CLACKAMAS WATER ENVIRONMENT SERVICES

Clackamas Water Environment Services (WES)

Storm System Master Plan (SSMP)

Final

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October 2022

Project No. 19109

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ACRONYMS

ARPA	American Rescue Plan Act
BCC	Board of County Commissioners | Clackamas County
BMP	Best Management Practice
CCSD1	Clackamas County Service District No. 1
CIP	Capital Improvement Program
CWA	Federal Clean Water Act
CWR	Cold Water Refugia
DEQ	Oregon Department of Environmental Quality
DMA	Designated Management Agency
DTD	Department of Transportation and Development | Clackamas County
EPA	U.S. Environmental Protection Agency
ESA	Federal Endangered Species Act
FEMA	Federal Emergency Management Agency
FMD	Floodway Management District
FTE	Full Time Equivalent
HSPF	Hydrological Simulation Program - FORTRAN
KPDX	Portland International Airport weather station
NCRA	North Clackamas Revitalization Area
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NROZ	Natural Resources Overlay Zone
PPID	Potential Project Identification
PVNC	Pleasant Valley/North Carver
ROW	Right-of-Way
SDC	System Development Charge
SLOPES	Standard Local Operating Procedures for Endangered Species
SSMP	Storm System Master Plan
SSURGO	Soil Survey Geographic Database
SWMACC	Surface Water Management Agency of Clackamas County
SWMP	Stormwater Management Plan
TCSD	Tri-City Service District
TMDL	Total Maximum Daily Loads
UGB	Urban Growth Boundary
UIC	Underground Injection Control
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WES	Water Environment Services
WPCF	Water Pollution Control Facilities
WQRA	Water Quality Resource Area

Executive Summary

The Clackamas Water Environment Services (WES) Storm System Master Plan (SSMP) provides a flexible framework for storm system infrastructure operations, maintenance, and expansion to improve the quality of surface water and maintain infrastructure function in the WES service area. The SSMP provides short- and medium-term recommendations for capital improvements and programmatic system improvements. The recommended projects and programs have been prioritized and initial cost estimates have been developed. The resulting priorities and costs were used to create a ten-year construction plan to sequence implementation and to equalize annual expenditures.

The plan includes a prioritization methodology and stormwater toolkit. These items will allow WES to adapt the implementation plan to changing circumstances, identify and evaluate future storm system needs, and develop project concepts to address future needs.

Stormwater Program Priorities

The SSMP recommendations were compared against each other, WES's goals, and anticipated available funding to determine relative priority. The priority assigned to any given program or project may change over time as partnership opportunities or changes in regulation or community values emerge. A summary comparison of all program recommendations is provided in Table E-1**.**

Table E-1 Summary of Recommended Stormwater Programs Costs and Priorities

Program and Scope (Identified Projects)	Priority	Cost	
		Total	Annual*
Small Drainage Project	High	$971,906	$97,100
Stormwater Pond Repair / Rehabilitation	High	$4,114,951	$411,000
Water Quality Retrofit	High	$1,724,260	$172,000
Capital Improvement Program (CIP) Projects**	High	$21,963,759	$2,196,000
Restoration and Property Acquisition	Medium	$8,227,088	$823,200
Underground Injection Control (UIC) Decommissioning / Retrofit	Medium	$528,412	$53,000
Emergency Repairs	Medium	$1,000,000	$100,000
Total		**$38,530,376**	**$3,852,300**

** Annual costs are averaged in this table and are based on a ten-year plan.*
*** Includes both existing planned CIPs and new CIPs developed for the SSMP*

In the 2020-2021 and 2021-2022 fiscal years combined, WES has budgeted more than $3 million in its surface water Capital Improvement Plan (CIP). The existing project categories provided the basis for the programs developed in the SSMP: capital repairs, water quality retrofits, hydrology improvement facilities, UIC retrofits, restoration, and property acquisition for stormwater benefit.

The final Stormwater CIP includes ten project recommendations and confirms continuing an additional two projects already in progress. The SSMP also identified smaller capital projects that address known issues. These intermediate size projects are too large to be addressed by routine maintenance, and the SSMP recommends establishing funding programs to provide consistent annual funding for these projects. Funding these projects would support WES's goal of proactively addressing performance deficiencies or enhancements and decreasing the number of customer service requests. Within these programs the projects were evaluated and prioritized in alignment with WES's goal to focus limited resources on the most pressing concerns and the most cost-beneficial solutions.

Small Drainage Project Program

The Small Drainage Project Program is intended to provide steady annual funding so that WES can both reactively and proactively address small flooding and drainage issues in a timely manner. The projects will improve drainage issues when flooding is caused by WES's stormwater infrastructure.

Stormwater Pond Repair / Rehabilitation Program

The Stormwater Pond Repair and Rehabilitation Program will provide a budget line for repairing stormwater quality and flow control facilities. Stormwater facility maintenance is required by the Clackamas Group National Pollutant Discharge Elimination System (NPDES) Permit (municipal stormwater permit) issued to WES and jurisdictions in Clackamas County by the Oregon Department of Environmental Quality (DEQ). Repair and rehabilitation extend the life and function of these assets. Repairing and rehabilitating these facilities delays need for asset replacement, reduces pollutants in stormwater runoff, and avoids increases in erosive runoff in stream channels.

Water Quality Retrofit Program

The Water Quality Retrofit Program will add water quality treatment capacity in existing developed areas. Water quality retrofits projects build new facilities in unserved areas or enhancements which add or increase water quality treatment within existing stormwater infrastructure. Water quality retrofits are among the most popular projects among the public and often support multiple programs and goals, including local and regional fish recovery, habitat enhancement, and water cleanup goals. The Water Quality Retrofits also supports the required infrastructure retrofit and hydromodification assessment update requirement of the municipal stormwater permit.

CIP Projects

The final Stormwater CIP includes the ten project recommendations as well as two projects already in progress summarized in Table E-2. The priority ranks are a relative guide. The actual implementation sequence will depend on factors such as financial constraints and partnership opportunities. Other projects on the potential projects list could be reconsidered at a later date for inclusion in the Stormwater CIP. A list of these projects is provided in the SSMP for future consideration**.**

Table E-2 Priority CIP Projects by Rank

Rank*	CIP No	Name	Cost
Existing CIP			
1	1124	3-Creeks Floodplain Enhancement Project	$3,600,000
3	1413	SE Valley View Terrace Conveyance (stormwater portion only)	$3,277,958
Planned CIP			
2	1005	SE Wildlife Estates Dr Ditch Inlet & Upstream Detention	$1,679,470
4	1079	Aldercrest Culvert Replacement & Kellogg Creek Restoration	$1,865,013
5	1606	NCRA Stormwater Plan	$5,144,850
6	1055	Thiessen Culvert Replacement & Kellogg Creek Restoration	$801,635
7	1406	Sunnyside Place Culvert Replacement & Stream Restoration	$573,623
9	1416	Idleman Conveyance	$1,394,900
11	1322	SE 172nd Ditch Conveyance Improvement	$88,800
13	1091	SE Clackamas Road Drainage Infrastructure	$508,400
14	1098	Rose Creek New Detention Pond and Instream Restoration	$2,589,010
15	1125	Aldercrest and Rusk Drainage Improvement	$440,100
Total			**$21,913,759**

** The final ranking indicates a relative priority but does not necessarily represent the order of implementation.*

Medium Priority Programs

During the SSMP process, WES identified a number of additional potential projects that were rated lower priority but also contribute to WES's goals. These potential projects were categorized into the following recommended funding programs. Funding these programs would support local and regional environmental goals, meet additional regulatory requirements, or reactively address stormwater issues.

Restoration and Property Acquisition Program

Many streams and rivers in the planning area are stressed by combinations of increases in impervious area, poor fish passage, increased stormwater runoff and flooding risk, poor riparian vegetation cover, in-stream erosion, and water quality degradation. These projects restore the ecological and stormwater benefits of the properties, supporting habitat improvement, and floodplain management.

UIC Decommissioning / Retrofit Program

The SSMP recommends establishing a program to fund nine identified projects to retrofit or decommission underground injection controls (UICs) owned by WES and identified as a potential threat to groundwater quality. This recommendation implements projects identified to satisfy WES's Water Pollution Control Facility Permit from DEQ.

Emergency Repairs

WES anticipates a certain level of emergency infrastructure repair will be required annually. These projects are similar to the projects included in the Stormwater Pond Repair / Rehabilitation Program; however, these projects are the result of new damage or unknown issues which require more urgent mitigation due to the immediate threat to safety or property. Currently WES does not budget for emergency repairs, and funds are redirected from other programs when needed. WES should budget annually to perform minor emergency repairs.

Policy Initiatives

In addition to funding these recommended programs and projects, the plan makes recommendations in three policy areas identified by WES as priorities.

Regional Stormwater Facility Implementation Strategy and Toolbox

WES should consider pursuing steps to implement a regional approach for stormwater management. These steps consist of creating stormwater plans, writing codes that encourage regional facilities, and providing developers with guidelines and minimum standards. The Pleasant Valley/North Carver (PVNC) Comprehensive Plan area is an opportunity to pilot this policy.

Identifying Public Storm System Extension Opportunities

As part of the SSMP, a simple web-based mapping tool and methodology were developed to locate areas where a lack of public stormwater conveyance may present a barrier to development. The tool will remain useful to WES as a tool for analysis of stormwater system needs.

Stormwater Credit Banking

The SSMP analyzed the benefits and implementation process of a stormwater credit program for Clackamas Department of Transportation and Development (DTD) and City of Happy Valley transportation projects. DTD and the City of Happy Valley would be the primary beneficiaries of a program such as this, and it could strengthen relationships between WES and those agencies.

Pleasant Valley/North Carver Stormwater Infrastructure Plan

The Pleasant Valley/North Carver (PVNC) area was recently brought into Happy Valley's urban growth boundary, and a Stormwater Infrastructure Plan for the PVNC area is included in this SSMP. The total estimated cost for regional stormwater infrastructure for the PVNC area is approximately $23,961,000.

Ten-Year Budget/Construction Plan

To accomplish the recommended CIP project and program scopes of work, the SSMP includes a ten-year Stormwater CIP implementation plan. The plan demonstrates one option to begin with the highest priority projects, stagger the start, and phase the construction of the recommended projects to even out the costs and allow a steady level of funding over ten years.

Likely Funding Sources

Capital projects may be funded using a combination of cash reserves, service charges, SDCs, or debt (typically bonds). The appropriate mix of financing will depend on the capital investment lifecycle for each project. Revenue from other sources may be available when a project benefits or is done in partnership with other agencies or funds, such as transportation or sanitary sewer funds. Competitive grants, state loans and funding, and federal grants and funding may also be available to fund projects that meet those sources' priorities.

Section 1. Introduction

Clackamas Water Environment Services (WES) produces clean water, protects water quality and recovers renewable resources. WES does this by providing wastewater services, stormwater management, and environmental education. WES protects public health and support the vitality of local communities, natural environment, and economy. WES is an independent service district authorized to provide stormwater and wastewater services within Clackamas County. WES was created as an intergovernmental partnership between Clackamas County Service District No. 1 (CCSD1), the Surface Water Management Agency of Clackamas County (SWMACC), and the Tri-City Service District (TCSD), and WES now provides the services provided by those agencies in their former services areas. The Board of County Commissioners (BCC) serves as the governing body. WES provides services in three service areas, which are described in the WES Service Area Overview.

WES identified developing a master plan as a strategic initiative supporting Clackamas County's Performance Clackamas goals. The purpose of the Storm System Master Plan (SSMP) is to create a framework for infrastructure maintenance and expansion to improve the quality of surface water in the WES service areas. The SSMP goals are to address system deficiencies, accommodate new growth, extend the service lives of existing assets, and improve water quality protection. The SSMP provides short- and medium-term recommendations for capital improvements and long-term guidance in evaluating the storm system.

The planning area included in this SSMP consists of 23,913 acres of incorporated and unincorporated Clackamas County.

Planning Process Overview

The SSMP planning process encompassed several steps with the goal of identifying system improvement priorities and developing program recommendations and Capital Improvement Program (CIP) projects to address those priorities.

Section 2 describes the planning area. The planning area is divided into ten study areas to organize the process and recommendations. The study areas were determined using a combination of topography and built features. Section 2 describes the study areas and their primary water bodies, land cover characteristics, and storm systems in detail.

Sections 3 describes the process of identifying and categorizing known issues, then developing solutions and projects to implement those solutions. Known issues were compiled by reviewing project lists, community complaints, work order databases, and drainage hotspots as well as interviewing staff from WES, Clackamas County Department of Transportation and Development (DTD), and City of Happy Valley. CIP projects and five programs of smaller projects were developed to meet WES's goals.

Section 4 presents the CIP project selection process and the recommended projects. Ten projects were selected to develop into CIP projects with concept level designs and cost estimates.

Section 5 presents recommendations for five programs to systematically improve elements of the storm and surface water systems. Each program groups similar types of projects that would be too small or otherwise ineligible to become a standalone CIP project.

The SSMP process also included drafting three white papers to explore potential policy initiatives including regional stormwater facilities, identification of areas not adequately served by the service areas' storm system, and stormwater credit banking. These papers are presented in the policy discussion in Section 6.

Lastly, a ten-year capital budget and implementation plan for capital improvements is presented in Section 7. The implementation plan describes how WES can strategically and realistically address major conveyance and flooding challenges, while also responding to smaller but critical upgrades and repairs over the next ten years.

Regulatory Considerations

Generally, stormwater discharges are known to create adverse impacts on streams, rivers, and lakes in a variety of ways including short-term changes in water quality associated with runoff from storms, long-term changes in water quality resulting from cumulative impact of pollutant discharges over time from many sources, and habitat-altering physical changes such as erosion, sedimentation, and scour resulting from changes to the volume, frequency, and duration of stream flows (United States Environmental Protection Agency, 1999). The WES storm system and stormwater discharges to natural resources are regulated by a variety of federal, state, and local laws, rules, and guidelines designed to mitigate these impacts.

Federal

Clean Water Act

National Pollutant Discharge Elimination System

The federal Clean Water Act of 1972 (CWA) created the National Pollutant Discharge Elimination System (NPDES) permit program to address sources of pollution in rivers, creeks, and streams. The program required all municipalities with populations greater than 100,000 to apply for and obtain a municipal NPDES permit for storm systems that discharge to rivers, streams, and other surface water bodies. In Oregon, these permits are administered by the Oregon Department of Environmental Quality (DEQ).

WES is a permittee of the Clackamas County Group Phase I Permit. WES is the Municipal Separate Storm Sewer System (MS4) permittee for the unincorporated urban area in Clackamas County and provides stormwater services in the City of Happy Valley and the City of Rivergrove. The permitted area ultimately drains to the Willamette River through numerous stream systems, the Clackamas River, and the Tualatin River. WES's permit involves unique challenges because the urbanized area of Clackamas County falls under several local jurisdictions. The current permit became effective in 2021 and will expire in 2026. Permits are issued for five-year periods.

The MS4 permit guides many of WES's stormwater management program's goals, policies, and day-to-day operations, and permit compliance represents a significant investment for WES.

Total Maximum Daily Load

The CWA describes a program of Total Maximum Daily Loads (TMDLs) to protect water quality when other measures have failed. A TMDL establishes the limit of each pollutant that can be discharged to a water body in order for the water body to achieve or maintain water quality standards.

Under the CWA, DEQ is responsible for identifying waters that do not meet water quality standards (known as the 303(d) list). Water quality standards are intended to protect human health, aquatic life, and uses of waters for fishing, swimming, and other activities. DEQ is also responsible for calculating the allowable pollutant loads and developing water quality management plans, which allocate pollutant limits among dischargers and describe how a TMDL will be implemented.

Clackamas WES participates in three established TMDL Implementation Plans as a Designated Management Agency (DMA) for the parameters listed below.

- *Willamette River Watershed TMDL Implementation Plan for Clackamas County, CCSD#1, and Happy Valley* (Water Environment Services, 2011)
    - E. coli
    - DDT and Dieldrin

- Mercury
- Temperature
- Cold Water Refugia (CWR)

- *Tualatin River Watershed TMDL Implementation Plan for SWMACC and the City of Rivergrove* (Water Environment Services, 2014)
  - E. coli
  - pH and Chlorophyll A (Total Phosphorus)
  - Mercury
  - Temperature
  - Dissolved Oxygen

- *Sandy River Watershed TMDL Implementation Plan for Clackamas County and CCSD#1 (DRAFT)* (Brown and Caldwell, 2008)
  - Temperature
  - E. Coli

In addition, the U.S. Environmental Protection Agency (EPA) issued the Willamette Basin Mercury TMDL in February 2021. EPA's TMDL incorporates the proposed 2019 Willamette Basin Mercury TMDL submitted by DEQ to EPA with major revisions to some load and wasteload allocations to meet the mercury water quality standards. Clackamas WES continues to be a DMA in this new TMDL. (Oregon Department of Environmental Quality, 2019)

Safe Drinking Water Act

The federal Safe Drinking Water Act regulates the injection of stormwater into the ground in order to protect the quality of aquifers used for drinking water. In Oregon, the DEQ is authorized to regulate stormwater Underground Injection Controls (UICs), which are deep injection wells that discharge stormwater to groundwater. WES operates a small number of regulated municipal UICs under a permit issued by DEQ.

Endangered Species Act

The 1973 federal Endangered Species Act (ESA) protects threatened and endangered species and their habitats. Steelhead were listed as threatened under the ESA in 1998 in the Lower Columbia River; Chinook Salmon were listed as threatened in 1999 in the Lower Columbia River, Coho Salmon were listed as threatened in 2005 in the Lower Columbia River, and Chum Salmon were listed as threatened in 1999 in the Columbia River.

The West Coast Region of National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (USFWS) implement the ESA in Oregon by prohibiting the kill, capture, or harm of threatened and endangered aquatic species. Habitat modifications that injure fish by significantly impairing essential behavioral patterns such as feeding, migrating, and spawning are included in the definition of "harm."

Both the discharge of pollutants from the municipal storm sewer and alterations to hydrology, such as addition of impervious surfaces that change the volume and timing of stormwater runoff (hydromodification), can impair fish habitat.

The ESA could influence some of the requirements for WES's stormwater projects as described in this SSMP. A project which discharges to a water of the state below the ordinary high water mark or creates a fill in a jurisdictional wetland or water of the state could be required to meet more stringent stormwater control standards under a program administered by the U.S. Army Corps of Engineers (USACE) called *Standard Local Operating Procedures for Endangered Species to Administer Maintenance or Improvement of Stormwater, Transportation, and Utility Actions Authorized or Carried Out by the U.S.*

Army Corps of Engineers in Oregon (SLOPES). If a project triggers review by the USACE, then SLOPES standards for detaining and treating stormwater runoff will apply to the project. Depending on the size of the project and the target protection level of the receiving water, the SLOPES requirements could be more rigorous than the analogous WES standard. (United States Army Corps of Engineers, 2014).

State

Statewide Planning Goals

Oregon Administrative Rules 660 Division 15 establishes several Statewide Land Use Planning Goals. Goal 5 describes the protection of natural resources, including wetlands and riparian corridors. Statewide Planning Goal 6 describes the protection of air, water quality, and land resources quality, and Goal 7 describes protection of areas subject to natural disasters and hazards. Goal 11 describes the steps needed to plan utility infrastructure along with the growth of development (Oregon Department of Land Conservation and Development, 2019). These goals are addressed through the local jurisdictions' comprehensive plans and local planning authorities' zoning codes as described below.

Local

Comprehensive Plans

Clackamas County Comprehensive Plan

The Clackamas County Comprehensive Plan includes goals and policies to manage growth in urban areas and protect landscapes, rivers, and other natural attractions. The plan's natural resources and energy chapter adopts goals and policies to address rivers and stream corridors in general, five individual river corridors, wetlands, and groundwater. The plan's public facilities and services chapter adopts specific policies for the development of storm drainage infrastructure to address water quality and erosion as well as infrastructure expansion and improvement. (Clackamas County, 2020)

Happy Valley Comprehensive Plan

The Happy Valley Comprehensive Plan includes goals and polices to manage stormwater to protect hydrology and water quality. The plan includes policies that focus on East Happy Valley as the area transitions to an urban area. The plan affirms the high value residents place on the natural qualities of the region and the importance of wise use and management of natural resources. (City of Happy Valley, 2017)

Pleasant Valley/North Carver Comprehensive Plan

The Pleasant Valley/North Carver (PVNC) area was recently brought into Happy Valley's urban growth boundary. By state law, a community Comprehensive Plan for the area must be completed before redevelopment of the area can occur. The PVNC Comprehensive Plan is in progress. As part of the SSMP, a stormwater infrastructure plan was developed for the PVNC area. (City of Happy Valley, 2021)

WES Rules and Stormwater Standards

Clackamas WES is in the process of updating its Rules and Standards. This project was initiated to review existing rules and standards and recommend updates to reflect new technologies, approaches, and development patterns; address regulatory changes and requirements; and provide uniform and streamlined development review and approval processes across WES's service area. A draft of the revised Rules and Standards was published in December 2021, and the final Rules and Standards are planned for adoption in 2022.

The stormwater related objectives of these Rules and Regulations are:

- To prevent or minimize the introduction of pollutants to waters of the state.
- To meet federal NPDES permit requirements.
- To establish policies that prevent future pollution and erosion through implementation of best management practices (BMPs).

- To provide for the fair distribution of the costs of the surface water management program.
- To better manage and control surface water.
- To protect the health of stream habitats.
- To protect watershed health.

The Stormwater Standards are intended to provide guidance for the reduction of pollutants in stormwater to the maximum extent practicable. These standards also address flow control, water quality, storm drainage system design, erosion prevention and sediment control, source control for pollutant activities, and operations and maintenance. (Water Environment Services, 2021)

Zoning and Development Codes

Each CIP in this plan will need to comply with the local zoning, land development, flood plain and other codes regulating development in the local jurisdictions where it is being constructed. This plan includes the jurisdictions of Clackamas County, Happy Valley and Rivergrove.

Stormwater Planning History

In 1995, DEQ issued the Clackamas County Phase I Municipal Separate Storm Sewer (MS4) permit (Clackamas Group NPDES Permit) to fourteen co-permittees in Clackamas County. Individually, none of these co-permittees met the threshold population of 100,000; however, their combined populations in close proximity did exceed 100,000. The primary goal of the Clackamas Group NPDES Permit is to ensure treatment or removal of pollutants and floatables from stormwater runoff before discharge into a waterway. Since 1995, five co-permittees have implemented a coordinated Clackamas County MS4 permit program: CCSD1, SWMACC, the cities of Rivergrove and Happy Valley, and Clackamas County. Prior to service area consolidation, WES implemented the permit on behalf of CCSD1 and SWMACC.

DEQ has renewed the MS4 permit several times since its original issuance. The 2021 Clackamas Group NPDES Permit is now issued to Clackamas County, City of Happy Valley, City of Lake Oswego, City of Oregon City, City of West Linn, Oak Lodge Water Services District, City of Gladstone, City of Johnson City, City of Milwaukie, City of Rivergrove, City of Wilsonville, and Water Environment Services. WES will review and update its Stormwater Management Plan in 2022 as a result of the 2021 Permit.

In 2005, WES prepared a draft Stormwater Management Program Master Plan for the area covering CCSD1. The plan was not adopted; however, following the draft plan recommendations, watershed action plans were developed for the Kellogg Creek-Mount Scott Creek and Rock Creek basins in 2009. The watershed action planning approach included structural, non-structural, and water resource restorative actions that WES and agencies could take to improve watershed health. (Shaun Pigott Associates, LLC, 2006)

The PVNC area was brought into the Portland Metro Urban Growth Boundary (UGB) for future expansion of Happy Valley city limits. The area is part of the Rock Creek study area directly east of Happy Valley. The PVNC Comprehensive Plan is expected to be adopted in 2022 and will include land use, transportation, and stormwater infrastructure planning. Developing a stormwater infrastructure plan for the area was included in this SSMP process.

