Bureau of Environmental Services • City of Portland

Stephens Subwatershed Improvement Strategies Report

2009

Willamette Watershed Team

Environmental Services
City of Portland
working for clean rivers

Dan Saltzman, Commissioner • Dean Marriott, Director

February 2005
Revised June 2009

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CITY OF PORTLAND
ENVIRONMENTAL SERVICES
1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204 ▪ Dan Saltzman, Commissioner ▪ Dean Marriott, Director

June 15, 2009

Dear Friends of Portland's Watersheds:

I am pleased to present this *Stephens Subwatershed Improvement Strategies Report* for the Willamette Watershed. This document helps guide the City of Portland's ongoing efforts to manage stormwater runoff and protect and restore our waterways and natural areas. The report describes the current conditions of the Stephens subwatershed and identifies opportunities to protect and improve watershed health.

In March 2006, City Council adopted the Portland Watershed Management Plan (PWMP). The plan describes the city's comprehensive, strategic, and integrative approach to improving watershed conditions. It identifies watershed health goals in hydrology, physical habitat, water quality and biological communities and outlines strategies and actions to meet these goals.

The *Stephens Subwatershed Improvement Strategies Report* builds upon the principles of the PWMP. Taking a watershed approach, we have identified opportunities to better manage stormwater runoff, protect and improve aquatic and terrestrial habitat and revegetate our natural areas. This approach uses collaboration and partnerships with landowners, neighborhood groups, non-profits and local agencies to achieve the greatest benefits from our actions.

We are currently developing Improvement Strategies reports for each of the Willamette watershed's 27 subwatersheds. The Stephens subwatershed in southwest Portland was the first area for which this process was applied. This report, originally published in 2005, includes a list of over 100 prioritized projects and recommendations. Today, with local citizen support, a number of these projects have been implemented including: the Burlingame Sewer Repair and Streambank Restoration, the SW Texas Green Street and Wetland Enhancement, and the Stephens Creek Confluence Habitat Enhancement project.

In addition to guiding the work of our bureau, it is our hope that this report will provide residents and friends of the Stephens subwatershed an opportunity for community stewardship of their local stream basin. Together, we can work to improve water quality and watershed health, and to protect and restore our natural resources.

Sincerely,

Paul Ketcham

Paul Ketcham
BES Willamette Watershed Manager

Southwest Subwatersheds Improvement Strategies

Stephens Subwatershed Improvement Strategies Final Report

Environmental Services
City of Portland
Watershed Services Group
Willamette Watershed

February 2005; Updated – June 15, 2009

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ACRONYMS

BDS	Bureau of Development Services
BPS	Bureau of Planning and Sustainability (formerly Bureau of Planning)
BES	Bureau of Environmental Services
CSO	Combined Sewer Overflow
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEQ	Oregon Department of Environmental Quality
EDT	Ecosystem Diagnosis and Treatment
ESA	Endangered Species Act
IS	Improvement Strategies
LID	Local Improvement District
LWD	large woody debris
NPDES	National Pollutant Discharge Elimination System
ODOT	Oregon Department of Transportation
PAH	polycyclic aromatic hydrocarbons
PBOT	Portland Bureau of Transportation
PP&R	Portland Parks and Recreation
PWMP	Portland Watershed Management Plan
ROW	right of way
SAC	Stormwater Advisory Committee
SWMM	Stormwater Management Manual
TMDL	Total Maximum Daily Loads
UIC	Underground Injection Controls

Executive Summary

Written for June 2009 Update

As of the date of this report, the Bureau of Environmental Services (BES) Willamette Watershed team has developed Improvement Strategies (IS) reports for the Willamette River watershed's Stephens, Marquam-Woods, Carolina-Terwilliger, and California subwatersheds. The reports identify and prioritize opportunities to protect and improve watershed conditions in the subwatersheds.

Improvement Strategies are groups of actions that individually and collectively improve watershed health. For the three reports produced after 2005, the actions are guided by the goals and objectives outlined in the Portland Watershed Management Plan (PWMP), a plan developed by the City of Portland in 2005 to improve watershed health and to protect and restore natural resources. The IS reports identify and rank recommended projects based on PWMP goals of improving hydrology, water quality, physical habitat, and biological communities.

The purpose of the subwatershed IS reports is to provide a guide for City staff as well as other interested stakeholders such as local agencies, non-profits, and volunteer citizen groups, to focus resources and efforts on actions that will best benefit watershed health.

