021, Evaluation of Stormwater and Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ January 2022.
- BES and GSI. 2021e. *2022 Sampling and Analysis Plan – Source Tracing and Stormwater Monitoring for Stormwater Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ August 2021.

- BES and GSI. 2022. *2023 Sampling and Analysis Plan – Source Tracing and Stormwater Monitoring for Stormwater Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ August 2022.
- BES and GSI. 2023a. *Source Tracing Investigation and Basin Characterization 2021-2022, Evaluation of Stormwater and Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ February 2023.
- BES and GSI. 2023b. *2024 Sampling and Analysis Plan – Source Tracing and Stormwater Monitoring for Stormwater Outfall Basins Discharging to the Columbia Slough*. Prepared by the City of Portland Bureau of Environmental Services and GSI Water Solutions, Inc. Submitted to DEQ August 2023.
- DEQ. 2005. *Record of Decision, Remedial Action Approach for Columbia Slough Sediment, Portland, Oregon*. Prepared by Oregon Department of Environmental Quality, Northwest Region Office. July 2005.
- DEQ. 2010. *Guidance for Evaluating the Stormwater Pathway at Upland Sites*. Prepared by Oregon Department of Environmental Quality, Environmental Cleanup Program. January 2009 (updated October 2010).