WES Service Area Overview

WES is an independent service district authorized to provide stormwater and wastewater within Clackamas County. WES was created in 2016 as a municipal partnership between CCSD1 and TCSD and only included wastewater services. In 2017, the BCC amended the agreement to include SWMACC, and WES began providing surface water management services to the City of Rivergrove and portions of unincorporated Clackamas County draining to the Tualatin River formerly provided by SWMACC. In 2018, WES began providing surface water management services within the City of Happy Valley and

unincorporated Clackamas County (the former area of CCSD1.) WES is managed by the County Department of the same name and the BCC is the governing body of WES. (Water Environment Services, 2019; Water Environment Services, 2018)

WES is organized into three geographic areas that correspond to the areas of the former service districts. Service Area #1 is the area formerly served by TCSD. Service Area #2 is the area formerly served by CCSD1. Service Area #3 is the area formerly served by SWMACC.

Authority and responsibility vested in WES are delegated by the BCC. The WES Rules and Regulations delineate WES's authority and responsibilities for services provided in each service area and for stormwater and wastewater assets owned and operated by WES. The overall purpose of the Rules and Regulations is to provide for a regional, consistent, and efficient way to plan for and provide North Clackamas County's current and future wastewater and surface water needs in a way that protects public health and the environment while supporting economic development. Under the current Rules and Regulations, the responsibility in each of the service areas is consistent with the services provided by the former service districts. As the governing body for WES, BCC adopts or revises the Rules and Regulations by ordinance and delegates authority to the Director to promulgate technical standards and requirements necessary to implement the purpose and intent of the Rules and Regulations.

The SSMP addresses stormwater needs in the geographic areas that include WES Service Area #2, excluding the areas in Boring, Hoodland, and Fischer's Forest Park, WES Service Area #3, and specified adjacent planned growth areas. Service Area #1 is not included in the SSMP because WES only provides wastewater services in this area. The planning area for the SSMP is non-contiguous and varies in system characteristics. Table 1 shows the services WES provides in each service area. The planning area is covered in more detail in Section 2.

The WES service areas encompass 60 square miles, of which Service Areas #2 and #3 are 40 square miles. This area includes the City of Happy Valley and small portions of other cities as well as 6,500 acres of unincorporated Clackamas County.

Table 1 Service Areas

Service Area	Area (Square Miles)	Boundary of Former Agency	Services Provided
Service Area #1	20	TCSD	Wastewater
Service Area #2	25	CCSD1	Wastewater, surface water and stormwater management
Service Area #3	15	SWMACC	Surface water and stormwater management

Storm System Overview

The surface water infrastructure is a separate storm sewer system, meaning stormwater runoff is collected and conveyed separately from sanitary sewerage. Over 10,000 catch basins and inlets collect stormwater from roads and private property. The collected water is conveyed through a network of approximately 308 miles of storm sewer mains (pipes) and nine miles of ditches to discharge to natural water bodies or to the ground. Of the 308 miles of pipe, 90 miles are concrete, 41 miles are polyethylene, 100 miles are polyvinyl chloride, and 68 miles are of unknown material. The remaining eight miles of pipe are variously of cast iron, corrugated metal, ductile iron, reinforced concrete, steel or other materials.

WES manages 893 detention pipes and facilities. Runoff from large precipitation events collects in these facilities and discharges slowly into water bodies. By quickly filling with runoff and slowing the released runoff, these facilities prevent both flooding of nearby neighborhoods and flooding and erosion in the

water bodies they drain into. WES also manages 620 vegetated water quality (treatment) facilities although much of the water collected by WES's storm system is conveyed and discharged without treatment.

Collected runoff enters water bodies through 584 outfalls which must be inspected for signs of erosion and illicit discharges of pollutants. Runoff also enters the ground through 370 UICs. These devices infiltrate surface runoff to groundwater where it either flows to waterbodies or enters aquifers. These also must be inspected and maintained to prevent contamination and to remove sediment and trash.

WES is responsible for complying with state and federal water quality regulations which require that the public surface water system be adequately inspected, maintained, and repaired.

WES Surface Water Program

WES's current Surface Water Program works to protect surface water and groundwater resources from storm runoff and non-point sources and to coordinate compliance with state and federal water pollution laws and cleanup plans. Primary responsibilities of this program include planning and building stormwater control facilities and capital improvements, monitoring stormwater runoff and streams, implementing public education and outreach campaigns, developing and enforcing water quality regulations, coordinating with municipalities and other agencies, and maintaining the public storm sewer systems within the WES service area.

As the population served by WES continues to increase, WES is committed to responsible stormwater management to keep waterways clean for people, fish, and wildlife. Unfortunately, many past drainage and stormwater management practices and regulations have proven inadequate to prevent stormwater runoff impacts to streams and groundwater, and thousands of developed acres in Clackamas County currently contribute to problems in local water bodies. The SSMP provides short- and medium-term recommendations for system maintenance and capital improvements and long-term guidance in evaluating storm system needs and to achieve WES's vision to be a collaborative partner in building a resilient clean water future where all people benefit, and rivers thrive.

Section 2. SSMP Planning Area

The planning area included in this SSMP consists of approximately 28,500 acres of Clackamas County in the Portland metropolitan area south of Portland, Oregon. The planning area includes WES Service Area #2, excluding areas in Boring, Hoodland, and Fischer's Forest Park, WES Service Area #3, and specified adjacent planned growth areas. Service Area #1 is excluded because WES only provides wastewater service in that area. The total planning area consists of 23,913 acres of WES service area and 4,500 acres outside the WES service areas in anticipation of their future annexation. The planning area is non-contiguous. The boundaries of the SSMP planning area, service areas, and study areas are shown in Figure 1.

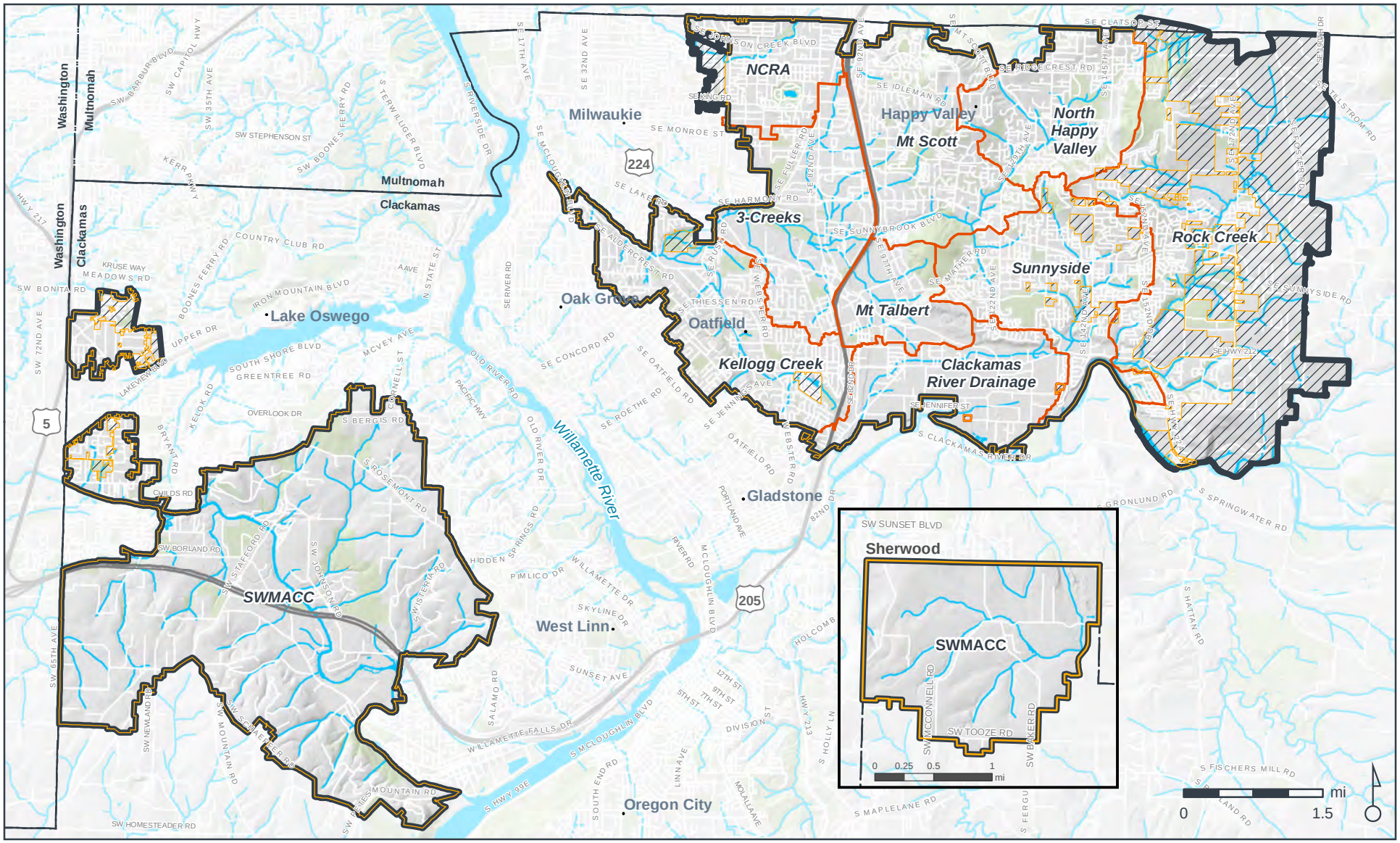

FIGURE 1

WES SSMP PLANNING AREA

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- SSMP Study Area
- Stream/Waterbody

DATE: 8/15/2022

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NOTE: THIS DATA IS NOT A SURVEY AND IS MEANT FOR PLANNING PURPOSES ONLY. DATA IS PROVIDED BY ESRI, WES, AND METRO RLIS.

Geography

WES Service Area #2 is located east of the Willamette River and primarily serves the City of Happy Valley and some unincorporated areas of Clackamas County. Adjacent cities include Portland to the north, Milwaukie to the west and Gladstone to the southwest. Adjacent unincorporated communities include Oak Grove to the west and Damascus to the east. Figure 2 WES Service Area #2 and Study Areas shows Service Area #2 and the associated study areas.

WES Service Area #3 comprises three areas west of the Willamette River and serves unincorporated areas of Clackamas County and the City of Rivergrove. Adjacent cities include Lake Oswego to the north, Tualatin and Sherwood to the west, West Linn to the east, and Wilsonville to the south. Sherwood also borders the far west SWMACC study area on the north. Figure 3 WES Service Area #3 and Study Areas shows Service Area #3 and the SWMACC study areas.

Clackamas County is one of three counties under the jurisdiction of the Metro regional government (Metro), which manages growth and provides other regional services within the tri-county area. The UGB is established by Metro.

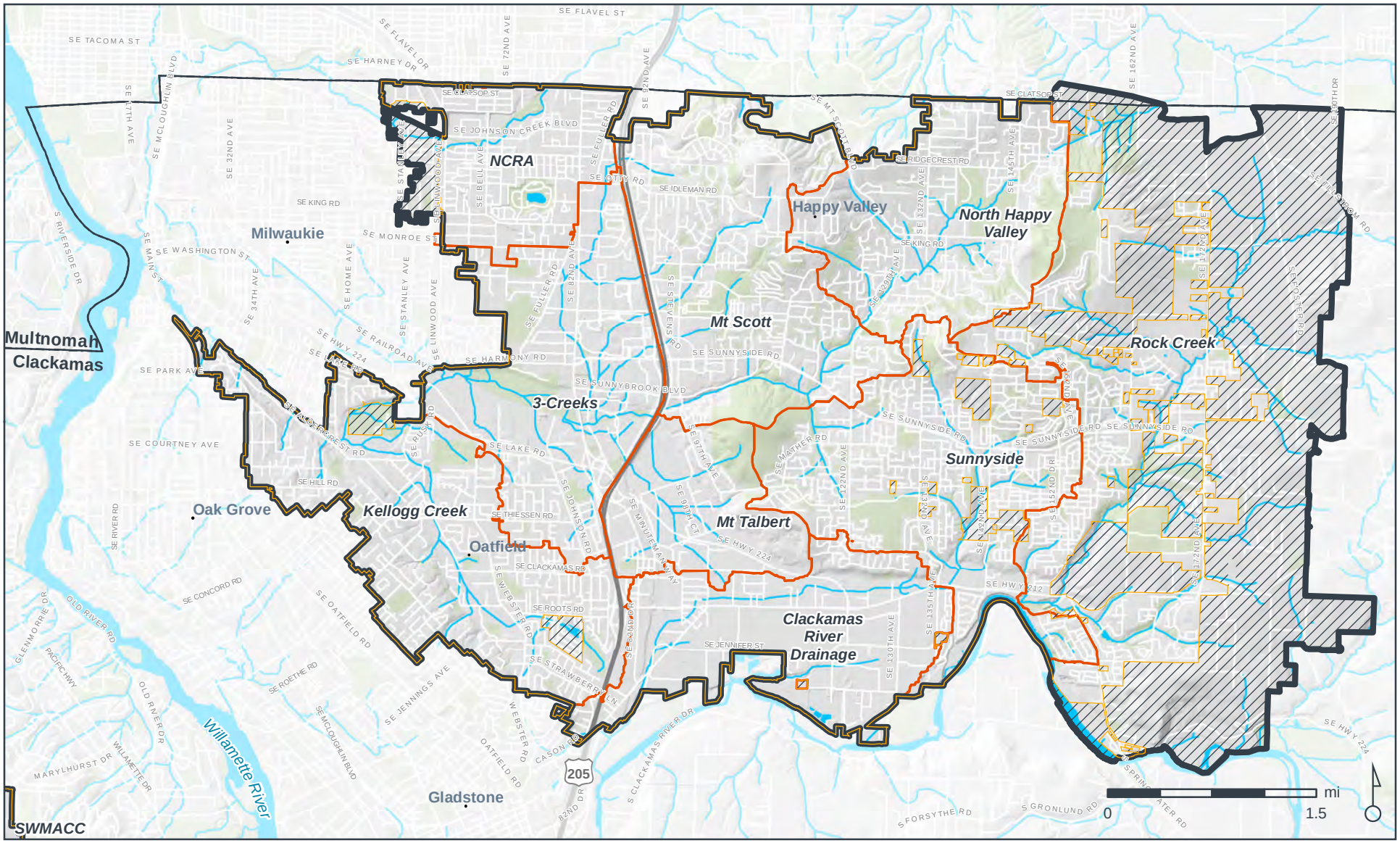

FIGURE 2

WES SERVICE AREA #2 AND SSMP STUDY AREAS

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- SSMP Study Area
- Stream/Waterbody

DATE: 8/15/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

Otak

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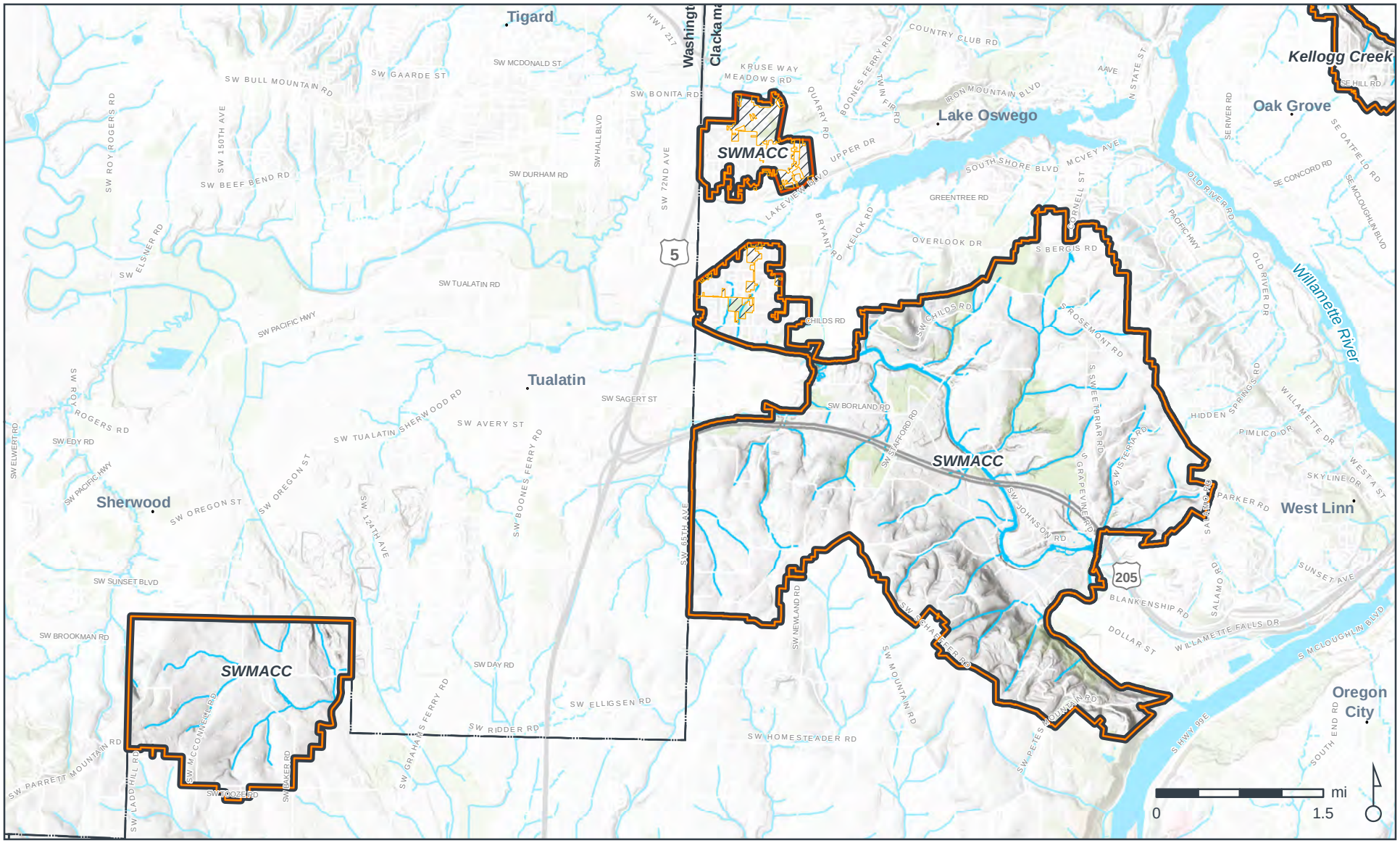

FIGURE 3

WES SERVICE AREA #3 AND SWMACC STUDY AREA

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- SSMP Study Area
- Stream/Waterbody

DATE: 8/15/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

Otak

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NOTE: THIS DATA IS NOT A SURVEY AND IS MEANT FOR PLANNING PURPOSES ONLY. DATA IS PROVIDED BY ESRI, WES, AND METRO RLIS.

Major Watersheds and Topography

Most of Clackamas County and all of the planning area is drained by the Willamette River and its tributaries, including the Clackamas and Tualatin Rivers. The remaining lands are drained by the Sandy River which enters the Columbia River at the City of Troutdale.

Service Area #2 is situated on the east side of the Willamette River, and the area rises eastward from the river toward the Cascade Mountains. The area is cut by the Clackamas River and several creeks including Kellogg Creek, Mount Scott Creek, Phillips Creek, and Rock Creek. These creeks cut into gently rolling, terraced hills creating steep slopes on their flanks. Several extinct volcanos punctuate this terrain, including Mount Scott and Mount Talbert. Elevation in the area ranges from near sea level to nearly 1,100 feet at the top of Mount Scott. (U.S. Department of Agriculture, 1926)

Service Area #3 lies on the west side of the Willamette River. The largest part of the service area consists of the Tualatin River valley. The Tualatin River flows east south of Rivergrove then southeast to the Willamette River with terraced ridges on either side of it. A separate portion of the service area is situated to the north on a flat plain west of Lake Oswego. This area drains to the west to Fanno Creek (outside the service area) which flows south into the Tualatin River. In the southwest, another separate portion of the service area is located on a terrace that slopes gently to the northeast and drains via Coffee Lake Creek (outside of the planning area) to the Willamette River.

The rivers and drainage basins in the WES Service Areas are shown in Figure 4 and Figure 5.

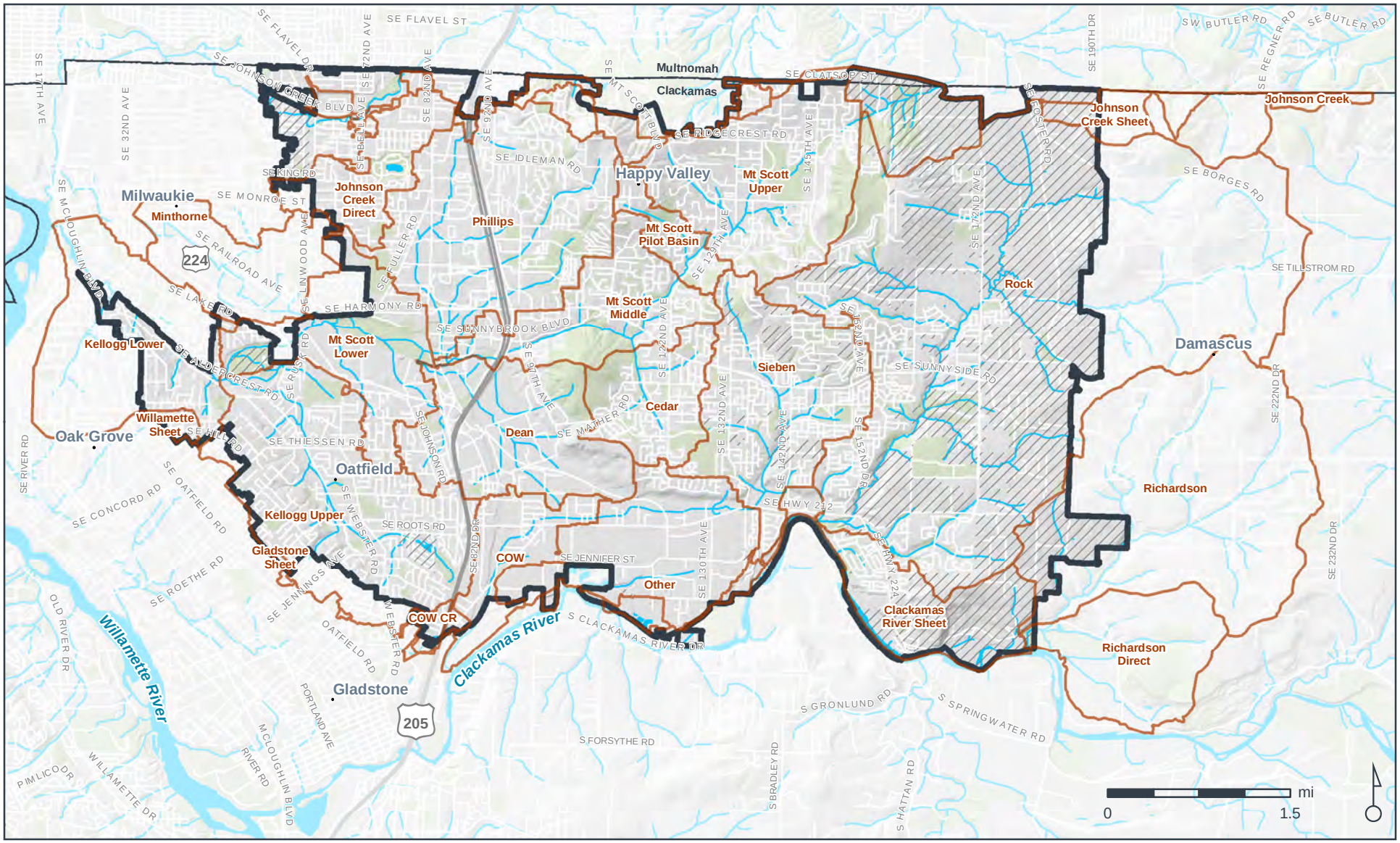

FIGURE 4

WES SERVICE AREA #2 DRAINAGE BASINS

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

- SSMP Planning Area
- Outside WES Service Area
- Stream/Waterbody
- WES Drainage Basins

DATE: 8/18/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

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NOTE: THIS DATA IS NOT A SURVEY AND IS MEANT FOR PLANNING PURPOSES ONLY. DATA IS PROVIDED BY ESRI, WES, AND METRO RLIS.