The IS process is conducted at the subwatershed scale for a number of reasons. The subwatershed scale has been identified as the most effective for evaluating watershed improvements (Schueler and Holland 2000a). Conditions that impact resources, such as impervious area, are more consistent and readily assessable at this scale. It is more efficient to encourage and support community and individual stewardship at this scale (e.g., neighborhood groups are organized at a similar scale). Finally, this scale is fine enough to conduct thorough field assessments and allow accurate analysis of the extent to which the identified improvement opportunities can contribute to meeting each watershed objective.

The reports identify recommended actions, grouped as geographic and/or programmatic clusters. The actions were assembled for their ability to address areas that have been identified as important assets to protect or problems to solve in order to improve local subwatershed conditions. With this update, recommendations have been made for the following areas/programs in the Stephens subwatershed: the Central Canyon area, Stephens Creek Natural Area, Texas Wetland, Terwilliger Corridor, and Stephens Creek (aquatic connectivity). Potential projects and programs for these areas are described in Section 7 and include:

	Central Canyon	Stephens Creek Natural Area	Texas Wetland	Terwilliger Corridor	Stephens Creek (Aquatic)
Stormwater	• Bertha/ Terwilliger Overpasses Water Quality (68) • ODOT (Interstate 5) Regional Water Quality Treatment Facility (81)	• North Nature Park Outfall Sediment Capture (21) • SW Capitol Hill Lot Treatment Facility (53) • South Nature Park Outfall Sediment Structure (60)		• Cloverleaf Apartments Stormwater Retrofit (48) • Aboy/U.S. Bank Stormwater Retrofit (14) • Fred Meyer Ecoroof (20) • Hollywood Video Stormwater Retrofit (30) • Safeway Stormwater Retrofit (32) • Fulton Park Parking Lot Retrofit (62) • Fred Meyer Stormwater Retrofit (67)	• Macadam Culvert Replacement (86) • Railroad Culvert Replacement (94) • Taylor's Ferry Culver Replacement (11)
Stream Enhancement	• Taylor's Ferry Culvert Re-placement (11)	• Bertha Property Restoration Project (90)	•	•	•
Revegetation Projects	•	• Stephens Creek Nature Park Revegetation (44) • Bertha Property Revegetation (55) • Christensen Lot Revegetation (63) • Cloverleaf Apartments Revegetation (69) • S. Nature Park Outfall Revegetation (71) • SW Capitol Lot Revegetation (72)	•	•	• Reach 2 Revegetation (25)
Protection and Policy Projects	• Four Central Canyon Property Acquisitions (37), (85), (93), (95)	• Bertha Property Acquisition (54) • SW Capitol Hill Lot Easement Acquisition (64)	• SW Texas Property Acquisi-tion (65)	•	•

	Central Canyon	Stephens Creek Natural Area	Texas Wetland	Terwilliger Corridor	Stephens Creek (Aquatic)
Outreach Projects	•	•	•	• Commercial Pollution Prevention Outreach (75)	•

SECTION 1: PURPOSE

This report summarizes the Improvement Strategies (IS) process for the Stephens subwatershed, which is located within the southwest portion of the lower Willamette watershed. Improvement Strategies are categories of actions that can be taken to improve watershed conditions. The main element of this report is Section 6, which lists and ranks specific projects and programs that have been identified through the IS process to improve the health of the Stephens subwatershed. The IS process is identified in the Framework for Integrated Management of Watershed Health (City of Portland 2004a).

Based on the significance of the conditions and opportunities present, the Stephens subwatershed was the first area for which the IS process was applied. The process has been reviewed and updated to ensure that it is conducted in a prioritized, efficient, and timely manner (Schueler and Holland 2000b).

Since this report was initially produced in 2004, the IS process has been updated and is guided by the Portland Watershed Management Plan (PWMP; City of Portland 2005a). The PWMP, adopted by Portland City Council in 2006, provides a long-term adaptive management cycle of identifying, implementing, measuring, and evaluating improvements to the conditions of the watershed. The PWMP uses a watershed approach to outline objectives and strategies for improving watershed health while meeting the City of Portland's (City) and BES missions, BES's service responsibilities, and environmental regulations. The watershed approach considers all activities that affect watershed conditions and maximizes the use of limited resources by looking for solutions that meet multiple objectives. The 26 subwatersheds within the City's Willamette Watershed that will undergo the IS process since approval of the PWMP will utilize the updated IS process and PWMP objectives and strategies. This Stephens subwatershed IS report utilizes the pre-PWMP process used to analyze and identify opportunities and create recommendations that help to achieve Stephens subwatershed objectives.