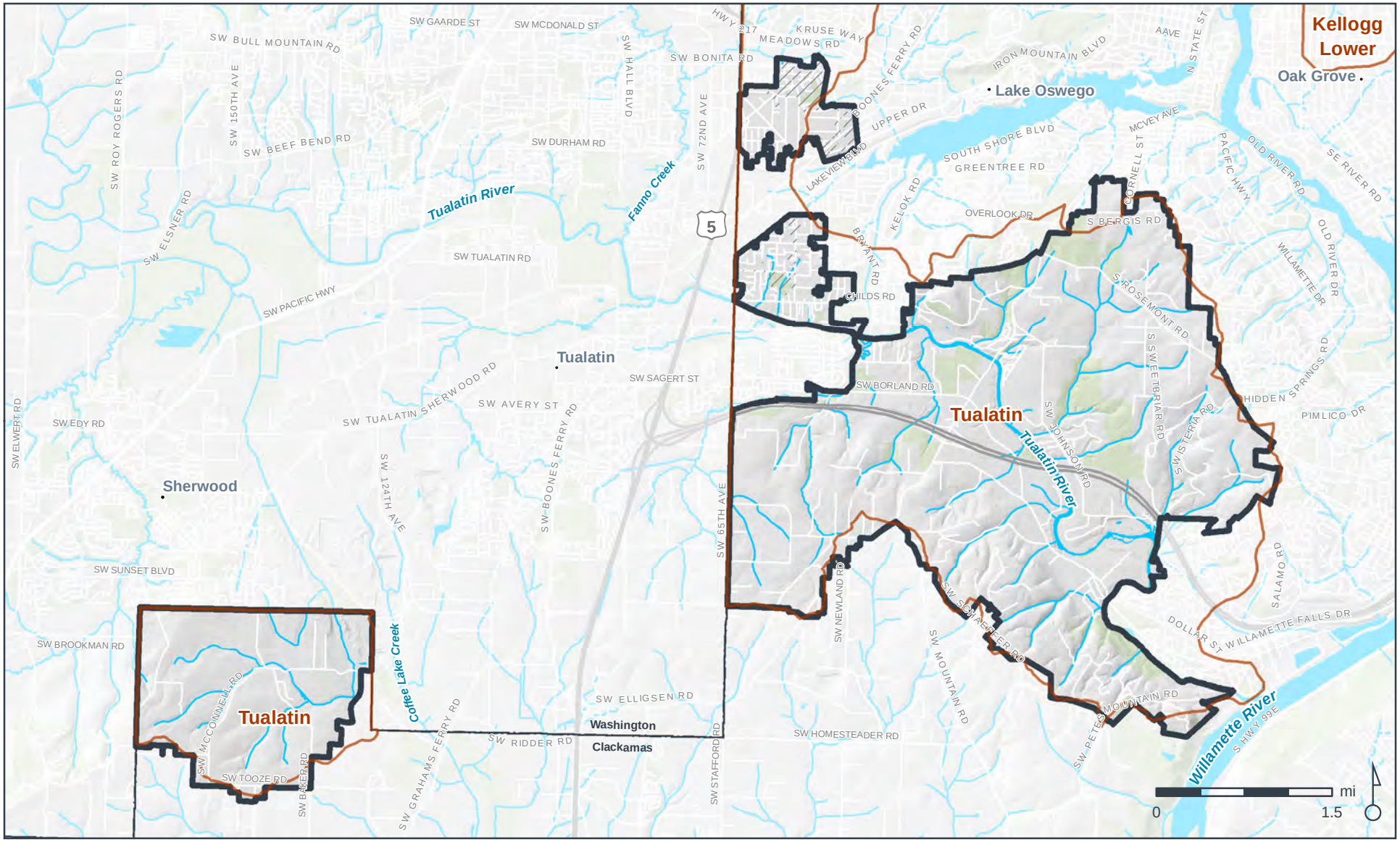

FIGURE 5

WES SERVICE AREA #3 DRAINAGE BASINS

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

- SSMP Planning Area
- Outside WES Service Area
- Stream/Waterbody
- WES Drainage Basins

DATE: 8/18/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

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NOTE: THIS DATA IS NOT A SURVEY AND IS MEANT FOR PLANNING PURPOSES ONLY. DATA IS PROVIDED BY ESRI, WES, AND METRO RLIS.

Floodplains

Floodplains are frequently inundated lands along streams and rivers. Floodplains naturally store increased flow during storms and are valuable for providing this function. The areas with a 1% chance or greater of flooding in any single year are designated as the Floodway Management District (FMD) by the Federal Emergency Management Agency (FEMA). FEMA refers to these areas as a Special Flood Hazard Area and they are commonly called the 100-year floodplain or the FEMA floodplain (see Figure D). There are approximately 1028 acres of regulated floodway in the planning area, which are described in more detail in the study area descriptions below. (Federal Emergency Management Agency, 2019). Development in these areas is regulated by the Clackamas County Zoning and Development Code and the Happy Valley Buildings and Construction Code.

Climate

Climate data is available from the NOAA website. The planning area is located in the Portland Metro area, and the Portland Weather Service Office is located at Portland International Airport approximately ten miles north-northwest of Happy Valley. According to the 2020 Local Climatological Data Annual Summary with Comparative Data for the Portland International Airport weather station (KPDX), the region's climate is dominated by the proximity of the Pacific Ocean and the shielding effects of the coast range and the Cascade Mountain range which moderate temperatures and create moderate rainfall. Summers are generally warm and dry while winters are generally cool and wet (National Oceanic and Atmospheric Administration, 2020).

The NOAA, 1991-2020 U.S. Climate Normals for Oregon City state normal mean temperature is 55 degrees F and ranges from an average monthly low temperature of 37 degrees (December) to an average monthly high of 81 degrees (August). Annual total precipitation is 45 inches, and most precipitation falls between October and May (National Oceanic and Atmospheric Administration, 2021).

Soils and Infiltration Capability

GSI Water Solutions Inc. conducted a preliminary soil infiltration characterization to support this SSMP. GSI assessed surface soil infiltration characteristics for Service Areas #2 and portions of Service Area #3 using data from the Natural Resource Conservation Service (NRCS) online Soil Survey Geographic Database (SSURGO). The results of this study are included in Appendix A. As Clackamas WES does not have specific criteria for evaluating stormwater infiltration facilities, GSI used the following criteria from the City of Portland's Stormwater Surface Management Manual to develop soil infiltration rankings for the study combined with depth to restrictive layers and depth to groundwater as reported in the NRCS database. Using these criteria, soil infiltration potential rankings of "good," "moderate," and "poor" were established for the SSMP planning area.

Using these criteria, GSI established rankings for infiltration potential for each soil type and service area. Figure 6 and Figure 7 depict the study areas divided by shallow soil units and corresponding NRCS map symbols. Figure 8 and Figure 9 depict rankings for infiltration potential for each soil type and service area.

Overall, infiltration potential is poor in most of the planning area except in the northwest portion of Service Area #2, corresponding roughly to the NCRA study area and scattered pockets primarily along the Clackamas and Tualatin Rivers.

In portions of Service Area #2 where conventional drywells are not an option, it may be possible to infiltrate stormwater into deeper deposits. The low infiltration potential is due to surface level silt deposits, and a potential solution may be to infiltrate stormwater below these layers to gravel or fresh basalt layers. This possibility is illustrated in Figure 10. Geologic conditions in Service Area #3 are not conducive to this approach. In Service Area #3 silt deposits typically overlay basalts with extremely low permeability.

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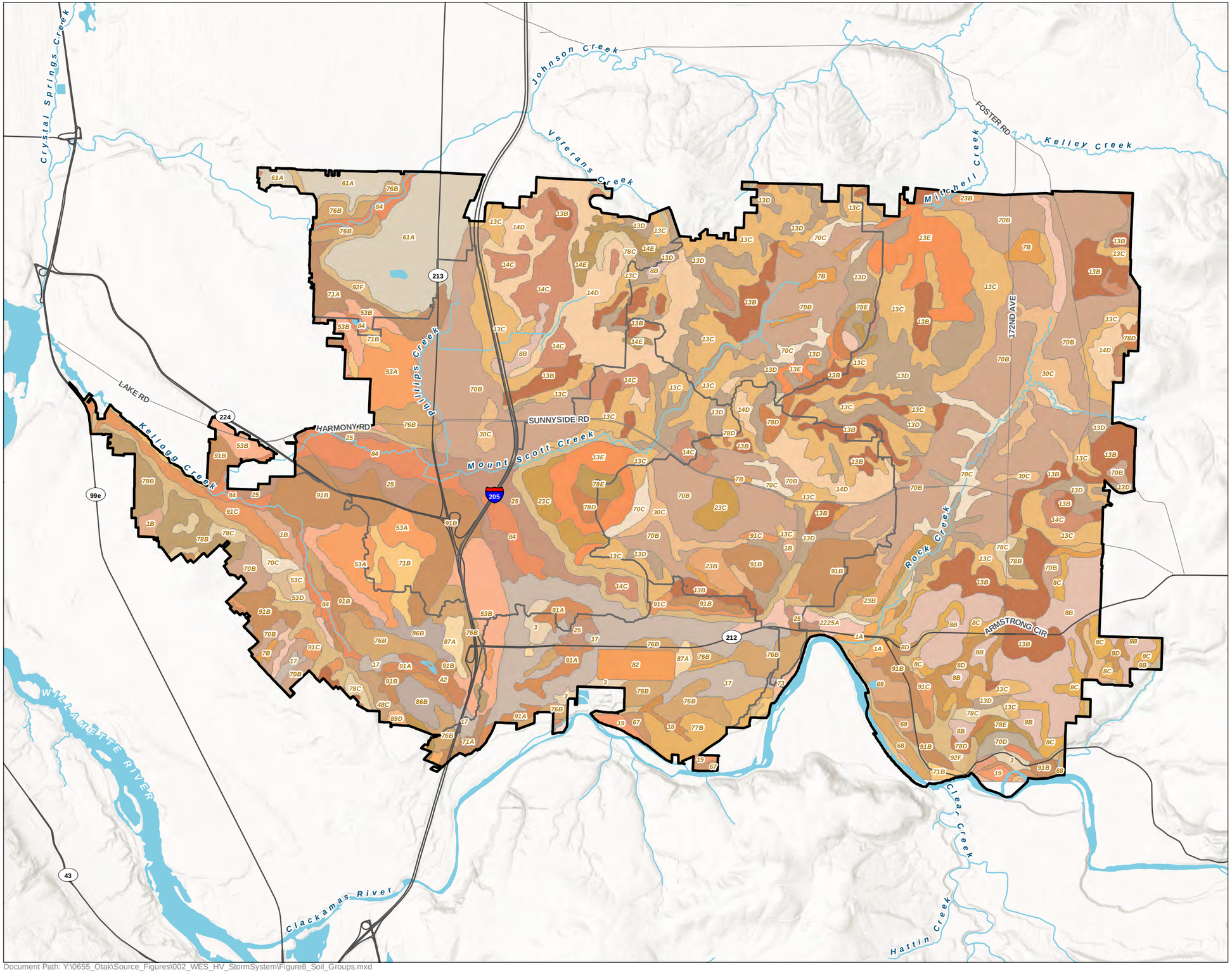
FIGURE 6

NRCS Soil Units

Clackamas WES Service Area 2



LEGEND

- Soil Type

All Other Features

- Study Area
- Sewer District Boundary
- Major Road
- Watercourse
- Waterbody

N

0 2,000 4,000 6,000

Feet

Date: July 15, 2016
Data Sources: OWRD, METRO, USGS, NRCS, Air Photo Summer 2018 COP

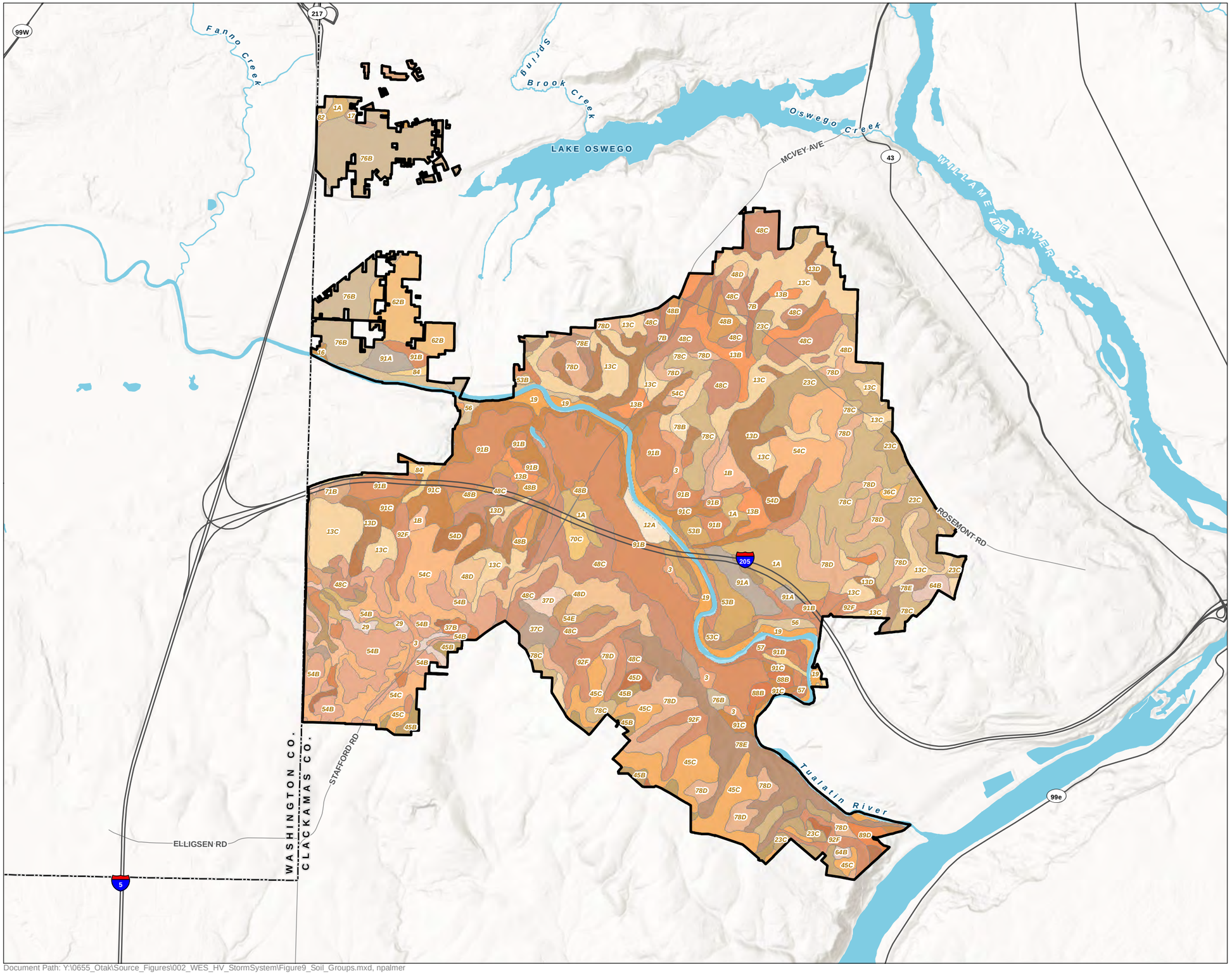
GSI Water Solutions, Inc.

Document Path: Y:\0655_Otak\Source_Figures\002_WES_HV_StormSystem\Figure8_Soil_Groups.mxd

FIGURE 7

NRCS Soil Units

Clackamas WES Service Area 3



LEGEND

- Soil Type

All Other Features

- Study Area
- County Boundary
- Major Road
- Watercourse
- Waterbody

N

0 1,800 3,600 5,400

Feet

Date: April 8, 2022

Data Sources: USGS, BLM, OGIC, NRCS

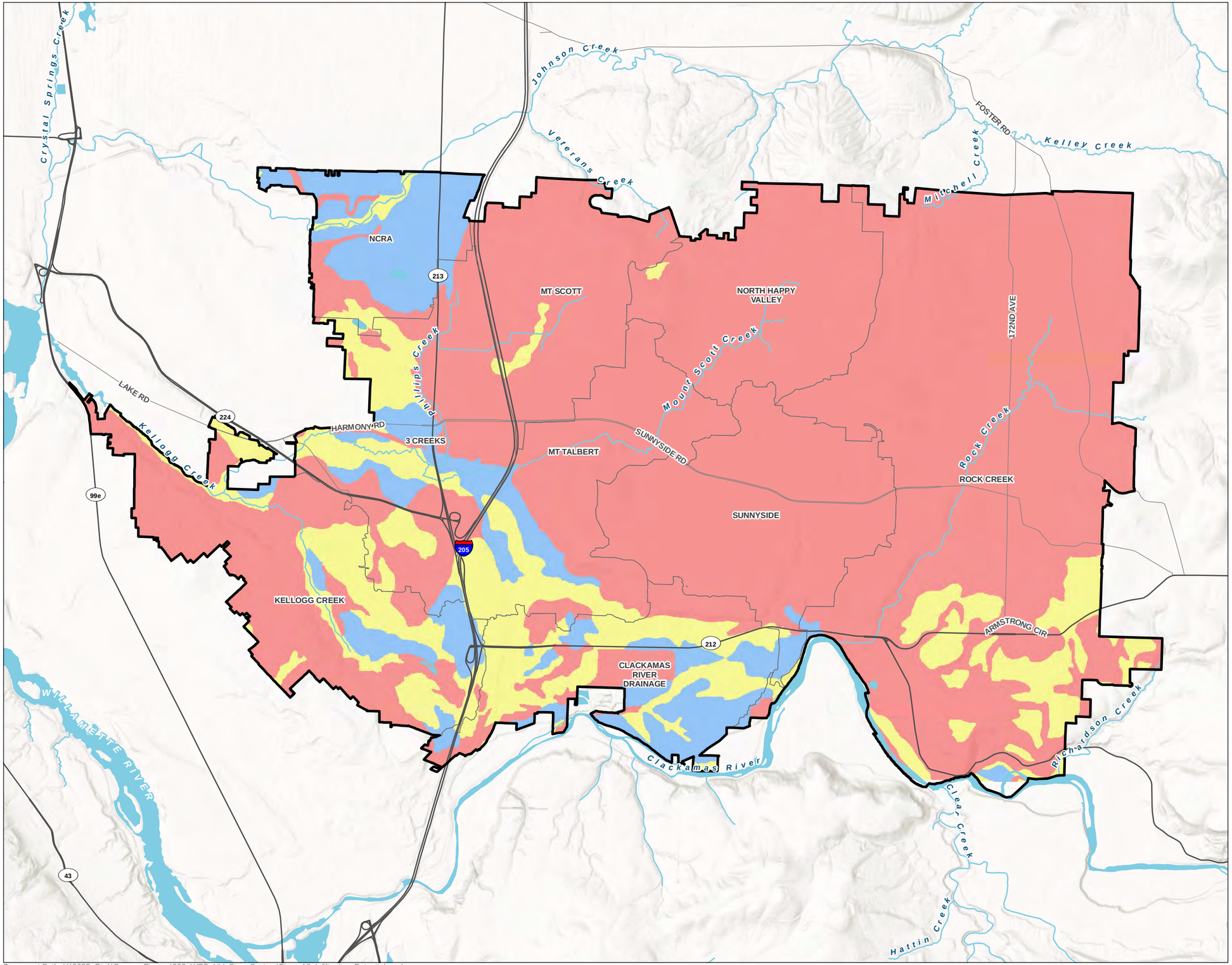
GSI Water Solutions, Inc.

Document Path: Y:\0655_Otak\Source_Figures\002_WES_HV_StormSystem\Figure9_Soil_Groups.mxd, npalmer

FIGURE 8

Infiltration Potential

Clackamas WES Service Area 2



LEGEND

Infiltration Rating

- Poor
- Moderate
- Good

All Other Features

- Study Area
- Sewer District Boundary
- Major Road
- Watercourse
- Waterbody

N

0 2,000 4,000 6,000

Feet

Date: July 15, 2016

Data Sources: OWRD, METRO, USGS, NRCS

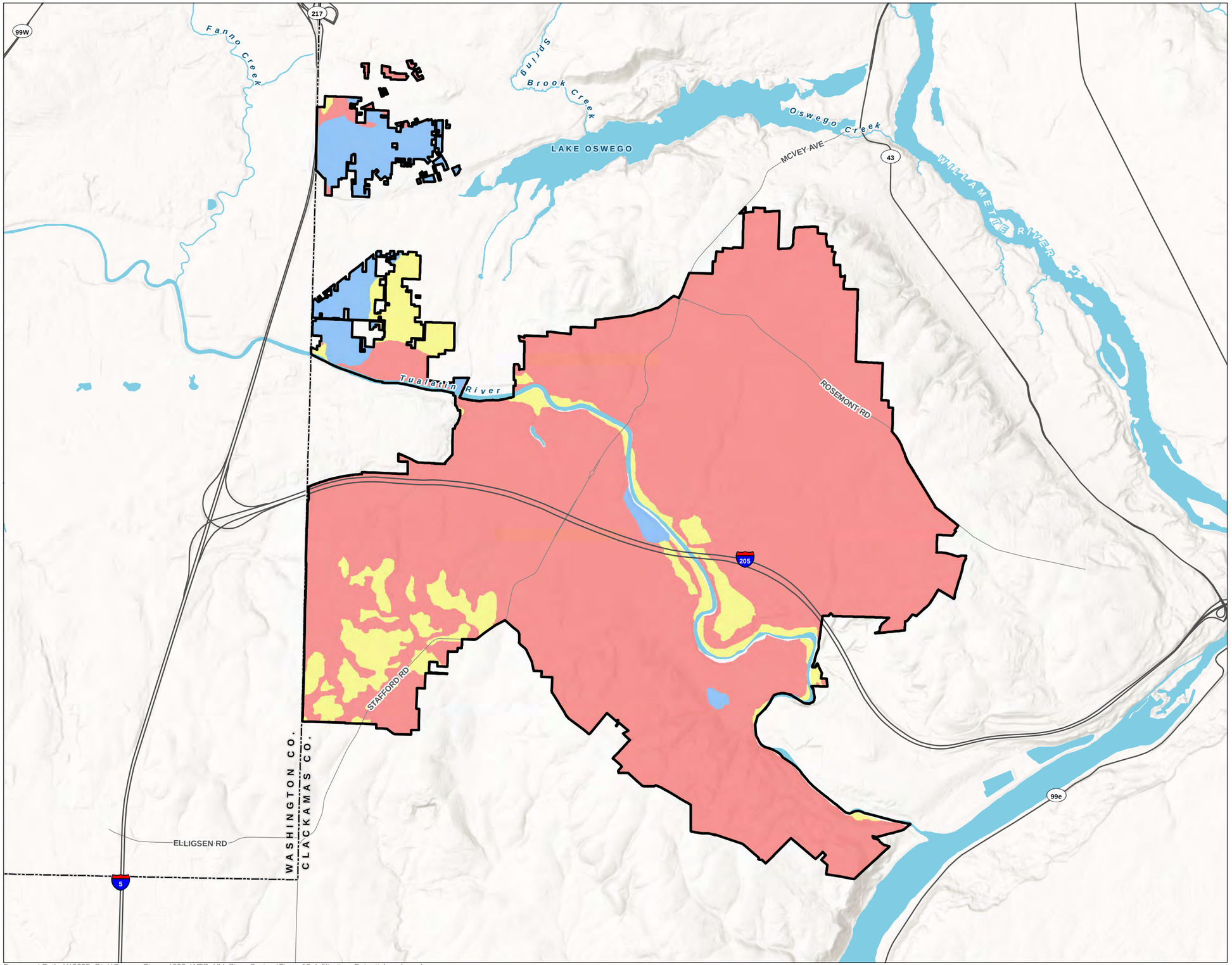
GSI Water Solutions, Inc.

Document Path: Y:\0655_Otak\Source_Figures\002_WES_HV_StormSystem\Figure18_Infiltration_Potential.mxd

FIGURE 9

Infiltration Potential

Clackamas WES Service Area 3



LEGEND

Infiltration Rating

- Poor
- Moderate
- Good

All Other Features

- Study Area
- County Boundary
- Major Road
- Watercourse
- Waterbody

N

0 1,800 3,600 5,400

Feet

Date: April 8, 2022

Data Sources: USGS, BLM, OGIC, NRCS.

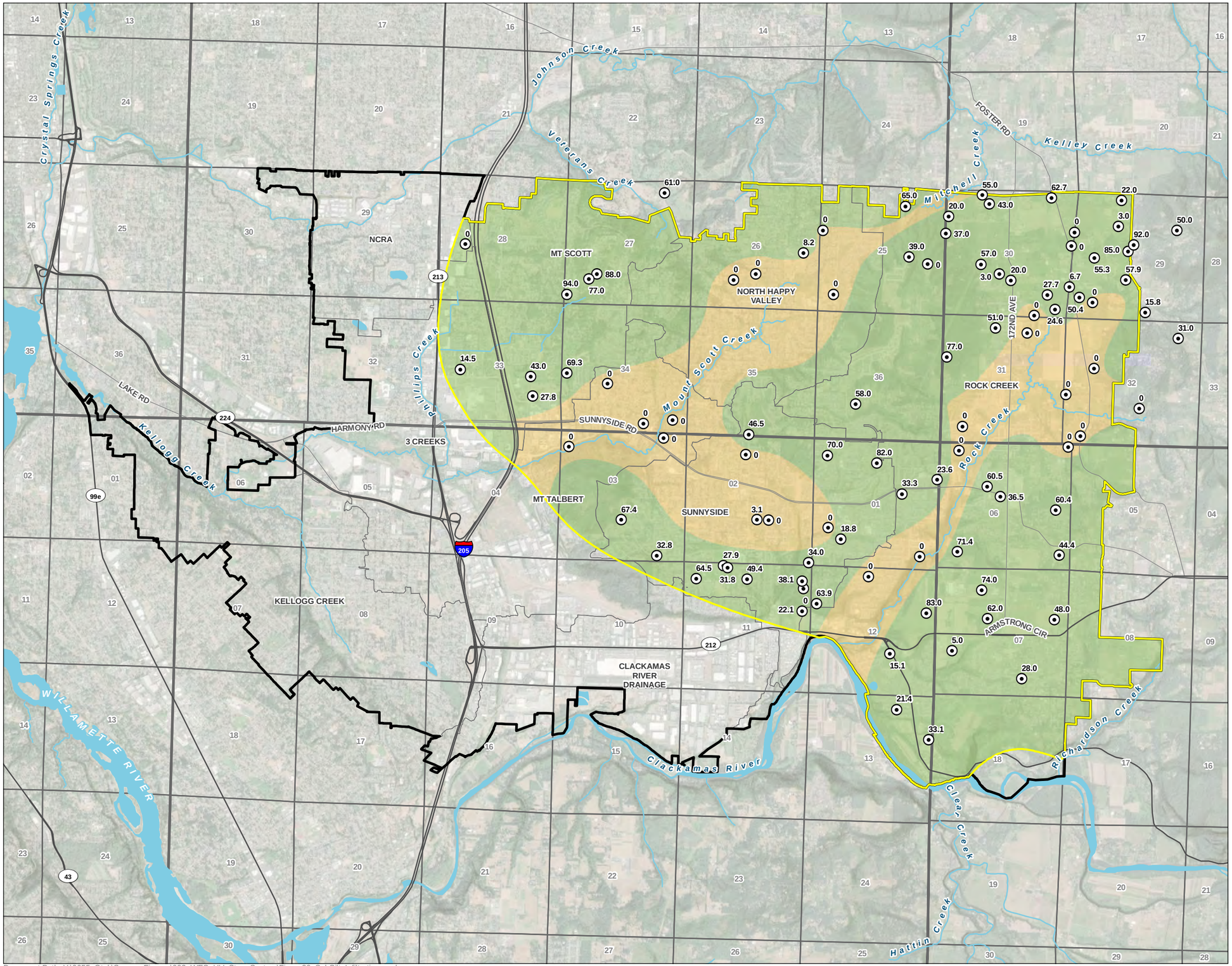
GSI Water Solutions, Inc.

Document Path: Y:\0655_Otak\Source_Figures\002_WES_HV_StormSystem\Figure19_Infiltration_Potential.mxd, npalmer

FIGURE 10

Sub-Silt Infiltration Potential

Clackamas WES



LEGEND

- Well, Values are the Thickness (feet) of Unsaturated Gravel within 100 feet of Ground Surface
- Sub-Silt Infiltration Study Area
- Infiltration, Feasible
- Infiltration, Not Feasible

All Other Features

- Study Area
- Sewer District Boundary
- Major Road
- Watercourse
- Waterbody

N

0 2,000 4,000 6,000

Feet

Date: July 15, 2016

Data Sources: OWRD, METRO, USGS, NRCS

GSI Water Solutions, Inc.

Document Path: Y:\0655_Otak\Source_Figures\002_WES_HV_StormSystem\Figure20_SubSilt_Infiltration.mxd

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Study Areas

The planning area is divided into ten study areas. The entirety of WES Service Area #3 is one study area, which corresponds to the historic boundary of SWMACC. WES Service Area #2 contains the other nine study areas. Each study area is described below, and a map of each is provided in Appendix B. Land use information in these maps dates from 2020 when the study began.

North Clackamas Revitalization Area

The North Clackamas Revitalization Area (NCRA) is an urban renewal district located between the City of Milwaukie and Interstate 205 just south of the Multnomah County boundary. It is within WES Service Area #2. The study area is approximately 1,000 acres and is currently developed with low-density residential zoning and a commercial corridor along Interstate 205. The northern portion drains to Johnson Creek and the southern portion to Phillips Creek, both of which eventually flow to the Willamette River.

The NCRA contains approximately 12 miles of stormwater main pipes and 70 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 23 vegetated stormwater facilities. Stormwater discharges to natural waterbodies at 12 outfalls. Stormwater also discharges to 89 drywells; of these, 57 are privately owned.

NCRA is known to lack public storm sewer conveyances on some residential streets (see Section 6) and experiences minor localized flooding.

3-Creeks

The 3-Creeks study area is located immediately south of the NCRA and consists of unincorporated Clackamas County between the City of Milwaukie and Interstate 205. It is within WES Service Area #2. The area is fully developed with a combination of low-density residential neighborhoods as well as commercial and industrial corridors along the highways. It is named after three creeks (Mount Scott Creek, Dean Creek and Phillips Creek) which combine to form Mount Scott Creek. The study area is approximately 1,700 acres.

The 3-Creeks study area contains approximately 34 miles of stormwater main pipes and 163 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 54 vegetated stormwater facilities. Stormwater discharges to natural waterbodies at 60 outfalls. Stormwater also discharges to 58 drywells; of these, ten are privately owned.

The study area is known to experience flooding along the lower reaches of Mount Scott Creek. WES is in the process of developing a project to reduce flooding and improve environmental functions at the 3- Creeks Natural Area. The project will enhance the floodplain, improve detention capacity to decrease downstream flooding, and increase habitat. The project is in preliminary design as of summer 2022.

Kellogg Creek

The Kellogg Creek study area consists of unincorporated Clackamas County between SE McLoughlin Boulevard and approximately Interstate 205. It is within WES Service Area #2. The area drains to Kellogg Creek, which eventually flows into the Willamette River. The study area is approximately 2,100 acres and is fully developed almost entirely with low-density residential neighborhoods (Brown and Caldwell, 2009). Johnson City, a 45-acre incorporated city located along SE Roots Road, is not within the WES Service Area and is fully enclosed within this study area.

The Kellogg Creek study area contains approximately 31 miles of stormwater main pipes and 70 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 49 vegetated stormwater facilities in this area.

Stormwater discharges to natural waterbodies at 73 outfalls. Stormwater also discharges to 104 drywells; of these, 28 are privately owned.

In 2009, WES published the *Kellogg-Mount Scott Watershed Action Plan* by Brown and Caldwell, including the Upper Kellogg basin, which is generally equivalent to this plan's Kellogg Creek study area. Upper Kellogg creek is known to experience significant flooding along creeks, and the action plan documents structure flooding in and around Southeast Aldercrest Road, west of Southeast Clackamas Road as it crosses Upper Kellogg Creek, northwest of Southeast Mabel Avenue as it crosses Upper Kellogg Creek, and Southeast Lillian Avenue. The data collection for this plan corroborates the existence of flooding problems in the Kellogg Creek study area. The action plan also documents concern for erosion of the stream banks in Upper Kellogg Creek.

The action plan documents changes to water quality and hydrology of streams in the Kellogg Creek, Mount Scott, and Mount Talbert study areas and recommends several actions related to storm system operations and improvements, which have been considered in this SSMP, including:

- Tracking and addressing flooding complaints related to WES infrastructure.
- Evaluating fish passage barrier removal opportunities.
- Developing a stormwater quality structural BMP retrofit program for streets in coordination with DTD.

Mount Scott

The Mount Scott study area consists of portions of the City of Happy Valley located east of Interstate 205 and south of the Multnomah County boundary. It is within WES Service Area #2. The area drains to Phillips Creek in the north and Mount Scott Creek in the south. Phillips Creek flows into Mount Scott Creek in the 3-Creeks study area which then flows into the Willamette River. The study area is approximately 2,000 acres and is built out with low-density residential with some mixed-use commercial along Interstate 205 (City of Happy Valley, 2018; Brown and Caldwell, 2009).

The Mount Scott study area contains approximately 49 miles of stormwater main pipes and 182 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 48 vegetated stormwater facilities. Stormwater discharges to natural waterbodies at 88 outfalls. Stormwater also discharges to three drywells; of these, one is privately owned.

Local flooding of streets and private property from public roads and the storm system have been documented; some of the issues are thought to be related to inadequate storm system design for steep roads. Concurrently with this plan, WES is studying storm system capacity to address flooding in a steep neighborhood south of Mount Scott Nature Park near SE William Otty Road and SE 121st Court.

In 2009, WES published the *Kellogg-Mount Scott Watershed Action Plan* by Brown and Caldwell, which includes the area encompassed by this plan's Mount Scott study area. Please see the Kellogg Creek section above for recommendations from the action plan.

Mount Talbert

The Mount Talbert study area consists of portions of unincorporated Clackamas County and the City of Happy Valley between Interstate 205 and the Mount Talbert Nature Park. It is within WES Service Area #2. The area drains to Dean Creek which flows into Mount Scott Creek then to the Willamette River. The study area is approximately 800 acres and is developed with business parks and high-density residential uses (Clackamas County, 2020; City of Happy Valley, 2018).

The Mount Talbert study area contains approximately seven miles of stormwater main pipes. In the area are 43 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 36 vegetated stormwater facilities in

this area. Stormwater discharges to natural waterbodies at 18 outfalls in this area. Stormwater also discharges to five private drywells.

In 2009, WES published the *Kellogg-Mount Scott Watershed Action Plan* by Brown and Caldwell, which includes the area encompassed by this plan's Mount Talbert study area. Please see the Kellogg Creek section above for recommendations from the action plan.

North Happy Valley

The North Happy Valley study area consists of portions of the City of Happy Valley generally west of SE 152nd Avenue and immediately south of the Multnomah County boundary. It is within WES Service Area #2. The area drains to the upper reach of Mount Scott Creek which then flows through the Mount Scott study area to Kellogg Creek. The flow from the North Happy Valley study area passes through the Mount Scott, 3-Creeks, and Kellogg Creek study areas on the way to the Willamette River. A small portion near the county border drains northwest toward Portland and Johnson Creek and a small portion at the northeast corner drains east through Mitchell Creek, a tributary of Johnson Creek. The study area is approximately 1,600 acres and is developed with low- to medium-density residential and public uses (City of Happy Valley, 2018).

The North Happy Valley study area contains approximately 38 miles of stormwater main pipes and 140 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 52 vegetated stormwater facilities in this area. Stormwater discharges to four private drywells and to natural waterbodies at 89 outfalls.

In 2009, WES published the *Kellogg-Mount Scott Watershed Action Plan* by Brown and Caldwell, which includes most of the area encompassed by this plan's North Happy Valley study area. Please see the Kellogg Creek section above for recommendations from the action plan.

Sunnyside

The Sunnyside study area consists of unincorporated Clackamas County and City of Happy Valley centering on SE Sunnyside Road. It is within WES Service Area #2. The area is an irregular shape bound roughly by SE Aldridge Road to the north, Mount Talbert Nature Park to the west, the Clackamas River to the south, and SE 152nd Avenue to the east. The study area is approximately 2,000 acres. Most of the area drains southward to the Clackamas River through the Sieben Creek and unnamed minor streams, although the western portion drains northerly through Mount Scott Creek. The study area is approximately 2,000 acres and is zoned low density residential, with some open space and small commercial sections along Highway 212 (Clackamas County, 2020; City of Happy Valley, 2018).

The Sunnyside study area contains approximately 59 miles of stormwater mains, 239 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 65 vegetated stormwater facilities. Stormwater discharges to one private drywell and to natural waterbodies at 87 outfalls.

Clackamas River

The Clackamas River study area is approximately 1,400 acres and consists of unincorporated Clackamas County east of Interstate 205 and north of the Clackamas River. It is within WES Service Area #2. The area sits on a flat plain and drains directly to the Clackamas River and to the river through Cow Creek. The area is zoned for general and light industrial uses and is fully developed with warehouses and business parks.

The Clackamas River Drainage study area contains approximately 24 miles of stormwater main pipes and 133 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 50 vegetated stormwater facilities in this study area. Stormwater discharges to natural waterbodies at 52 outfalls. Stormwater discharges to 28 drywells; of these, 27 are privately owned.

Rock Creek

The Rock Creek study area is 5,800 acres and consists of portions of unincorporated Clackamas County east of Happy Valley and the eastern portion of Happy Valley. It is within WES Service Area #2. The study area stretches from the Multnomah County boundary at the north to the Clackamas River at the south. The area is drained by Mitchell Creek, a tributary of Johnson Creek, and by Rock Creek, which flows to the Clackamas River. The area is primarily used for agriculture, private forest land, open space, and rural residences (City of Happy Valley, 2018; Brown and Caldwell, 2009). Approximately 2,700 acres in the easternmost portion of the Rock Creek study area were brought into the Urban Growth Boundary about 20 years ago and are included in the PVNC Comprehensive Plan (see more below).

The Rock Creek study area contains approximately 35 miles of stormwater main pipes and 140 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 175 vegetated stormwater facilities in this area. Stormwater discharges to natural waterbodies at 69 outfalls in this area.

Most of the stormwater management opportunities in the Rock Creek study area are regional facility concepts in PVNC.

Related Planning Processes

Happy Valley is in the process of comprehensive planning for expansion in PVNC. The area is part of the Rock Creek Study area directly east of Happy Valley. The area is transected by many creeks that are tributaries of Rock Creek. The PVNC Comprehensive Plan area includes a variety of existing and proposed land uses ranging from agriculture and low density rural residential to a range of residential land use densities and some commercial and employment areas. Portions of the area, particularly to the south, have already been developed to proposed densities, other areas are proposed to remain very low density residential, and still others are proposed to become much more densely developed than current conditions. Portions of the area have very steep slopes that have been identified as conservation areas where little to no future development will occur.

In areas of PVNC where development has occurred recently, it is assumed that stormwater infrastructure is already in place and additional stormwater management and conveyance infrastructure would be constructed site by site, on an as needed basis. Regional stormwater ponds have been proposed in the areas where substantial new development is proposed. This SSMP determined preliminary sizes and proposes tentative locations for 14 regional stormwater facilities in the PVNC area described in Section 7, Implementation Plan. Establishing regional stormwater facility locations during planning for the area will facilitate future development of the area. (City of Happy Valley, 2021)

SWMACC

The SWMACC study area is 9,758 acres consisting of three non-contiguous areas that are within WES Service Area #3.

7,816 acres straddle Interstate 205 and the Tualatin River south of the City of Lake Oswego and abut the Washington County boundary to the west. The majority is unincorporated Clackamas County and also encompasses the small city of Rivergrove. This part of the study area drains to the Tualatin River. This area is zoned rural residential and agriculture in the county, and the residential areas are partially built out.

North of this is 231 acres of the study area between the Washington County boundary and Interstate 5 and the City of Lake Oswego. This section drains west to Fanno Creek (outside of the SSMP planning area), which flows into the Tualatin River. This area is within the UGB and is developed with low-density housing.

1,674 acres is located south of Sherwood and bounded on three sides by Washington County. This section primarily drains to Rock Creek which flows north to the Tualatin River. A small portion flows south to Mill Creek which flows to Corral Creek and then to the Willamette River. This area is zoned rural residential and agriculture, and the residential areas are partially built out. (Clackamas County, 2020)

The SWMACC study area is largely rural and has relatively little public storm sewer infrastructure. It contains approximately five miles of stormwater main pipes and 23 mechanical stormwater flow control and treatment facilities, including oil/water separators, hydrodynamic separators, and flow control manholes. There are also 44 vegetated stormwater facilities. Stormwater discharges to natural waterbodies at 27 outfalls. Stormwater also discharges to 66 drywells; of these, one is privately owned.

Section 3. Planning Process

In 2019, WES retained Otak to coordinate development of the SSMP. The primary outcomes of the SSMP are a recommended set of programs to address systemic problems and a stormwater CIP to address capital construction needs for conveyance and water quality. The planning methodology selected for this SSMP relies primarily on identifying problems through an analysis of existing conditions. Future conditions are addressed in areas where significant growth or infill are expected.

Existing conditions for flow and water quality concerns were characterized using existing studies and institutional knowledge collected from the staff of WES, DTD, and the City of Happy Valley. Otak examined previous planning documents, storm sewer maintenance records, requests for service, and interviewed staff to identify the backlog of existing problems. The information collected from these sources was compiled, mapped, and used for analysis and as a basis for field visits.

The majority of known issues were documented from three sources. About 54% of the known issues were identified by WES staff during a 2017 CIP review which was revisited and updated in 2019 for this plan. Another 26% were identified by talking to staff, relying on their familiarity with the system and its function, and 16% were identified by reviewing maintenance records and other documentation. The remainder were documented from various sources.

To support the known issue identification and solutions analysis, Otak collected and mapped supporting data, including hydrologic basin delineation and storm system convenance.

Initial System Review

Identifying known issues was the first step in the process of studying the storm system and developing solutions. Otak compiled a list of storm system issues already known to WES, DTD, and the City of Happy Valley for evaluation and consideration for inclusion in the SSMP. Sources of information reviewed included previous storm drainage master plans, watershed action plans, existing CIPs, the Happy Valley Comprehensive Plan, Clackamas County Comprehensive Plan, and the PVNC Comprehensive Plan, and interviews with WES and City of Happy Valley staff.

Identified storm system issues were compiled along with geographic data in a Geographic Information System geodatabase. Each site was designated a “known issue” and given a unique identification number in the geodatabase and conditions at each site described in detail. The known issues were then classified into four categories: water quality, water quantity, erosion, and maintenance. Sites with known issues could be classified into multiple categories if appropriate.

Water quality issues consist of discharges of untreated runoff to natural water resources. These include stormwater detention ponds without treatment and UICs that discharge untreated stormwater to shallow groundwater. Water quality issues were identified through the system inventory.

Water quantity issues consisted of pipes, outfalls, and culverts that lack sufficient conveyance capacity during storms. Lack of capacity can result in slow drainage, local flooding, and backwatering the upstream system. Most capacity issues were identified through observation of current flooding and backwater conditions without reliance on assumptions about future conditions.

Erosion issues are areas where stormwater discharge volume or intensity results in sediment in the receiving water, requiring restoration or stabilization.

Maintenance issues include a wide variety of issues. These include detention ponds with poor maintenance history or that are difficult to maintain, inlets which clog or have collapsed, and pipes and culverts that have cracked or broken or are clogged by roots or have collapsed.

To further describe some of the known issues, 60 sites were selected for field visits to document site conditions and collect information to develop potential solutions. Otak staff were often accompanied by WES staff on these visits. Staff recorded information about the primary observed problem, underlying issues, solution alternatives, project feasibility, and potential impacts of alternative solutions.

Modeling Review

A review was conducted of existing hydrologic and hydraulic models used in the WES Service Areas to assess their value for identifying problem areas for inclusion in the "known issues" list. After review, none of the models were used to identify problems or develop CIP projects. In each case, the models had limitations that made them unhelpful for this planning process. Models were obsolete or the data available was out of date or insufficiently detailed for the study area.

WES has developed a simplified BMP sizing tool based on the Hydrological Simulation Program - FORTRAN (HSPF) hydrologic model that is capable of sizing facilities to meet post-construction stormwater management requirements. This tool is sufficient for the concept level design of the CIP projects developed for the SSMP and it was used for some CIPs. Implementing the recommended CIP projects would require detailed design. Data collection and modeling should be included in the project design costs, and the project cost estimates included in this plan reflect the cost of these efforts where required.

The details of this model review are included with this plan in Appendix C.

Identified Known Issues

Through the initial system analysis, a total of 217 known issue locations were mapped where storm system issues were identified. Counts and percentages of known issues by type are presented in Table 2 and Figure 11. Some issues fall into multiple categories.