The IS process is based on the development of the watershed health objectives package, which documents reference and current conditions of a variety of watershed attributes, describes the type of improvements sought for these attributes, and identifies how these improvements will be measured. The objectives package was developed in coordination with the other City Bureau watershed programs and Science, Fish and Wildlife Program staff, and is documented in the draft Objectives and Measures Report (City of Portland 2005b).

The IS process is conducted at the subwatershed scale to identify opportunities that will contribute to cumulative improvements for Portland's Willamette watershed and Willamette River channel as a whole. The subwatershed scale has been identified as the most effective for evaluating watershed improvements (Schueler and Holland 2000a). Conditions that impact resources, such as impervious area, are more consistent and readily assessable at this scale. It is much more efficient to encourage and support community and individual stewardship at this scale; citizens generally have higher levels of knowledge and interest in the conditions of their local area or stream basin. In addition, neighborhood groups are also organized at a similar scale, providing stewardship opportunities for individual and community actions to improve watershed health. Finally, the subwatershed scale is fine enough to conduct thorough field assessments and allow accurate analysis of the extent to which the identified improvement opportunities can contribute to meeting each watershed objective.

The IS objectives are built off of the specific conditions of each subwatershed identified in the Stephens Characterization.[1] Opportunities to improve watershed health are identified through a comprehensive process that includes data analysis, review of existing recommendations [Stormwater Advisory Committee (SAC), Willamette River Fish Study, regulatory requirements, etc.], field assessments, stakeholder involvement, and City staff input. Potential opportunities were initially organized by the following categories: stormwater, outreach, revegetation, protection and policy, maintenance, and stream enhancement.[2] The Stephens subwatersheds opportunities prioritization was done through a separate multi-attribute utility analysis described in a separate memo (City of Portland 2004b).

SECTION 2: BACKGROUND

Improvement Strategies Process

The purpose of the IS process is to identify specific project and program opportunities to protect and improve subwatershed health. The IS process, products, and subtasks for the Stephens subwatershed are discussed in further detail in Figure 1 and Table 1.

Characterization Overview

Stephens Creek begins at a steep ridge south of the Hillsdale Neighborhood center and flows about two miles to the Willamette River just north of the Sellwood Bridge. Its drainage area, the Stephens subwatershed, includes 754 acres of Southwest (SW) Portland. The subwatershed is mostly residential neighborhoods but also includes the commercial areas around the Burlingame Fred Meyer store, part of the Interstate 5 corridor, and the canyon that holds SW Taylors Ferry Road (Figure 2, at the end of this section).

The sanitary and stormwater systems that drain the Stephens subwatershed are separated. Sanitary waste from residential and commercial areas is collected in sanitary sewer pipes and is routed to the Columbia Boulevard Wastewater Treatment Plant for treatment. The main trunkline of this pipe system runs along the Stephens Creek mainstem, which can cause bacteria problems when sewer leaks occur and seep into the stream channel. Stormwater runoff throughout the subwatershed is routed into pipes that discharge into Stephens Creek (Figure 3, at the end of this section). This leads to various problems such as pollutants entering the creek, significant increases in flow during rain events, and erosion of the creek bed.

[1] http://www.portlandonline.com/bes/watershedapp/index.cfm?action=DisplayContent&SubWaterShedID=16&SectionID=1

[2] After development of the PWMP, these categories were replaced with the following strategies: stormwater management; revegetation; aquatic and terrestrial enhancement; protection and policy; operations and maintenance; and education, involvement, and stewardship. Opportunities in this report are based upon the initial categories; however, subsequent subwatershed opportunities such as for the three reports completed in 2008-2009 are based upon the PWMP strategies.