Table 2 Known Issues by Type

Type of Issue	Count[1]	Category Description
Quality	81	Quality of runoff discharges
Quantity	134	Water quantity, typically flooding
Erosion	26	Erosion in a natural resource
Maintenance	54	Maintenance of stormwater facilities

[1] *Many issues fall into multiple categories, so the total count of these categories does not add up to 217, which is the total number of sites with known issues.*

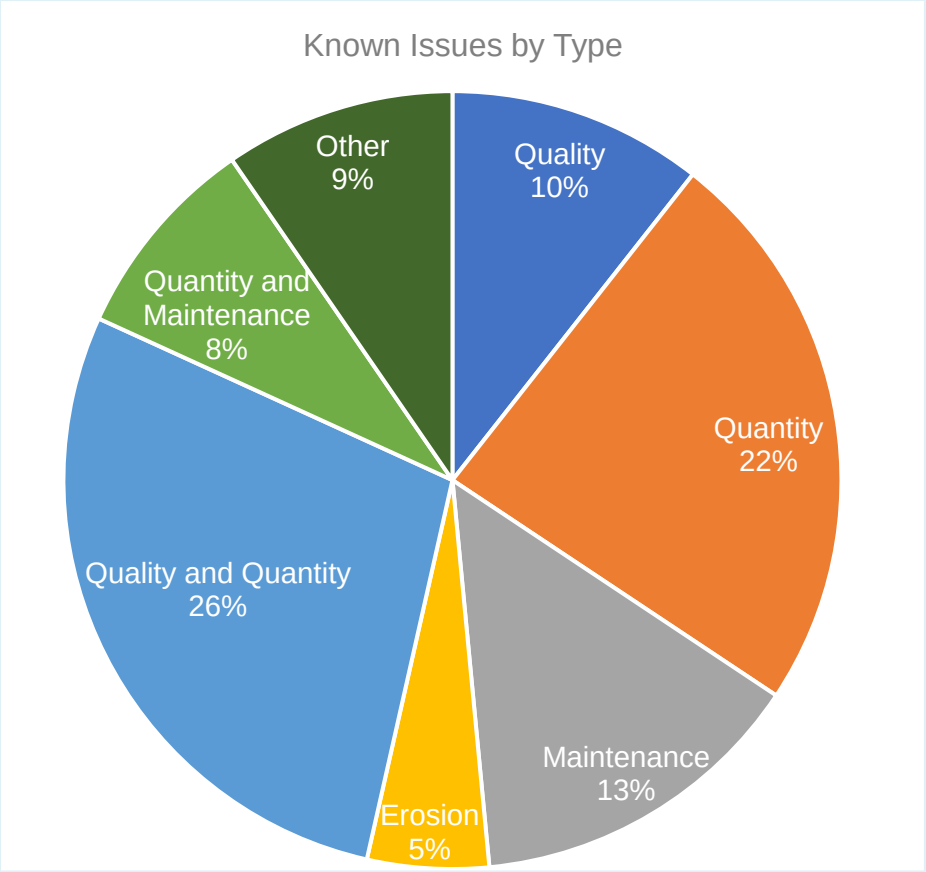

Figure 11 Known Issues by Type

A memo summarizing this process and listing all issues is presented in Appendix D.

The project atlas in Appendix E also maps the location of identified issues, including those eventually determined to be private concerns.

Potential Solutions

For most known issues, a potential solution was proposed. A solution to a known issue could either be a large capital project or a programmatic solution. For each known issue that would be best solved with a capital improvement project, a solution idea (potential project) was generated. Section 4 describes the further development and selection of potential projects.

Programs are groups of similar small and medium projects that are addressed gradually over time with fixed yearly funding. Most of the known issues can be grouped into programs that will enable the WES staff to address stormwater needs that require attention but do not rise to the scale or priority level of a capital project. Some programs have already been defined in the WES 2020-2025 Capital Improvement Plan. In addition to these, this SSMP proposes to develop new programs to address common problems among the known issues. Program candidates were also identified in the Known Issues Geodatabase.

A few known issues were designated as “no action” because the site visit or additional information determined that no additional action is recommended. This could include issues or locations on private property or not within WES jurisdiction or authority to resolve.

Section 4. Stormwater CIP

Screening Methodology

The system analysis and planning process outlined in Section 3 was used to develop a comprehensive potential project list. Known issues that can be resolved with programs are described in Section 5.

Screening and Capital Project Selection

The project selection consisted of two steps: screening out program candidates and identifying potential stormwater capital projects.

Identify Program Candidates

Some types of issues are widespread and/or similar in nature and may be important to address but are not urgent. In a typical CIP, these important but non-urgent issues may be passed over for several reasons. Any one issue might be too small to consider individually. Alternately, a large issue may not be urgent enough to compete for available funds against critical repairs or storm sewer capital investments that are driven by the priorities of other county departments. When these non-urgent but important improvements are not addressed, they can eventually become urgent or get in the way of meeting long-term goals such as water quality improvement.

When issues similar to each other were, as a group, important but not urgent, Otak screened them out of consideration for the Stormwater CIP and grouped them into five programs: Small Drainage Projects; Stormwater Pond Repair and Rehabilitation; Water Quality Retrofit; Restoration and Property Acquisition; and UIC Decommissioning and Retrofits. For example, the numerous detention ponds that discharge untreated stormwater were grouped into the Water Quality Retrofits Program. Otak calculated a cost estimate and proposed an annual budget for each program, which would allow WES to proactively address individual issues systematically over time. Of the initial issues, 60% were grouped into one of these programs. See Section 5 for additional information on these programs.

Identify Potential Stormwater Capital Projects

For each remaining issue after grouping some issues into programs, the Otak team identified an initial concept for a potential Stormwater CIP project that could correct the issue. In some cases, adjacent issues could be solved simultaneously and with a single effort, so they were combined into a single potential project. Otak identified a total of 33 potential CIP projects for further consideration. These 33 were then evaluated to determine feasibility and priority for selection as CIP projects. Table 3 contains the list of potential projects evaluated for inclusion in the CIP by potential project identification (PPID) number and name.

Table 3 Potential CIP Projects

PPID	Name
1606	NCRA Stormwater Plan
1124	3-Creeks Floodplain Enhancement Project
1306	Solomon Court Culvert Removal
1406	Sunnyside Place Culvert Replacement & Stream Restoration
1416	Idleman Conveyance Improvement
1413	SE Valley View Terrace New Conveyance
1322	SE 172nd Ditch Conveyance Improvement
1005	SE Wildlife Estates Dr Ditch Inlet
1055	Thiessen Culvert Replacement & Kellogg Creek Restoration
1098	Rose Creek New Detention Pond and Instream Restoration
1013	Mabel Ave Swale Sedimentation
1017	Pipe Rehabs: Spring Mountain, Cavalier, Mystery Springs
1125	Aldercrest and Rusk Drainage Improvement
1507	Safeway Distribution Center
1503	Clackamas High School Cattle Field Conveyance
1023	Emerald Loop Drainage Swale
1028	130th/135th Ave Outfall/Stormwater Treatment Facility
1136	Echo Valley Meadows Ph 2
1320	Regency View & 137th Hillside Inlets
1021	Mountain Gate Road Conveyance
1604	SE Aldercrest Ct Channel
1505	SE Boyer Dr Parking Lot
1003	SE 147th Ave. Collection System
1130	Pebble Beach & 145th New Conveyance
1327	SE Lampert Ct Drainage
1321	SE 162nd Culvert
1415	Greenspace Pipe at SE Dundee Dr Near Carnaby Way
1411	SE Parmenter Dr Backyard Drainfield Replacement
1145	129th Ave Culvert south of King Rd
1146	SE 129th & King Rd Storm Pipe Repair
1307	Sunburst Ln Hillside Culvert
1508	SE Shady Meadow Ct Backyard Conveyance
1405	Sunnycreek Outfall Rehabs and Stream Restoration

Project Rating and Ranking Process

The number of potential projects was too large for WES to consider in a ten-year Stormwater CIP. To reduce the list into a manageable size for creating conceptual designs and cost estimates, a set of rating criteria to score and rank the potential projects were developed. Only the highest-scoring projects were then further developed and presented as the Stormwater CIP.

Develop Rating Criteria

The basis of developing the rating criteria were the values of the Clackamas County and the City of Happy Valley and the practical needs of operating the storm system. The Performance Clackamas strategic priorities served as a foundation for developing the rating criteria (Clackamas County, 2021):

- Build public trust through good government
- Grow a vibrant economy
- Build a strong infrastructure
- Ensure safe, healthy and secure communities
- Honor, utilize, promote and invest in our natural resources

For WES, these priorities are translated into several key results/initiatives that contribute to the rating criteria (Water Environment Services, 2018):

- WES will utilize a Risk-based Asset Management Plan so that asset renewal and replacement decisions for assets will be made based on a risk-to-cost decision matrix.
- 30% of streams within WES's jurisdiction meet or exceed water quality standards.
- 95% of surveyed WES customers are satisfied with the service they receive.
- Rates will not increase more than 10% in any year nor less than the adopted index stating the current rate of inflation.
- 75% of all WES Maintenance activities will be planned efforts to address performance deficiencies or enhancements.

Additionally, during a series of workshops and meetings throughout 2020, Otak worked with WES, Clackamas County DTD, and City of Happy Valley stakeholders to explore the drivers and goals of the SSMP. Those meetings also resulted in the criteria used to rate and rank potential projects. During the earliest workshop with staff, a brainstorm about the values of the County and City and the values of the staff yielded many areas of significance. Some of the key items included:

- Public and worker safety
- Environmental stewardship
- Providing infrastructure for growth
- Resiliency and adaptability
- Partnership between organizations and with residents
- Care for underserved communities

The rating criteria also incorporated project assessment criteria used by WES in 2017. During the visioning discussion, the assessment criteria were reviewed and adjusted. The following criteria were included in the 2017 CIP assessment and continued into the current assessment:

- Magnitude and frequency of the problem
- Watershed priority and health
- Regulatory requirements (MS4/TMDL/UIC)
- Site ownership and constraints

Ultimately, 17 rating criteria were developed and grouped into six categories as presented in Table 4.

Table 4 CIP Project Rating Criteria

Categories	Criteria	Scoring Concept Project scores higher when:
Watershed Health Improvements	Ecosystem Health	It provides direct improvement to riparian habitat or aquatic biological communities
	Stream Channel	It directly or indirectly improves stream channel stability, reduces erosion, or reduces the quantity or rate of stormwater discharges to a water body
Water Quality Improvements	Pollutant Reduction	It removes pollutants from runoff
	Treated Land Use	It treats land uses that generate more pollutants in stormwater
	Acres Treated	It increases the number of acres treated
Conveyance and Flooding	Frequency	The project site would flood less frequently
	Extent	It reduces the extent of flooding
	Flood Risk	It reduces risk of flooding that threatens lives, buildings, or important infrastructure
Multiple Benefits	Underserved Areas	It provides service in an area with insufficient public storm sewer service
	Project Coordination	It can be easily coordinated with other entities to either share costs or achieve multiple objectives while reducing disruptions to the community
	Community Amenities	It can be expanded to include educational or recreational amenities to the community
Maintenance	Streamline Maintenance	It reduces the frequency of required maintenance
	Safety/Access	It improves maintenance access to a less accessible location or improves safety for workers
	Useful Life	It extends the useful life of an existing asset or, if a new asset is constructed, is a permanent solution
Implementation	Site Constraints	The site has fewer constraints on construction (e.g., steep slopes)
	Type of Permitting	It requires fewer and/or less complex permits prior to construction
	Property Acquisition	It does not require property acquisition

Scoring

After the initial scoring criteria were established, a trial run was used to evaluate whether the scoring criteria aligned with the adopted goals and performance priorities. Otak scored the potential projects and asked WES and the City's staff to comment on the resultant project scores. During the review process, a number of changes were made to the criteria and weighting.

During the review, the SWMACC study area was also re-examined because no CIPs were originally identified in SWMACC, although no CIPs were ultimately added to the SWMACC study area. Separately, a new program was established to accomplish most stream restoration and culvert replacement projects. This program is described in greater detail in Section 5. Programs. This program would not fall under WES's Stormwater CIP because the individual projects require coordination with other entities. Including this program removed some highly ranked projects from the CIP list.

The top 20 projects from the initial round of scoring were subjected to a second round of review and re-ranked. The final criteria matrix is presented in Appendix F. WES approved the final scoring criteria and the ranked list. Table 5 presents the final scores and rankings of 33 potential projects. See Figure 12 for a map of these locations.

Table 5 Project Scores and Ranks

Rank	PPID	Name	Score
1	1124	3-Creeks Floodplain Enhancement Project	75.0
2	1005	SE Wildlife Estates Dr Ditch Inlet & Upstream Detention	57.5
3	1413	SE Valley View Terrace New Conveyance	57.0
4	1079	Aldercrest Culvert Replacement & Kellogg Creek Restoration	56.0
5	1606	NCRA Stormwater Plan	56.0
6	1055	Thiessen Culvert Replacement & Kellogg Creek Restoration	55.0
7	1406	Sunnyside Place Culvert Replacement & Stream Restoration	53.0
8	1306	Solomon Court Culvert/Fill Removal & Creek Restoration	52.5
9	1416	Idleman Conveyance	51.5
10	1089	Parmenter Rd Culvert Replacement & Kellogg Creek Restoration	51.0
11	1322	SE 172nd Ditch Conveyance Improvement	50.5
12	1028	130th/135th Ave Outfall/Stormwater Treatment Facility	50.0
13	1091	SE Clackamas Road Drainage Infrastructure	47.5
14	1098	Rose Creek New Detention Pond and Instream Restoration	57.0
15	1125	Aldercrest and Rusk Drainage Improvement	45.5
16	1503	Clackamas High School Cattle Field Conveyance	45.0
17	1325	Hamilton Ln Drainage and Pond Rehab	44.0
18	1013	Mabel Ave Swale Sedimentation	42.5
19	1023	Emerald Loop Drainage Swale Rehab	41.0
20	1017	Pipe Rehabs: Spring Mountain, Cavalier, Mystery Springs	40.5
21	1136	Echo Valley Meadows Restoration Phase 2	40.0
22	1021	Mountain Gate Road Conveyance	38.5
23	1003	SE 147th Ave. Conveyance	37.0
24	1320	Regency View & 137th Hillside Inlet Improvements	35.5
25	1505	SE Boyer Dr Parking Lot Pipe Replacement	35.5
26	1321	SE 162nd Culvert Replacement	33.0
27	1608	SE 145th at Mt Scott Creek Conveyance	32.5
28	1411	SE Aldercrest Loop & Willow Lane Conveyance	31.5
29	1507	Safeway Distribution Center Right-of-Way (ROW) Conveyance	30.5
30	1415	Outfall Rehab in Greenspace at SE Dundee Dr Near Carnaby Way	28.5
31	1145	129th Ave at SE Scott Creek Ln Culvert Repair/Replace	27.0
32	1146	SE 129th & King Rd Culvert Repair/Replace	27.0
33	1405	Sunnycreek Outfall Rehabs & Stream Restoration	19.0

Repeatable Methodology

The process described above is a repeatable methodology for rating, ranking and prioritizing capital projects. The methodology uses criteria that reflect WES's values.

Stormwater CIP Project List

After determining the project scores and ranks, ten projects were selected as presented in Table 6 for implementation over the next ten years.

Two ranked projects were already in design and were not included in the new CIP: CIP 1124, 3-Creeks Floodplain Enhancement Project and CIP 1413, SE Valley View Terrace Conveyance. Two high-ranking stream restoration projects were not included because WES requires the CIP to include a balance of project types: CIP 1306, Solomon Court Culvert/Fill Removal & Creek Restoration and CIP 1089, Parmenter Culvert Replacement & Kellogg Creek Restoration. The CIP ID for the selected projects is the same as the PPID used in the screening and selection process.

Table 6 Selected Stormwater CIP

CIP ID	Rank	Project Name	Study Area	Primary Project Benefits	Cost
1005	2	SE Wildlife Estates Dr. Ditch Inlet & Upstream Detention	Kellogg Creek	▪ Reduce erosion and improve habitat in Tributary C of Kellogg Creek ▪ Reduce flooding of road and private property ▪ Improve water quality in Kellogg Creek ▪ Reduce maintenance requirements for WES staff	$1,679,470
1055	6	Thiessen Culvert Replacement & Kellogg Creek Restoration	Kellogg Creek	▪ Prevent flooding of private property ▪ Prevent flooding of roadway ▪ Improve fish passage	$801,635
1079	4	Aldercrest Culvert Replacement & Kellogg Creek Restoration	Kellogg Creek	▪ Reduce flooding ▪ Improve fish and wildlife habitat	$1,865,013
1091	13	SE Clackamas Road Drainage Infrastructure	Kellogg Creek	▪ Reduce flooding on roadway and private property ▪ Improve habitat and stream channel stability	$508,400
1098	14	Rose Creek New Detention Pond and Instream Restoration	Sunnyside	▪ Stabilize the stream bank and minimize headcutting ▪ Reduce roadway flooding downstream of the site ▪ Improve aquatic habitat and water quality	$2,589,010
1125	15	Aldercrest and Rusk Drainage Improvement	Kellogg Creek	▪ Protect private property and roadway from flooding	$440,100
1322	11	SE 172nd Ditch Conveyance Improvement	Rock Creek	▪ Reduce flooding ▪ Protect private property and roadway	$88,800

CIP ID	Rank	Project Name	Study Area	Primary Project Benefits	Cost
1406	7	Sunnyside Place Culvert Replacement & Stream Restoration	Sunnyside	▪ Reduce flooding on roadway and private property ▪ Improve habitat and stream channel stability	$573,623
1416	9	Idleman Conveyance	Mount Scott	▪ Reduce flooding on roadway and private property	$1,394,900
1606	5	NCRA Stormwater Plan	NCRA	▪ Reduce flooding in the Johnson Creek Watershed ▪ Improve water quality in Johnson Creek	$5,144,850
Total					**$15,085,801**

The final project list reflects WES's priorities of ensuring adequate drainage in the storm sewer and creek systems as well as improving the water quality of runoff discharged to natural resources. A map of the Stormwater CIP projects is presented in Figure 13. The CIP project details are included in Appendix G.

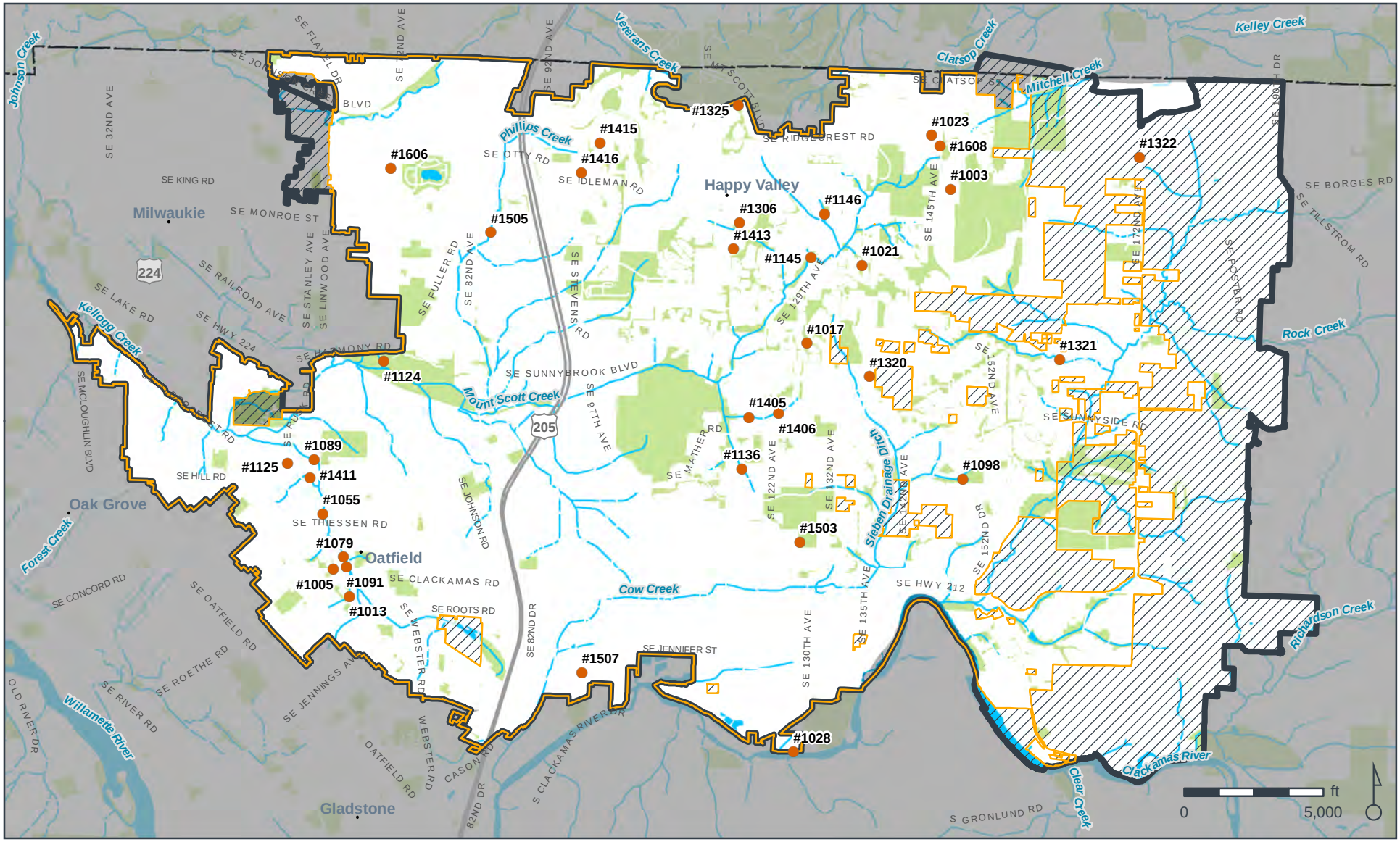

FIGURE 12

POTENTIAL CIP PROJECTS

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

Legend

- Potential CIP Project
- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- Outdoor Recreation and Conservation Areas

DATE: 8/18/2022

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NOTE: THIS DATA IS NOT A SURVEY AND IS MEANT FOR PLANNING PURPOSES ONLY. DATA IS PROVIDED BY ESRI, WES, AND METRO RLIS.

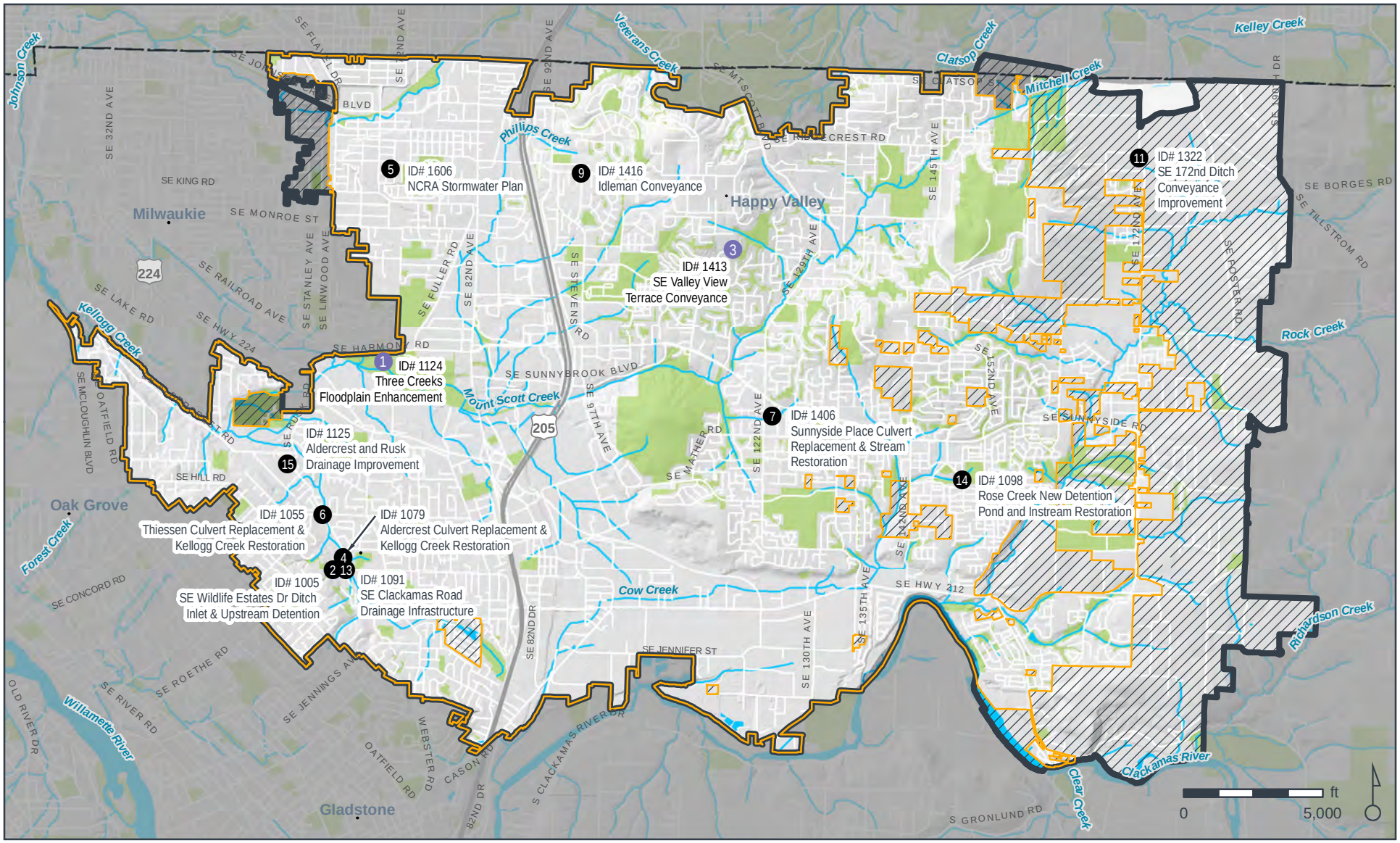

FIGURE 13

CAPITAL IMPROVEMENT PROGRAM PROJECTS

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

Legend

- CIP, Existing (Rank)
- CIP, Planned (Rank)
- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- Outdoor Recreation and Conservation Areas

DATE: 8/17/2022

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Cost Estimating Procedure

Based on the scoping-level design of each selected project, a cost estimate was prepared using the methods further detailed below. Costs were estimated for design, permitting and mitigation, land acquisition and easements, and construction and materials. Costs are presented in 2020 dollars.

In the future, when WES establishes a budget for each CIP, or when the CIP program is considered in a rate setting study or similar financial study, costs should be escalated to the then-current year using an established index such as the Engineering News Record Construction Cost Index.

Stormwater Tool Kit

Project costs were developed based on a simplified Stormwater Tool Kit. A single price was established for the construction of each tool kit component. This component price list was then used to establish the base construction cost for each project. CIP projects which required components that are not included in the Stormwater Tool Kit used a hybrid approach where prices for tool kit components were combined with a more traditional cost estimating procedure. The construction costs were then combined with standardized design, permitting, and mobilization costs based on project size and complexity to come up with a total planning level cost estimate for each project.

Detailed descriptions of the stormwater tool kit tools containing uses, benefits, and cost assumptions are included with this plan in Appendix H.

Construction Costs

Unit costs for construction and materials were drawn from a variety of sources, including bid tabulations from recent water quality facility rehabilitation projects within the City of Hillsboro and City of Beaverton and average bid tabulations from 2018 from the Oregon Department of Transportation. Bid tabulations from 2018 were the latest available at the time the cost estimates were developed. From the available data, Otak's engineers used professional judgement to estimate unit prices for each project. The following are descriptions of how project costs were estimated. Table 7 shows how construction costs influence other project costs.

Table 7 Construction Costs by Line Item

Project Unit Costs	How Calculated
Construction Mobilization	10% of total Construction Costs
Erosion and Sediment Control	2% of total Construction Costs
Traffic Control (where needed)	6% of total Construction Costs

Construction Contingency

A contingency based on total construction cost is included in each estimate. Two tiers were established using an inverse correlation. A 30% contingency was applied when total construction costs exceeded $1 million and 40% was applied when it was less. In some cases, engineering judgement was used to apply an additional 10% contingency.

Utility Conflict Resolution

Costs for Utility Conflict Resolution were included when the proposed improvements were likely to necessitate the relocation of some existing utilities. The costs for this item were estimated using professional judgement based on Otak's design and construction support experience.

Temporary Water Management

Temporary water management is required when working in streams. The estimated cost is based on the extent and duration of in-stream work presented in Table 8.

Table 8 Temporary Water Management

Cost	Description
$50,000	Project requires a larger or longer bypass system and the duration of in stream construction is longer.
$25,000	Project requires a small bypass system and the duration of in stream construction is short.
$10,000	Project requires minimal isolation (i.e., turbidity curtain) and only partial stream isolation.

Additional cost factors include easements or land acquisition, permitting, environmental mitigation, final design, project administration, and construction management.

Easement Acquisition

Acquisition of permanent easements was estimated at $6.00 per square foot. The administrative costs for easements, including property appraisals, were estimated at $10,000 per impacted property.

Permitting

Permitting costs depended on both complexity of the permitting requirements and construction costs. All projects were assumed to require a basic level of permitting, which was estimated based on construction cost. Projects which include any portion of the project being located in a natural resource area, such as a wetland, stream corridor, county-designated Water Quality Resource Area (WQRA), or city-designated Natural Resources Overlay Zone (NROZ), were assumed to require additional permitting from state and federal agencies as well as from the City of Happy Valley or Clackamas County. These costs were estimated based on the level of expected impacts to the resource area and the complexity of expected permitting. Assumptions for permitting costs are presented in Table 9.

Table 9 Assumptions for Permitting Costs

Type of Permitting	Project Construction Cost	Estimated Permitting
Basic Permitting	Over $500,000	$15,000
	$100,000 to $500,000	$10,000
	Less than $100,000	$5,000
Permitting in Jurisdictional Waters	No water quality sensitive permitting	$0
	Major impact to natural resource area	$50,000
	Significant impact	$30,000
	Minor impact	$15,000

The cost of design effort to bring the project design from conceptual design to final design was calculated as a percentage of total construction costs. Three tiers were established where the design proportion of the total project cost decreases for larger projects as presented in Table 10. In some cases, engineering judgement was used to apply a different percentage.

Table 10 Assumptions for Final Design Costs

Project Construction Cost	Design Percentage
Over $1.5 million	15%
$500,000 to $1.5 million	20%
Less than $500,000	25%

Project administration incorporates staff time for project management, financial management, and grant management into the estimate. Project administration is assumed to be a percentage of total construction costs, including contingency. Three tiers were established using an inverse correlation as presented in Table 11.

Table 11 Assumptions for Project Administration Costs

Project Construction Cost	Project Administration Percentage
Over $1.5 million	10%
$500,000 to $1.5 million	12%
Less than $500,000	15%

Section 5. Programs

Program Summaries

Known issues that were similar in scope and approach were grouped in a program approach for resolution. Each of the programs is summarized below and the programs are described in detail in Appendix I.

WES previously included many of the types of activities grouped into programs in its capital project types and was completing some of these efforts. Table 12 below links the previous project types with the recommended programs.

Table 12 SSMP Program Crosswalk

WES Project Types – Prior CIP	Proposed Change	Recommended Programs
Capital Repairs	Name change and expanded project list	Priority CIP
Water Quality Retrofits	Updated and expanded project list, updated costs	Water Quality Retrofits
Hydrology Improvement Facilities	Change includes reassessing and redistributing these projects into the new programs, likely into the Priority CIP or the Stormwater Pond Repair/Rehabilitation Program.	N/A, discontinue
Underground Injection Control Retrofits	Name change and expanded project list	Underground Injection Control Decommissioning/Retrofit
Restoration	Expanded project list	Restoration
Property Acquisition for Stormwater Benefit	No change	Property Acquisition for Stormwater Benefit
n/a	Add new program	Stormwater Pond Repair/Rehabilitation
n/a	Add new program	Small Drainage Project

Small Drainage Projects

Providing regular maintenance to existing stormwater infrastructure is important to proper asset management. In reviewing the known issues and creating the programs, a subset of nuisance issues of similar nature became clear and were grouped together. Projects correcting nuisance issues are

estimated to cost less than $100,000 each and include small pipe conveyance, upgrading manholes and inlets, and small pipe lining and root removal.

The Small Drainage Projects Program improves drainage issues when flooding is caused by WES-owned stormwater infrastructure. These projects would support WES's goal of proactively addressing performance deficiencies or enhancements and decrease the number of customer service requests.

The known issues analysis identified 32 instances where a new inlet or manhole is needed, three instances of root removal in small pipe, and assumed 3,000 linear feet of 18" (or smaller) pipe that could be installed to address some flooding and ponding issues through a given year. The 32 inlet/manhole replacement locations are shown on Figure 14. Pipe locations are expected to be identified as problems arise and are not shown on the map.

The Small Drainage Project Program is intended to provide steady annual funding so that WES can both reactively and proactively address small flooding and drainage issues in a timely manner. Without this program, damage to roadways or public and private property could result, and public complaints could rise.

The Small Drainage Project Program is expected to be carried out by WES field staff or contractors as the issues arise or once staff sees that a problem needs to be addressed to avoid a flooding issue or complaint. Associated costs include project management, mobilization, traffic control, erosion controls, and surface restoration. The completion of current inventory of these projects is expected to cost approximately $970,000.

Stormwater Pond Repair and Rehabilitation

WES owns or operates 621 stormwater facilities that reduce pollutants in stormwater runoff and/or control flows prior to discharge to a natural wetland, stream, or river. These facilities also help reduce erosive runoff, or drainage hydromodification, in stream channels.

Of those facilities, 58 are currently in need of repair or rehabilitation based on information provided by WES and the City of Happy Valley, and in some cases verified by Otak inspections. The 58 sites are shown on Figure 15. WES currently has allocated $250,000 per year through FY 2023 for Detention Facility Repair/Rehab to return detention facilities to their original design function. This typically funds five or six facility rehabilitations per year, which are bid to contractors. Generally, these facilities need routine inspection and maintenance, as well as eventual rehabilitation, to ensure functionality and maximize their useful life.

The Stormwater Pond Repair and Rehabilitation Program would provide a clear budget line for these assets that are critical to meeting water quality goals and to protecting conveyance infrastructure downstream. In order to repair and rehabilitate 63 stormwater facilities and stay ahead of asset management needs, WES could elect to complete this work over five years. The SSMP assumes one additional facility per year will need rehabilitation or repair in addition to the 58 facilities already identified.

Associated costs include project management, mobilization, traffic control, erosion controls, and surface restoration. The repair and rehabilitation of 63 facilities (58 identified plus one/year for five years) is expected to cost approximately $4.1 million. To keep up with maintenance needs, WES should provide funding for repair and rehabilitation of 10% of all facilities every five years.

Water Quality Retrofits

Water quality retrofits generally include new facilities in unserved areas or enhancements which add or increase water quality treatment within existing stormwater infrastructure. New facilities serving existing impervious surfaces may be placed in the ROW or on public property. Enhancements of existing facilities could include installation of cartridge filter systems, conversion of swales to rain gardens or wet ponds, and other improvements to stormwater facilities or conveyance systems where water quality treatment is

either inadequate or can be significantly improved. The Water Quality Retrofit Program would add a new water quality retrofit where a clear benefit to a nearby stream has been identified and there is sufficient space for installation. The existing known issues list identified eight potential areas for water quality retrofits. The program recommendations include implementation of three types of retrofits: large stormwater ponds, stormwater planters in the right of way, and vegetated swales.

To complete the retrofits identified in the known issues plus an additional retrofit at a location to be identified in the future, WES should plan to complete one large stormwater pond (20-acres treatment capacity), five ROW stormwater planters (3,000 square feet treatment capacity), and three vegetated swales (one-acre treatment capacity). The sites are shown on Figure 16. The completion of these water quality retrofits is expected to cost approximately $1.7 million.

Restoration and Property Acquisition

WES puts a high value on stream restoration, habitat improvement, and floodplain management and sees these actions as part of its mission to protect and improve water quality. These projects maximize the ecological and stormwater benefits of properties and support numerous local and regional environmental goals. For the purposes of this program summary, restoration and property acquisition can include in-stream restoration, riparian revegetation, culvert replacement or repair for fish passage, and property acquisition.

According to watershed action plans for Rock Creek and Kellogg/Mount Scott Creeks, the main challenges for these waterbodies include poor fish passage, changes to aquatic habitat conditions, flooding risks, lack of riparian vegetation, in-stream erosion and down cutting, and water quality concerns. The known issues list includes 13 locations where restoration and property acquisition projects would address these challenges. The SSMP recommends an annual baseline funding allocation to put toward restoration, revegetation, and culvert replacement efforts, as well as an allocation of funding spread across a five-year period for property acquisition that would support restoration efforts. The restoration and property acquisition program would fund the following types of activities:

- **In-stream habitat improvement** such as channel enhancements or stabilization, or floodplain reconnections.
- **Streamside property acquisition** to protect existing valuable habitat from alteration.
- **Culvert replacement or repair** to re-introduce habitat to fish that had been previously cut off due to culverts that prevented passage.
- **Revegetation of streamside properties** to improve habitat for fish and aquatic invertebrates.
- **Streamside property acquisition** to protect existing valuable habitat from alteration.

The restoration and property acquisition program is expected to cost approximately $825,000 a year or $8.2 million over ten years.

Underground Injection Control Decommissioning and Retrofits

UICs are systems that place fluids below the ground. UICs for stormwater are most commonly used where connections to piped storm system infrastructure are not available and where drainage can accommodate infiltration. Common types of UICs include drywells or sumps that receive stormwater runoff from roofs, parking lots, or street surfaces. UIC's are regulated under the Safe Drinking Water Act and must be registered with DEQ. In 2018, WES developed cost estimates for decommissioning or retrofitting ten UIC locations that do not adequately protect drinking water quality. Since that time, one location has been decommissioned. WES has prioritized addressing UIC compliance requirements through a risk-based approach. The known issues list includes nine UICs that intersect with high seasonal groundwater at least one day a year. Each UIC would need to be either decommissioned or retrofitted. To decommission the nine identified UICs will cost approximately $530,000. Priority locations are mapped on Figures 17 and Figure 18.

Program Cost Summary

Planning level cost estimates were prepared for each program and each program total is the cost to complete all currently identified issues. Program costs were estimated using the Stormwater Tool Kit, recent construction costs, and Otak engineering estimates to develop project and unit costs (see Section 4 for additional information on cost estimating methodology and sources). Within the Restoration and Property Acquisition Program, an annual baseline funding is recommended to allow flexibility given the range and scope of potential projects. Each program cost estimate includes construction costs, associated costs, and staff costs. Costs are presented in 2020 dollars.

See Table 13 for a summary of program cost estimates over a ten-year planning horizon, and detailed program cost estimates are included in Appendix I.

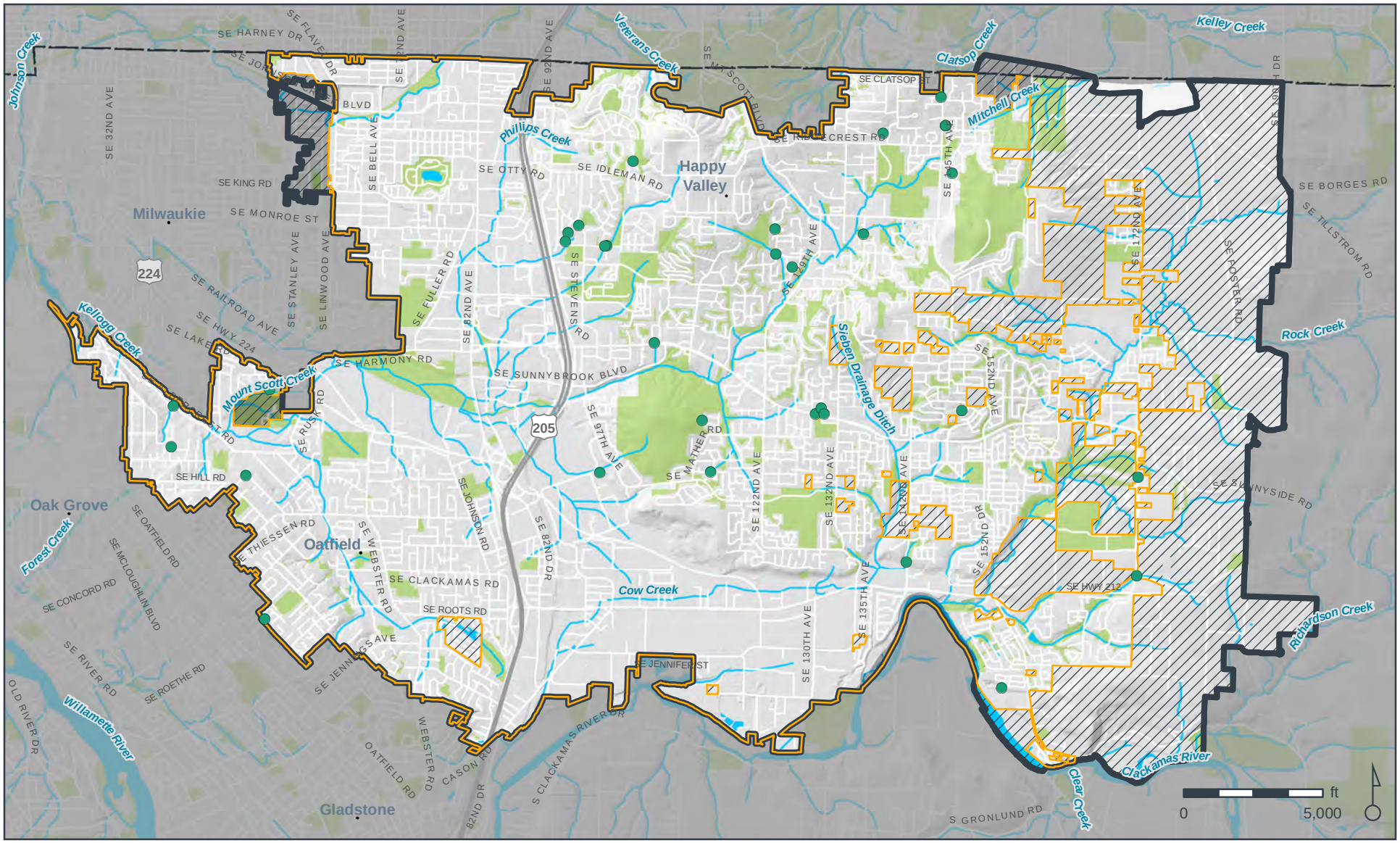

FIGURE 14

SMALL DRAINAGE PROGRAM INLET & MANHOLE REPLACEMENT SITES

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

Legend

- Inlet/Manhole Replacements
- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- Outdoor Recreation and Conservation Areas

DATE: 8/17/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

Otak

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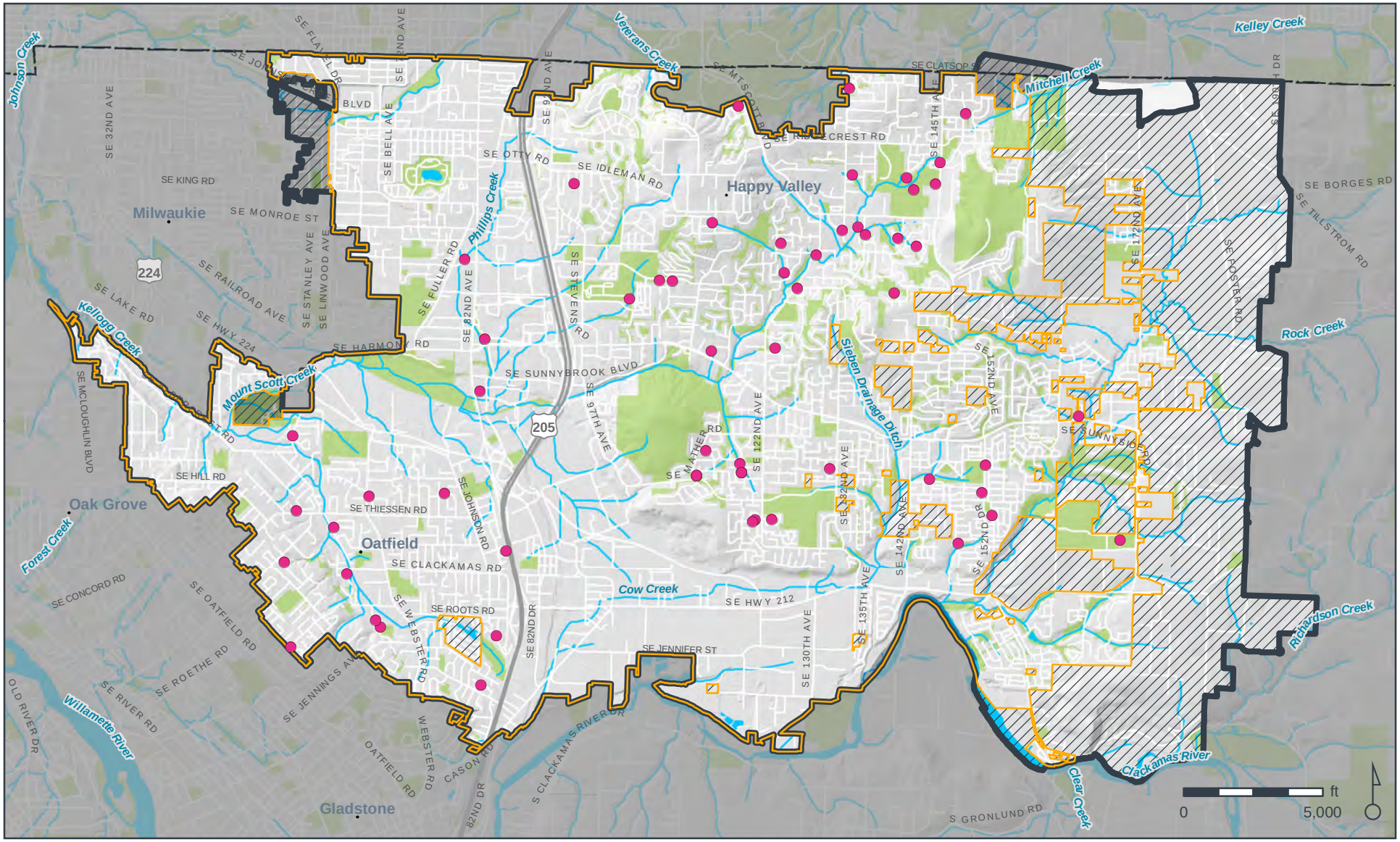

FIGURE 15

STORMWATER POND REPAIR AND REHABILITATION

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

Legend

- Repair / Rehab Program Sites
- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- Outdoor Recreation and Conservation Areas

DATE: 8/17/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

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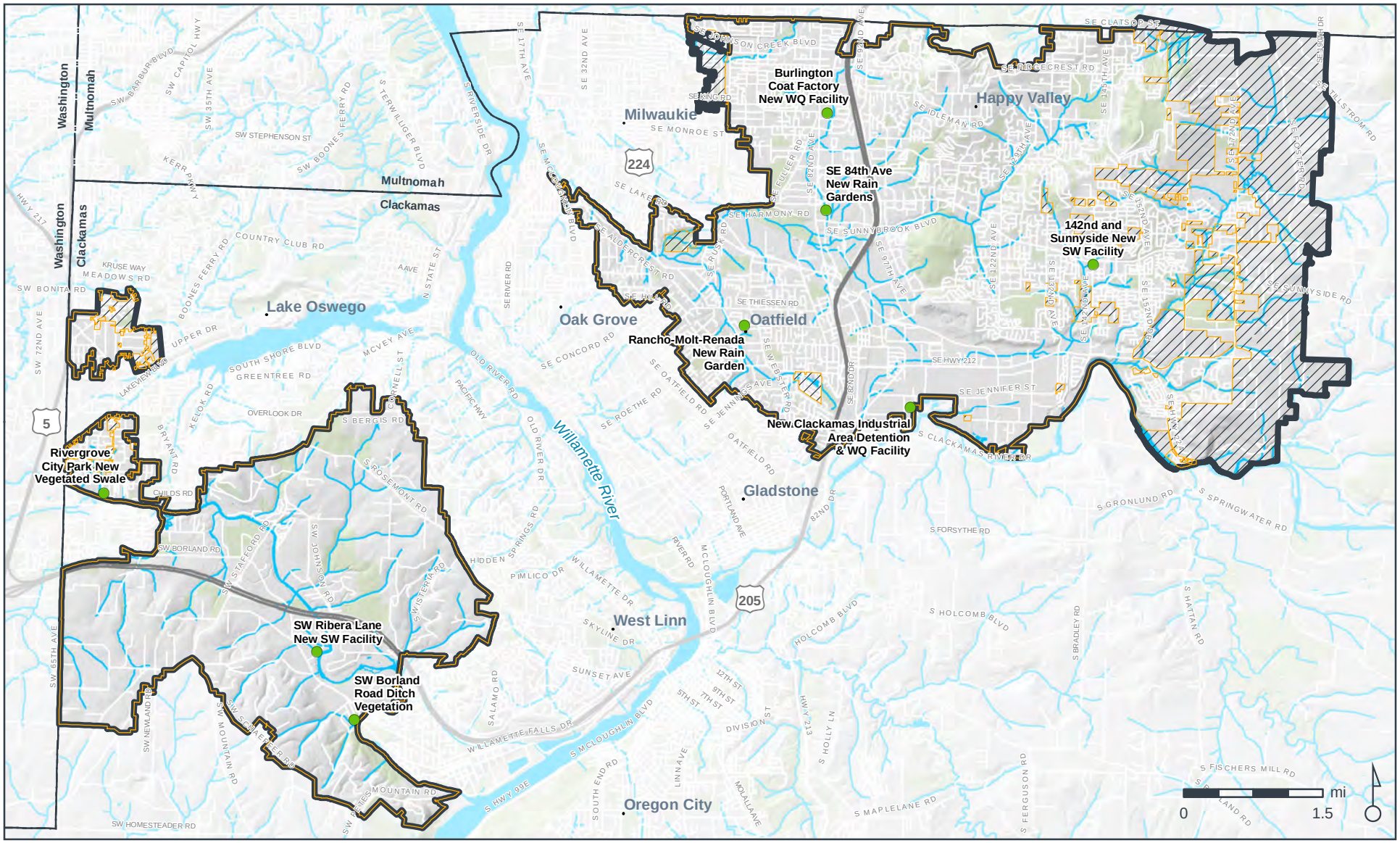

FIGURE 16

WATER QUALITY RETROFIT PROGRAM LOCATIONS

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

- SSMP Planning Area
- Outside WES Service Area
- WES Service Area
- Water Quality Retrofit
- Stream/Waterbody

DATE: 8/17/2022

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NOTE: THIS DATA IS NOT A SURVEY AND IS MEANT FOR PLANNING PURPOSES ONLY. DATA IS PROVIDED BY ESRI, WES, AND METRO RLIS.