Figure A: Improvement Strategies (IS) Process and Products

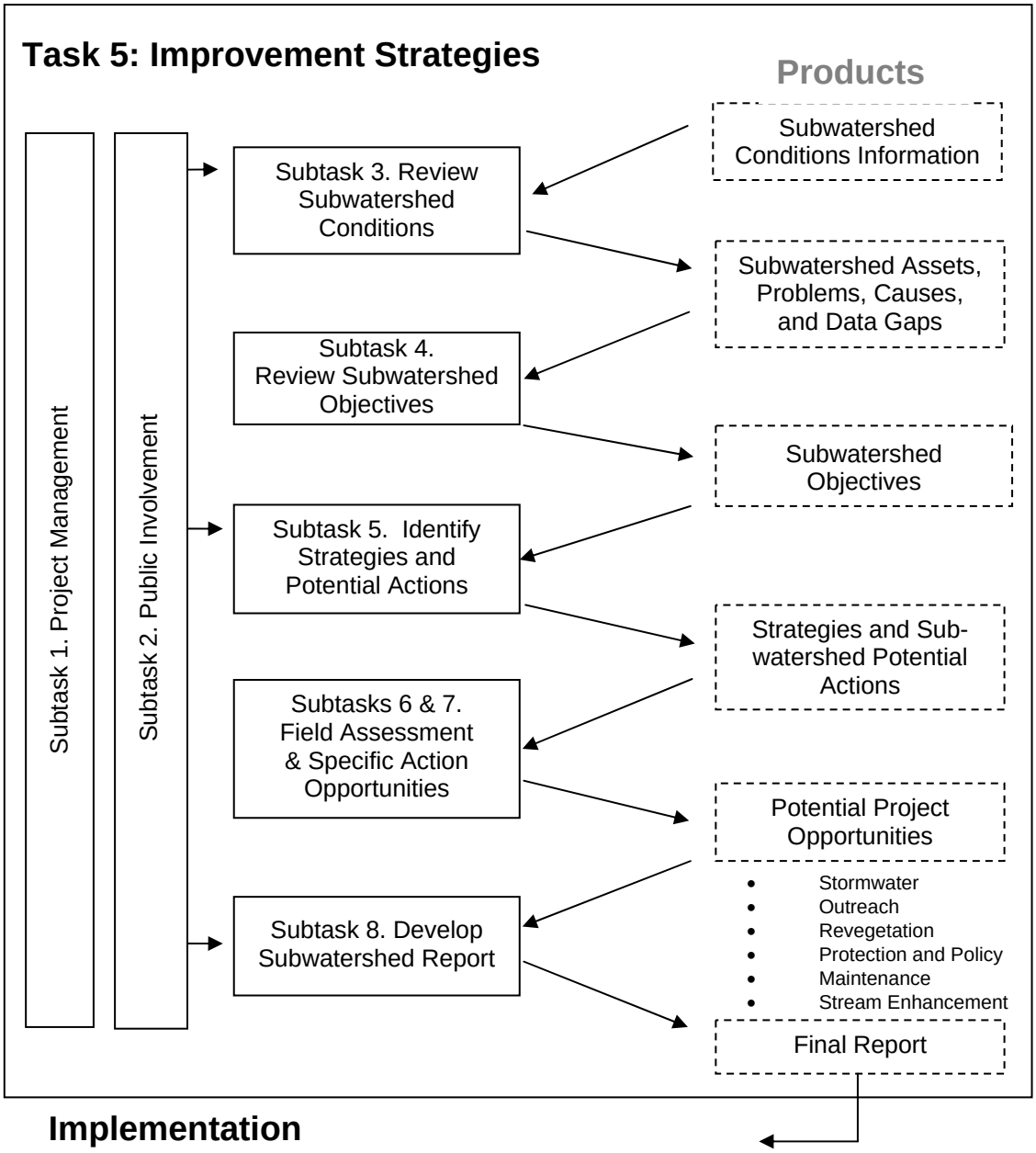


Table 1. Improvement Strategies (IS) Subtasks[3]

[3] Three additional IS reports for SW Willamette subwatersheds were developed in 2008-2009, using an updated IS process and PWMP objectives and strategies.

Subtask	Subtask Description	Product
Project Management	– Planning, scheduling, and coordination – Project Team set up and coordination – Protocol review and update	
Public Involvement	– Public involvement planning – Public involvement meetings	Coordination and input from key stakeholders, public, property owners
Subwatershed Conditions	– Gather, review subwatershed conditions information from Characterization, other sources – Subwatershed reconnaissance – Integration Exercise	Stephens assets, problems, causes, and data gaps
Subwatershed Objectives	– Assessment of applicability of each objective to the subwatershed – Measures development and weighting	Subwatershed Objectives Weighted measures
Strategies and Potential Actions	– Strategies and potential actions compilation from Characterization, Integration Exercise, existing reports, other sources	Strategies and potential actions and sites to guide field assessments and opportunities development
Field Assessments	– Mapping exercise – Prepare for field assessments – Stream and upland assessments – Download and store data	Identified and documented specific actions: • Stormwater • Outreach • Revegetation • Protection and Policy • Maintenance • Stream Enhancement
Specific Action Opportunities	– Identify and describe specific action opportunities (potential projects and programs) – Rank actions based on contribution to watershed health	Subwatershed Concept Plan Six category lists of potential specific actions, ranked by relative watershed value
Subwatershed Report	– Develop report with summaries of process and all products	Subwatershed IS Report (this document)