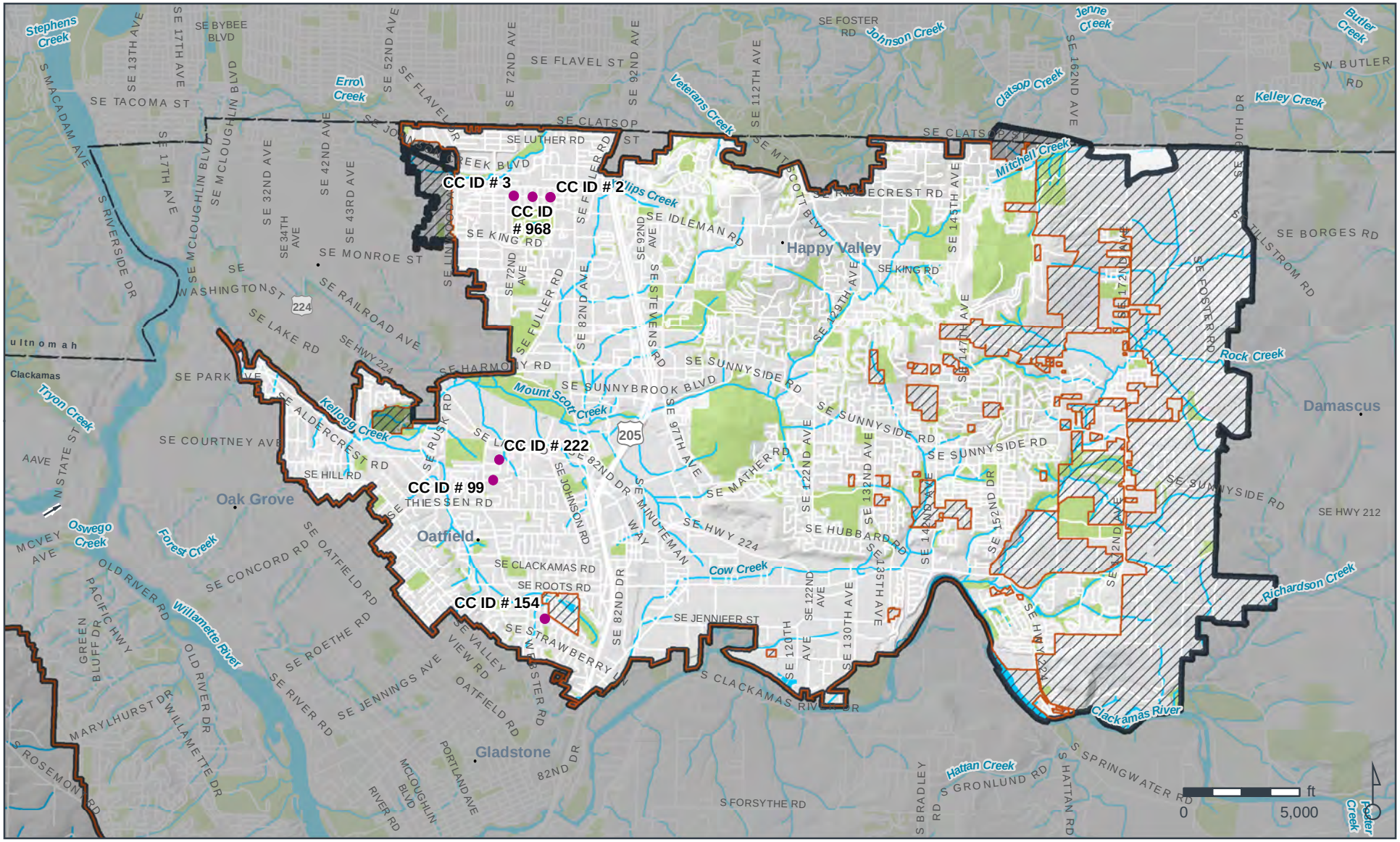

FIGURE 17

UIC DECOMMISSIONING / RETROFIT PROGRAM
WES SERVICE AREA 2

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

Legend

- Priority UICs
- WES Planning Area
- WES Service Area
- Outside WES Service Area
- Outdoor Recreation and Conservation Areas

DATE: 7/8/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

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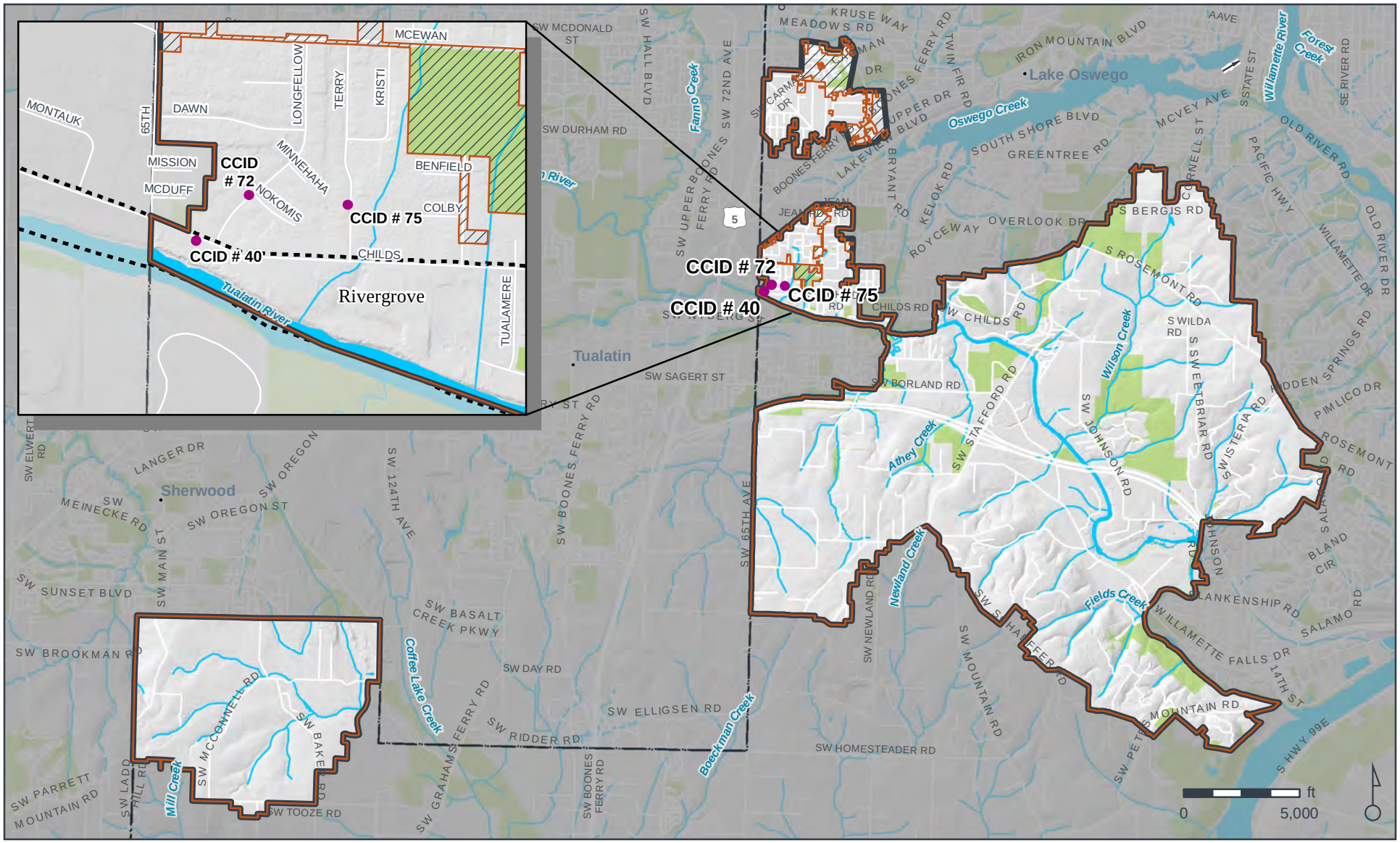

FIGURE 18

UIC DECOMMISSIONING / RETROFIT PROGRAM
WES SERVICE AREA 3

WES STORM SYSTEM MASTER PLAN

CLACKAMAS COUNTY, OR

Legend

- Priority UICs
- WES Planning Area
- WES Service Area
- Outside WES Service Area
- Outdoor Recreation and Conservation Areas

DATE: 7/11/2022

CLACKAMAS WATER ENVIRONMENT SERVICES

Otak

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Table 13 Summary of Program Cost Over Ten Years, Including CIP (in 2020 $)

Program	Total Program Cost	Duration	Annual Cost (Rounded) FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	FY9	FY10	Program Scope Quantity	Unit
1. Small Drainage Project Program														
New Large Birdcage Inlet or Manhole	$ 276,480	10	$ 27,600	$ 27,600	$ 27,600	$ 27,600	$ 27,600	$ 27,600	$ 27,600	$ 27,600	$ 27,600	$ 27,600	34	Structures
Small Conveyance	$ 567,000	10	$ 56,700	$ 56,700	$ 56,700	$ 56,700	$ 56,700	$ 56,700	$ 56,700	$ 56,700	$ 56,700	$ 56,700	3000	Linear Feet
Root Removal/Pipe Lining	$ 128,426	10	$ 12,800	$ 12,800	$ 12,800	$ 12,800	$ 12,800	$ 12,800	$ 12,800	$ 12,800	$ 12,800	$ 12,800	3	Known Issues
Program Cost	**$ 971,906**		**$ 97,100**	**$ 97,100**	**$ 97,100**	**$ 97,100**	**$ 97,100**	**$ 97,100**	**$ 97,100**	**$ 97,100**	**$ 97,100**	**$ 97,100**		
2. Stormwater Facility Repair/Rehabilitation Program	**$ 4,114,951**	10	$ 411,000	$ 411,000	$ 411,000	$ 411,000	$ 411,000	$ 411,000	$ 411,000	$ 411,000	$ 411,000	$ 411,000	63	Facilities
3. Water Quality Retrofit Program														
Large Stormwater Pond (20 acres treated)	$ 1,080,288	10	$ 110,000	$ 110,000	$ 110,000	$ 110,000	$ 110,000	$ 110,000	$ 110,000	$ 110,000	$ 110,000	$ 110,000	1	Pond
Stormwater Planter in the ROW (3000 SF treated)	$ 236,250	5	$ 47,300	$ 47,300	$ 47,300	$ 47,300	$ 47,300						5	Planters
Vegetated Swale (1 acre treated)	$ 407,722	10	$ 41,000	$ 41,000	$ 41,000	$ 41,000	$ 41,000	$ 41,000	$ 41,000	$ 41,000	$ 41,000	$ 41,000	3	Swales
Program Cost	**$ 1,724,260**		**$ 198,300**	**$ 198,300**	**$ 198,300**	**$ 198,300**	**$ 198,300**	**$ 151,000**	**$ 151,000**	**$ 151,000**	**$ 151,000**	**$ 151,000**		
4. Capital Projects (current estimate)	**$ 21,963,759**	10	$ 1,339,000	$ 2,140,000	$ 2,153,000	$ 2,100,000	$ 2,151,000	$ 2,054,000	$ 2,100,000	$ 2,165,000	$ 2,139,000	$ 3,623,000	12	Projects
5. Restoration and Property Acquisition Program														
Box Culvert	$ 1,565,088	10	$ 157,000	$ 157,000	$ 157,000	$ 157,000	$ 157,000	$ 157,000	$ 157,000	$ 157,000	$ 157,000	$ 157,000	5	Culverts
Riparian Revegetation	$ 162,000	10	$ 16,200	$ 16,200	$ 16,200	$ 16,200	$ 16,200	$ 16,200	$ 16,200	$ 16,200	$ 16,200	$ 16,200	2	Known Issues
Instream Restoration (Baseline Funding)	$ 5,000,000	Annual	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	$ 500,000	not estimated	
Property Acquisition for Habitat (Baseline Funding)	$ 1,500,000	$750K/5yrs	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000	not estimated	
Program Cost	**$ 8,227,088**		**$ 823,200**	**$ 823,200**	**$ 823,200**	**$ 823,200**	**$ 823,200**	**$ 823,200**	**$ 823,200**	**$ 823,200**	**$ 823,200**	**$ 823,200**		
6. UIC Decommissioning/Retrofit Program														
Tier 1 - < 0' groundwater separation	$ 528,412	10	$ 53,000	$ 53,000	$ 53,000	$ 53,000	$ 53,000	$ 53,000	$ 53,000	$ 53,000	$ 53,000	$ 53,000	10	Tier 1 UIC Retrofits
Program Cost	**$ 528,412**		**$ 53,000**	**$ 53,000**	**$ 53,000**	**$ 53,000**	**$ 53,000**	**$ 53,000**	**$ 53,000**	**$ 53,000**	**$ 53,000**	**$ 53,000**		
7. Emergency Repairs	**$ 1,000,000**	Annual	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	not estimated	
TOTAL PROGRAM COSTS	**$ 38,530,376**		**$ 3,021,600**	**$ 3,822,600**	**$ 3,835,600**	**$ 3,782,600**	**$ 3,833,600**	**$ 3,689,300**	**$ 3,735,300**	**$ 3,800,300**	**$ 3,774,300**	**$ 5,258,300**		

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Section 6. Policy Discussion

As part of the WES SSMP, Otak developed white papers to advance policy development or strategic planning around issues and challenges facing WES. The following topics were selected during the visioning workshops:

- Regional Stormwater Facility Implementation Strategy and Toolbox.
- Identifying Public Storm System Extension Opportunities.
- Stormwater Credit Banking.

Each paper is summarized below, and the full text is of each is provided in Appendix J.

Each of these papers addresses challenges facing WES's ability to meet its goals.

Regional Stormwater Facility Implementation Strategy and Toolbox

The PVNC area was recently brought into Happy Valley's urban growth boundary. By state law, a community Comprehensive Plan for the area must be completed before redevelopment of the area can occur. The Comprehensive Plan includes planning for infrastructure including stormwater management. The City has many creeks and streams that will be impacted by development if stormwater runoff is not carefully managed.

WES and Happy Valley identified managing stormwater using regional stormwater facilities as efficient and desirable from an overall land availability and long-term operations perspective, and potential locations for regional ponds were identified and sized to provide treatment and detention for the development of the planned land uses.

A regional stormwater facility is typically described as a large stormwater management solution strategically situated and designed to serve multiple properties or subdivisions in order to optimize stormwater management as part of a development project. Regional facilities provide several advantages to jurisdictions and developers:

- **Lower design and construction costs.** One or two regional stormwater facilities could be much more cost-effective to implement than multiple individual onsite structural controls.
- **Reduced operation and maintenance costs.** Jurisdictions can more cost-effectively manage operations and maintenance for fewer facilities. Fewer sites also increase the likelihood that maintenance activities are carried out regularly for both public and private operators.
- **Visibility.** Regional stormwater facilities have high visibility due to their size making them more likely to be maintained. This also engages the community to understand the purpose and benefits of the regional stormwater facility, and stormwater management in general.
- **Higher utilization of developable land.** Developers can maximize the developable land by minimizing the land normally set aside for the construction of stormwater controls.
- **Community benefits.** Well-designed regional stormwater facilities can serve as educational, recreational, ecological, and aesthetic amenities for a community.

While the use of regional facilities provides advantages for managing stormwater, implementation presents challenges including:

- **Size and Siting.** One or several regional stormwater facilities may be difficult to site depending on the size, and particularly in infill development.

- **Sequencing and Funding.** Coordinating the regional stormwater facility and related conveyance systems can be complicated depending on the number of property owners and developers involved, as well as the topography.
- **Time and Schedule.** Successfully implemented regional stormwater facilities typically completed rigorous planning, as well as reviewed options for funding, and possible permitting requirements. Additionally, land acquisition or easements must be in place before development can begin.

While these challenges have been overcome in other areas, Clackamas County has previously had mixed results at implementing a regional facility approach. New policies and procedures will be required to allow implementation of this regional approach. Otak prepared the *Regional Stormwater Facilities White Paper* to examine possible tools and strategies for successful implementation of regional stormwater facilities in the PVNC area.

Identifying Public Storm System Extension Opportunities

The purpose of this white paper is to identify portions of the planning area for the WES SSMP that may not have access to public storm system infrastructure. A lack of public storm sewer conveyances may present a barrier to development or redevelopment, and areas without sufficient infrastructure may drain poorly or not at all. In order to create plans and budget projections, WES can analyze the service district area and identify areas in need of new or upgraded storm system infrastructure.

As a first step, Otak developed a simple web-based mapping tool and methodology so that WES can locate these areas, assess the extent of the issues, and see adjacent infrastructure, as well as land use, zoning, and other helpful data on one map. The mapping application was created using ArcGIS Online Web App Builder. The map is hosted online and does not require an ArcGIS license to access or view the map. This tool can be replicated and easily maintained for WES's use to drive policy initiatives, assist community development and planning staff, and prioritize capital projects.

The white paper (Appendix J) describes the tool, the methodology, and the result of the initial analysis. It also provides information on how to maintain the map data and further analysis that could be completed in the future. This map encompasses the planning area of the SSMP, including Service Areas #2 and #3 and adjacent planned growth areas. A description of the analysis and key results are below. The white paper contains further information on the maintenance and future use of the web map as well as a map of areas where public storm system extension opportunities may exist.

Results

Tax lots were classified by proximity to a public storm conveyance system as follows:

- **Well Served.** Directly served by an existing public storm system within 100 feet.
- **Adequately Served.** Within 100 to 200 feet of an existing public storm system.
- **Potential Public Storm System Extension Opportunity.** Private residential property with a lot line more than 200 feet away from a public storm system conveyance.

A minimum threshold of 200 feet was selected as distances of under 200 feet can typically be addressed with lateral extensions or minor sewer extensions as a condition of development. Distances beyond 200 feet would require a larger public works improvement to provide sewer within a reasonable distance for a property to be connected by service laterals.

The mapping analysis revealed that the majority of Service Area #2 is well served but revealed distinct clusters of where public storm system extension opportunities may exist. These clusters were reviewed, and four were found upon more detailed investigation to have sufficient stormwater controls or service. Two areas are recommended for future study and planning to determine if public storm system extension opportunities may exist or if the analysis indicates future risk.

1. The northern area of the Kellogg Creek basin on the edge of the service district. It appears this area is a public storm system extension opportunity due to steep grades and is a densely forested area. This area is approximately 25 acres and includes 24 tax lots that are zoned R10 (residential). Properties may drain via private outfall to creek systems or have onsite drywells. Additional research is recommended to determine how properties are currently managing drainage and stormwater.
2. Western and central areas of NCRA. This is a known problem area for WES in terms of storm system infrastructure and was an expected result of the analysis. This area is approximately 25 acres and includes 122 tax lots that are zoned R7 (residential). While this result validates the approach and the results, additional research is recommended to determine how properties are currently managing drainage and stormwater.

One of the rating criteria for selecting projects for the CIP is whether the potential project provides new drainage or stormwater management to an underserved area. Based on this analysis, three potential CIP projects were given a score for this criterion, and two listed below were selected for the CIP program:

1. **PPID #1606, NCRA Stormwater Plan.** Clackamas County hopes to encourage development in NCRA by improving and updating infrastructure. This analysis shows that there is a need for new stormwater infrastructure (in addition to the planned retrofitting) in NCRA.
2. **PPID #1322, SE 172nd Ditch Conveyance Improvement.** The SE 172nd Ditch Conveyance Improvement project is an under-capacity ditch in the PVNC area. It is currently outside WES jurisdiction, but it is expected to be annexed into WES in the near future.

Stormwater Credit Banking

All development that results in 5,000 square feet or more of new impervious surface and/or a modification of existing impervious surfaces is subject to the stormwater management standards for water quality treatment, infiltration/retention, and quantity/flow control. These requirements apply within Service Areas #2 and #3.

For some transportation projects that exceed the 5,000 square foot threshold, it is often cost prohibitive to design and construct stormwater facilities that meet the standards within the project area. This is most commonly an issue on smaller transportation projects that occur within relatively narrow ROW corridors. For these projects, the cost to acquire ROW from adjacent landowners, the engineering design and construction costs of a stormwater facility, or creating small, dispersed stormwater facilities through the entire project area would likely make the overall project infeasible to complete. Projects that only involve sidewalk or curb ramp improvements are common project types where it can be difficult to meet the current standards.

WES would like to review approaches for developing a stormwater credit program for DTD and City of Happy Valley transportation projects to provide additional flexibility in meeting stormwater management goals. Stormwater credit banking can help ensure that no net negative impact occurs from project implementation. The desired outcomes of the stormwater credit banking program will be to foster development of stormwater management solutions that provide protection to surface waters while reducing the costs of implementation on a specific project basis.

While the terms stormwater credits or banking are often used interchangeably, each term has a distinct meaning. The overall concept recognizes that stormwater facilities have a quantifiable benefit that can be commodified. Stormwater facility capacity, in this case for water quality treatment, is the good being purchased. A stormwater facility with extra capacity generates a benefit, or “credits,” that can be sold, or “credited” to other projects. A project can also purchase stormwater credits prior to a specific stormwater facility being built. Proactive installation of stormwater facilities creates a “bank” of “stormwater credits” (aka “banking”) for future purchase. Having a bank of available stormwater credits for WES projects and

partnering transportation agencies would facilitate small safety and accessibility projects that would otherwise become financially infeasible.

Section 7. Implementation Plan

The Clackamas Water Environment Services (WES) Storm System Master Plan (SSMP) is the first plan undertaken since WES began providing storm and surface water management services to the former service areas of the Surface Water Management Agency of Clackamas County (SWMACC) in 2017 and Clackamas County Service District No. 1 (CCSD1) in 2018. WES identified the development of a master plan as a strategic initiative to support Clackamas County's Performance Clackamas goals. The purpose of the SSMP is to create a framework for storm system infrastructure operations, maintenance, and expansion to improve the quality of surface water in the WES service areas. The SSMP goals are to address system deficiencies, support redevelopment, accommodate new growth, extend the service lives of existing assets, and improve water quality protection.

The SSMP provides short- and medium-term recommendations for capital improvements, programmatic system improvements, and long-term guidance in evaluating storm system needs to advance that strategic initiative. A ten-year construction plan with cost estimates is a cornerstone of the plan. A series of programs consolidate minor improvements into larger initiatives to address surface water needs. This implementation plan attempts to provide focus and to establish priorities for the near term and the next ten years. All of the recommendations build on areas of practice already engaged in by WES.

The implementation plan may be used as a standalone document, so it repeats some information provided in other sections of the SSMP.

Stormwater Program Priorities

The SSMP recommendations were compared against each other, WES's goals, and anticipated available funding to determine relative priority. The priority assigned to any given program or project may change over time as partnership opportunities or changes in regulation or community values emerge. A summary comparison of all program recommendations is provided in Table 14. WES could initially focus on the four high priority programs over the next couple of years. Additionally, WES should study existing revenues and potential funding sources to identify the resources needed to fully implement the recommended programs and projects.

Table 14 Summary of Recommended Stormwater Programs

Program	Priority	Driver	Cost	
			Total	Annual*
Small Drainage Project	High	Service Driven	$971,906	$97,100
Stormwater Pond Repair / Rehabilitation	High	Compliance and Service Driven	$4,114,951	$411,000
Water Quality Retrofit	High	Service Driven	$1,724,260	$172,000
CIP Projects**	High	Service Driven	$21,963,759	$2,196,000
Restoration and Property Acquisition	Medium	Service Driven	$8,227,088	$823,200
UIC Decommissioning / Retrofit	Medium	Compliance Driven	$528,412	$53,000
Emergency Repairs	Medium	Service Driven	$1,000,000	$100,000
Total			$38,530,376	$3,852,300

** Annual costs are averaged in this table and are based on a ten-year plan.*
*** Includes both existing planned and new CIPs*

Policy Initiatives

In addition to funding these recommended programs and projects, WES should continue study and implementation of the recommendations in the policy areas identified by WES as priorities:

- Regional Stormwater Facility Implementation Strategy and Toolbox.
- Identifying Public Storm System Extension Opportunities.
- Stormwater Credit Banking.

Each policy is described further in Appendix J.

Regional Stormwater Facility Implementation Strategy and Toolbox

WES should consider pursuing the key steps identified to successfully implement a regional approach for stormwater management. These steps consist of creating stormwater plans, writing codes that encourage regional facilities, and providing developers with guidelines and minimum standards. The Pleasant Valley/North Carver (PVNC) Comprehensive Plan area could be the first area in which to pilot this approach.

Identifying Public Storm System Extension Opportunities

A lack of public storm sewer conveyances may present a barrier to development or redevelopment, and areas without sufficient infrastructure may drain poorly or not at all. As part of the SSMP, a simple web-based mapping tool and methodology were developed to locate Public Storm System Extension Opportunities, assess the extent of the issues, and view adjacent infrastructure, as well as land use, zoning, and other helpful data.

The tool contributed to the selection of two priority CIP projects included in this implementation plan: CIP ID #1606, NCRA Stormwater Plan and CIP ID #1322, SE 172nd Ditch Conveyance Improvement. WES could continue to proactively plan storm sewer extension or upgrades in these areas.

WES could also use the web map as a tool for other analysis such as to analyze the distribution of detention ponds, to determine the relationship between stormwater infrastructure and indicators of poverty or inequality, or to conduct more detailed tax lot-based analysis.

Stormwater Credit Banking

WES may consider developing a stormwater credit program to support Clackamas Department of Transportation and Development (DTD) and City of Happy Valley transportation projects. DTD and the City of Happy Valley projects that support safety and accessibility improvements would be the primary beneficiaries of a program such as this, and it could strengthen relationships between WES and those agencies.

Implementation Phases

Existing Stormwater Success

WES has been successful operating its storm system and responding to urgent or emergency flooding and system failures, such as collapsed detention pipes. In the 2020-2021 and 2021-2022 fiscal years combined, WES has budgeted more than $3 million in its surface water CIP, including the following project types: capital repairs, water quality retrofits, hydrology improvement facilities, UIC retrofits, restoration, and property acquisition for stormwater benefit. Highlights of upcoming projects and projects completed beginning in 2019 include:

- Carli Creek Water Quality project, completed in 2019.
- Small Drainage Repair Projects completed in 2020, including Knee Court, Mount Sun Detention Pond, and Highland View Estates.
- SE 106th Outfall Conveyance System project, completed in 2020.

- Mount Scott Trail Stormwater Repair project, construction to be complete in 2022.
- Replace storm sewer inlets to reduce localized flooding on SE 93rd and 95th Courts, SE Solomon Court, and SE 130th and Sunnyside Streets, construction in 2022.
- 3-Creeks Floodplain Enhancement project, currently in design.

High Priority (Near Term) Programs

By allocating increased budgets to the Small Drainage Project Program and the Stormwater Pond Repair / Rehabilitation Program, WES may begin reducing the number of urgent or emergency drainage and stormwater pond repairs and shifting to a more proactive and preventive approach. This type of shift is expected to require focus and may take a number of years to come to fruition. It is not expected that urgent or emergency situations will disappear, and WES should continue to fund the Emergency Repairs program, which is included in the Medium Priority Programs section, below.

Small Drainage Project Program

The Small Drainage Project Program is intended to provide steady annual funding so that WES can both reactively and proactively address small flooding and drainage issues in a timely manner. This program category includes nuisance issues, such as blockages of small pipes by roots, degradation of small pipes, and minor flooding due to clogged or degraded inlets or missing small pipes. This program would manage repairs and upgrades that are too large for routine maintenance and are estimated to cost less than $100,000 each. The projects will improve drainage issues when flooding is caused by WES's stormwater infrastructure and would support WES's goal of proactively addressing performance deficiencies or enhancements and decreasing the number of customer service requests. The Small Drainage Project Program aligns well with WES's goal to focus limited resources on the most pressing concerns and the most cost-beneficial solutions (Water Environment Services, 2020).

Stormwater Pond Repair / Rehabilitation Program

The Stormwater Pond Repair and Rehabilitation Program will provide a budget line for repairing stormwater quality and flow control facilities. Stormwater facility maintenance is required by the Clackamas Group NPDES Permit (municipal stormwater permit) issued to WES and jurisdictions in Clackamas County. WES owns or operates stormwater facilities that reduce pollutants in stormwater runoff and prevent erosive runoff in stream channels. New development requirements will generate more stormwater facilities needing ongoing maintenance. The existing known issues includes 58 stormwater facilities that currently need repair or rehabilitation. Detention pipes appear to cause a notable proportion of emergency repair needs, so WES could prioritize detention pipes whenever possible in implementing this program. The Stormwater Pond Repair / Rehabilitation Program aligns well with WES's goal to focus limited resources on the most pressing concerns and the most cost-beneficial solutions (Water Environment Services, 2020).

Water Quality Retrofit Program

The Water Quality Retrofit Program will add water quality treatment capacity in existing developed areas. Water quality retrofits generally include new facilities in unserved areas or enhancements which add or increase water quality treatment within existing stormwater infrastructure. The existing known issues list identified nine potential areas for water quality retrofits. Water quality retrofits are among the most popular projects among the public. They are well aligned with WES's goals to minimize the degradation of receiving waters from impacts of stormwater runoff in existing developed areas and to prioritize projects with the greatest potential to support multiple programs and goals, including local and regional fish recovery, habitat enhancement, and water cleanup goals (Water Environment Services, 2020). The Water Quality Retrofits also supports the required infrastructure retrofit and hydromodification assessment update requirement of the municipal stormwater permit.

CIP Projects

An outcome of the SSMP process is a repeatable methodology for rating, ranking and prioritizing capital projects. The methodology uses criteria that reflect the WES's values and priorities.

The final Stormwater CIP includes the ten project recommendations as well as two projects already in progress summarized in Table 15. Figure 12 (above) is a map of the new projects. Several factors can influence the actual implementation sequence including financial constraints and partnership opportunities. The priority ranks are a relative guide.

Priority CIP Projects

Table 15 Priority CIP Projects by Rank

Rank*	CIP No	Name	Cost
Existing CIP			
1	1124	3-Creeks Floodplain Enhancement Project	$3,600,000
3	1413	SE Valley View Terrace Conveyance (stormwater portion only)	$3,277,958
Planned CIP			
2	1005	SE Wildlife Estates Dr Ditch Inlet & Upstream Detention	$1,679,470
4	1079	Aldercrest Culvert Replacement & Kellogg Creek Restoration	$1,865,013
5	1606	NCRA Stormwater Plan	$5,144,850
6	1055	Thiessen Culvert Replacement & Kellogg Creek Restoration	$801,635
7	1406	Sunnyside Place Culvert Replacement & Stream Restoration	$573,623
9	1416	Idleman Conveyance	$1,394,900
11	1322	SE 172nd Ditch Conveyance Improvement	$88,800
13	1091	SE Clackamas Road Drainage Infrastructure	$508,400
14	1098	Rose Creek New Detention Pond and Instream Restoration	$2,589,010
15	1125	Aldercrest and Rusk Drainage Improvement	$440,100
Total			**$21,963,759**

** The final ranking indicates a relative priority but does not necessarily represent the order of implementation.*

Other Potential CIP Projects

Other projects on the potential projects list could be reconsidered at a later date for inclusion in the Stormwater CIP. A list of projects is provided in Table 16 for future consideration.

Table 16 Summary of Stormwater Capital Projects and Capital Programs for Future Consideration

CIP No	Name	Score
1306	Solomon Court Culvert/Fill Removal & Creek Restoration	52.5
1089	Parmenter Culvert Replacement & Kellogg Creek Restoration	51.0
1028	130th/135th Ave Outfall/Stormwater Treatment Facility	50.0
1503	Clackamas High School Cattle Field Conveyance	45.0
1325	Hamilton Ln Drainage and Pond Rehab	44.0
1013	Mabel Ave Swale Sedimentation	42.5
1023	Emerald Loop Drainage Swale Rehab	41.0
1017	Pipe Rehabs: Spring Mountain, Cavalier, Mystery Springs	40.5
1136	Echo Valley Meadows Restoration Phase 2	40.0
1021	Mountain Gate Road Conveyance	38.5
1003	SE 147th Ave. Conveyance	37.0
1320	Regency View & 137th Hillside Inlet Improvements	35.5
1505	SE Boyer Dr Parking Lot Pipe Replacement	35.5
1321	SE 162nd Culvert Replacement	33.0
1608	SE 145th at Mount Scott Creek Conveyance	32.5
1411	SE Aldercrest Loop & Willow Lane Conveyance	31.5
1507	Safeway Distribution Center Right-of-Way (ROW) Conveyance	30.5

Medium Priority Programs

Restoration and Property Acquisition Program

WES puts a high value on restoration, habitat improvement, and floodplain management and sees these types of projects as part of its mission to protect and improve water quality. These projects maximize the ecological and stormwater benefits of the properties, supporting numerous local and regional environmental goals. Many streams and rivers in the planning area are stressed by combinations of increases in impervious area, poor fish passage, increased stormwater runoff and flooding risk, poor riparian vegetation cover, in-stream erosion, and water quality degradation.

To fund restoration and property acquisition which may help alleviate some of these conditions, the SSMP recommends an annual baseline funding allocation to put toward restoration efforts, as well as an allocation of funding every five years for property acquisition that would support restoration efforts. With many project specifics unknown, this was the preferrable way to estimate costs than assigning a cost per project.

UIC Decommissioning / Retrofit Program

WES owns and operates underground injection controls (UICs) and administers the Water Pollution Control Facilities (WPCF) permit issued by the Oregon Department of Environmental Quality (DEQ) to the former CCSD1, SWMACC, and the Tri-City Service District (TCSD). Under the WPCF permit, stormwater injection devices are required to be operated in a manner which protects groundwater quality. To meet this requirement, WES adheres to the System-Wide Assessment (SWA) and Underground Injection Control System Management Plan (UICSMP) submitted to DEQ in accordance with the WPCF permit.

The SSMP recommends funding the nine projects listed in Table 17 to protect water quality. The recommendation for this Program is to continue the ongoing work WES has already begun. The locations

of these nine projects are illustrated above on Figure 17 and Figure 18 (above). Additionally, there are private property UICs and/or UICs near drinking water wells that WES may want to retrofit with treatment.

Table 17 Priority UICs

Service Area	UIC ID	Groundwater Separation	Action
#2	2	- 1.20	Shallow existing and add new UIC
#2	3	- 6.65	Shallow existing and add new UIC
#2	99	- 0.35	Shallow existing and add new UIC
#2	154	- 1.05	Shallow existing and add new UIC
#2	222	- 0.76	Shallow existing and add new UIC
#2	968	- 7.07	Shallow existing and add new UIC
#3	40	- 12.08	Decommission; replace with perforated pipe
#3	72	- 0.51	Decommission; replace with perforated pipe
#3	75	- 0.57	Shallow existing and add new UIC

Emergency Repairs

WES anticipates a certain level of emergency infrastructure repair will be required annually. These projects are similar to the projects included in the Stormwater Pond Repair / Rehabilitation Program; however, these projects are the result of new damage or unknown issues which require more urgent mitigation due to the immediate threat to safety or property. Currently WES does not budget for emergency repairs, and funds are redirected from other programs when needed. WES should establish a budget to perform minor emergency repairs each year.

Pleasant Valley/North Carver Stormwater Infrastructure Plan

The PVNC area was recently brought into Happy Valley's urban growth boundary, and a Community Plan for the area must be completed before redevelopment of the area can occur.

Preliminary sizes and locations were developed for 14 regional stormwater facilities in the PVNC District using the WES Best Management Practice (BMP) Sizing Tool. The pond sizes range from 0.4 acres to 2.1 acres, including area for maintenance access and freeboard, and they are each less than 2.2% of the area of the basin that drains to them.

A cost estimate was prepared for each of the regional stormwater ponds and the North Carver Waterfront District conveyance system. The total estimated cost for regional stormwater infrastructure included for the PVNC area is summarized in Table 18.

Table 18 PVNC Regional Stormwater Infrastructure Total Cost Summary

Type	Costs*
Construction	$15,214,000
Engineering/Permitting	$6,846,000
Land Acquisition	$1,901,000
Total	$23,961,000

** Costs have been rounded.*

The PVNC Stormwater Infrastructure Plan is included in this SSMP as found in Appendix K.

Ten-Year Budget/Construction Plan

This plan identifies ten new CIP projects and $21.9 million in capital improvements to WES's storm and surface water systems, including two existing projects that are in progress.

Table 19 presents one possible ten-year Stormwater CIP implementation plan. The cost of each project is spread over several years, ranging from two to five years. The first year is design, followed typically by one or two years of construction and then one or two years of post-construction monitoring and plant establishment.

The highest priority projects are 3-Creeks Floodplain Enhancement Project, which is in progress, Valley View Terrace Conveyance, which has a concept design and cost estimate that includes both roadway and drainage improvements, and SE Wildlife Estates Drive Ditch Inlet and Upstream Detention, which experienced significant flooding in 2022.

Table 19 Planning Level Ten-Year Design & Construction Cost Estimate[1]

ID	Status	Name	Rank	Total Costs	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	FY9	FY10
1124	*Existing, Ongoing*	*3-Creeks Floodplain Enhancement Project (Remaining Costs Only)*	*1*	$ 3,600,000	$ 250,000	$ 250,000	$ 1,500,000	$ 1,500,000	$ 100,000					
1413	*Existing, Planned*	*SE Valley View Terrace Conveyance (Storm Costs Only)[2]*	*3*	$ 3,277,958						$ 250,000	$ 750,000	$ 750,000	$ 1,000,000	$ 527,958
1005	New	SE Wildlife Estates Dr Ditch Inlet & Upstream Detention	2	$ 1,679,470	$ 500,000	$ 1,000,000	$ 179,470							
1079	New	Aldercrest Culvert Replacement & Kellogg Creek Restoration	4	$ 1,865,013					$ 450,000	$ 850,000	$ 400,000	$ 165,013		
1606	New	NCRA Stormwater Plan	5	$ 5,144,850	$ 150,000				$ 450,000	$ 450,000		$ 250,000	$ 750,000	$ 3,094,850
1055	New	Thiessen Culvert Replacement & Kellogg Creek Restoration	6	$ 801,635				$ 200,000	$ 601,635					
1406	New	Sunnyside Place Culvert Replacement & Stream Restoration	7	$ 573,623	$ 250,000	$ 250,000	$ 73,623							
1416	New	Idleman Conveyance	9	$ 1,394,900		$ 300,000	$ 400,000	$ 400,000	$ 294,900					
1322	New	SE 172nd Ditch Conveyance Improvement	11	$ 88,800	$ 88,800									
1091	New	SE Clackamas Road Drainage Infrastructure	13	$ 508,400					$ 254,200	$ 254,200				
1098	New	Rose Creek New Detention Pond and Instream Restoration	14	$ 2,589,010						$ 250,000	$ 950,000	$ 1,000,000	$ 389,010	
1125	New	Aldercrest & Rusk Conveyance	15	$ 440,100	$ 100,000	$ 340,100								
Total Program Costs				**$ 21,963,759**	**$ 1,338,800**	**$ 2,140,100**	**$ 2,153,093**	**$ 2,100,000**	**$ 2,150,735**	**$ 2,054,200**	**$ 2,100,000**	**$ 2,165,013**	**$ 2,139,010**	**$ 3,622,808**

1. The cost basis year is 2020.
2. The SE Valley View Terrace project is a transportation and drainage project. The costs shown here are for drainage components only. Implementation of this project requires coordination with DTD, and it may not proceed as shown. WES may implement near-term drainage spot fixes in lieu of the CIP.

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Total Program Costs and Staffing

Together with the CIP, the programs are estimated to require $38.5 million to complete the identified scopes of work.

Table 20 Summary of Program and CIP Costs

Program	Total Program Cost	Program Scope	
		Quantity	Unit
1. Small Drainage Project			
New Large Birdcage Inlet or Manhole	$ 276,480	34	Structures
Small Conveyance	$ 567,000	3,000	Linear Feet
Root Removal/Pipe Lining	$ 128,426	3	Known Issues
Program Cost	**$ 971,906**		
2. Stormwater Pond Repair/Rehabilitation	**$ 4,114,951**	63	Facilities
3. Water Quality Retrofit			
Large Stormwater Pond	$ 1,080,288	1	Pond
Stormwater Planter in the ROW	$ 236,250	5	Planters
Vegetated Swale	$ 407,722	3	Swales
Program Cost	**$ 1,724,260**		
4. Capital Projects	**$ 21,963,759**	12	Projects
5. Restoration and Property Acquisition			
Box Culvert	$ 1,565,088	5	Culverts
Riparian Revegetation	$ 162,000	2	Known Issues
Instream Restoration (Baseline Funding)	$ 5,000,000	$500,000	Annual Funding
Property Acquisition for Habitat (Baseline Funding)	$ 1,500,000	$150,000	Annual Funding
Program Cost	**$ 8,227,088**		
6. UIC Decommissioning/Retrofit			
Tier 1 - < 0' groundwater separation	$ 528,412	10	Tier 1 UIC Retrofits
Program Cost	**$ 528,412**		
7. Emergency Repairs	**$ 1,000,000**	As needed	
TOTAL PROGRAM COSTS	**$ 38,530,376**		

Program and CIP costs assume an administration rate of 15% to cover staff needed to manage programs and projects. Using an assumed fully burdened salary rate of $73.12, the full time equivalent (FTE) has been calculated. If implemented over ten years, the programs and CIP are expected to require an average of 3.4 FTE to manage.

Likely Funding Sources

The stormwater CIP and programs may be funded through several revenue sources. WES maintains three budgeted surface water funds, including Operating, Construction, and System Development Charge (SDC) Funds. Budgeted surface water fund sources and uses are summarized in Table 21. Generally, surface water service charges (monthly user fees) support routine maintenance, including repair and upgrade of existing stormwater assets. One-time capital projects typically have an ongoing impact on annual operating budgets through ongoing maintenance expenses and commitments. Some portion of service charges may be available to pay for ongoing priority programs.

Table 21 Surface Water Budgeted Funds

Budgeted Fund	Source of Funds	Uses of Funds
Operating Fund	Service Charges (user fees) Interest Other miscellaneous income	Materials and Services Transfers to the Surface Water Construction Fund Transfers to the Debt Service Fund
Construction Fund	Project participation New debt Transfers from the Surface Water Operating Fund Interest	Capital Project Expenditures
SDC Fund	SDC Interest	Capacity-enhancing Capital Project Expenditures Transfers to the Debt Service Fund for SDC-eligible debt

SDCs are allowed under Oregon Revised Statute 223.297 through 223.314. These funds may only be used for projects that serve growth or future development. Stormwater capital projects that increase capacity may be eligible to use SDC funds. SDC potential capital project funding would be limited to the portion of the project that creates new capacity.

Capital projects may use a combination of cash reserves, service charges, SDCs, or debt (typically bonds). The appropriate mix of financing will depend on the capital investment lifecycle for each project. Revenue from other sources may be available when a project benefits or is done in partnership with other agencies or funds, such as transportation or sanitary sewer funds.

Competitive grants, state loans and funding, and federal grants and funding may be available through a variety of agencies and for a variety of targeted priorities. Potential revenue from the State of Oregon Clean Water State Revolving Loan Fund, such as supported the 3-Creeks Floodplain Enhancement Project, is project specific and is managed administratively as debt. Federal recovery dollars (e.g., American Rescue Plan Act (ARPA)) and infrastructure spending (e.g., Infrastructure and Investment Jobs Act) may be available to support construction projects that meet federal guidelines and priorities. For example, the Carli Creek Water Quality Project was supported by stream restoration funding provided by Portland General Electric in addition to surface water service charges. Prior to completion of this plan, WES submitted the following three CIPs for ARPA funding:

- Aldercrest Culvert Replacement & Kellogg Creek Restoration (CIP ID 1079)
- SE Clackamas Road Drainage Infrastructure (CIP ID 1091)
- Thiessen Culvert Replacement & Kellogg Creek Restoration (CIP ID 1055)

Summary

The SSMP implementation plan is designed as a flexible framework rather than a rigid schedule of work. As circumstances change, the order of programs and projects should change to reflect urgent needs and emergent opportunities. WES should continuously evaluate the community's needs and the progress of implementation to ensure resources are being allocated to urgent needs, preventative maintenance, and anticipatory improvements in the correct proportion.

The prioritization methodology and stormwater toolkit are included with the SSMP. When WES identifies new issues and opportunities, staff will be able to rapidly rank projects against existing priorities and develop conceptual plans and estimate costs to implement solutions. These tools will allow WES to adapt the implementation plan to changing circumstances.

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