The majority of open channels in Stephens Creek are protected by City Bureau of Planning and Sustainability (BPS) Environmental Zone overlays - Environmental Protection or Conservation overlays designed to protect important natural resources. Other important natural resources in the subwatershed include the relatively undeveloped Cemetery and Mausoleum properties, undeveloped

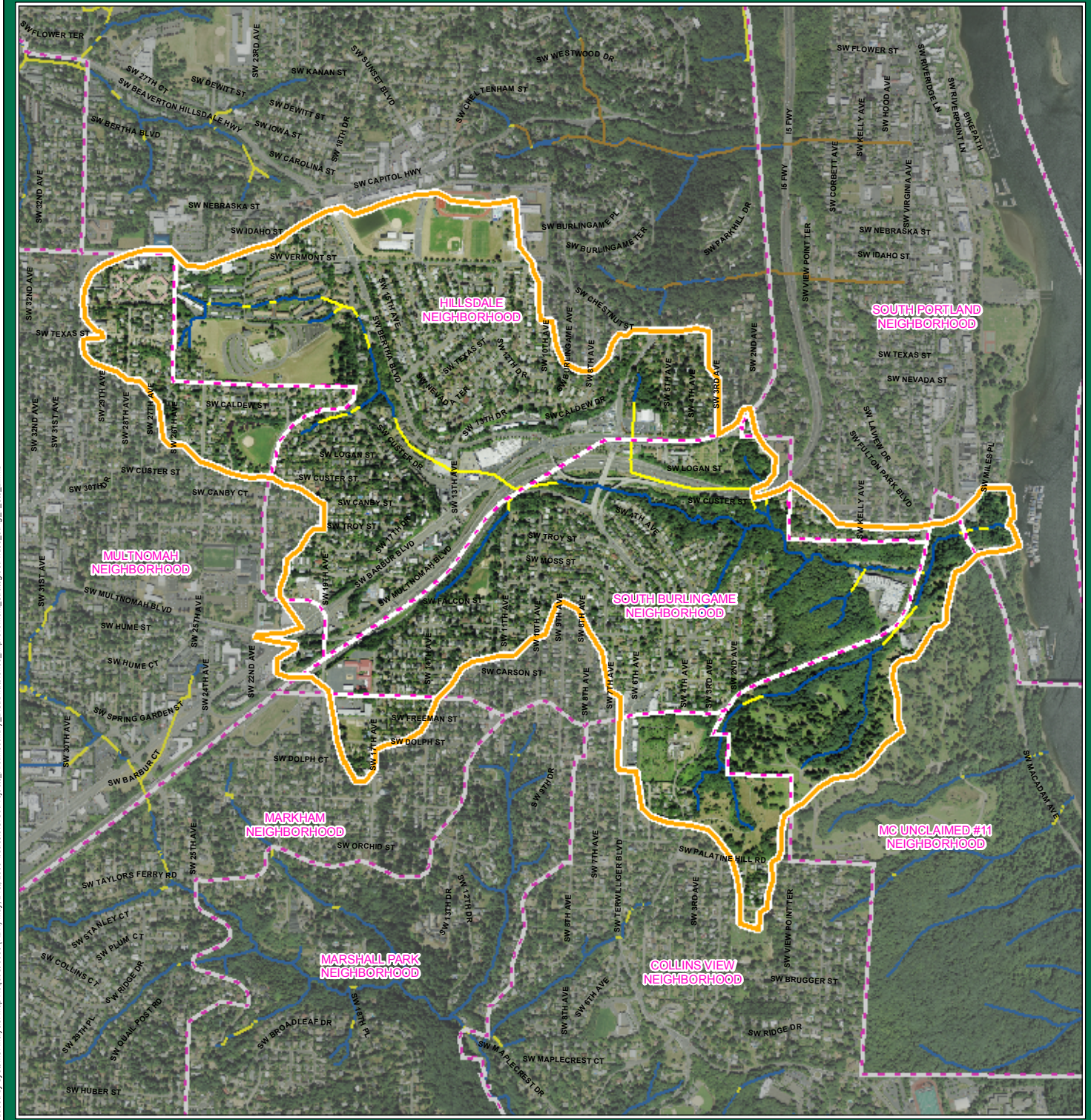
forested areas surrounding the Creek, and a number of parks, including Stephens Creek Nature Park (Figure 4, at the end of this section).

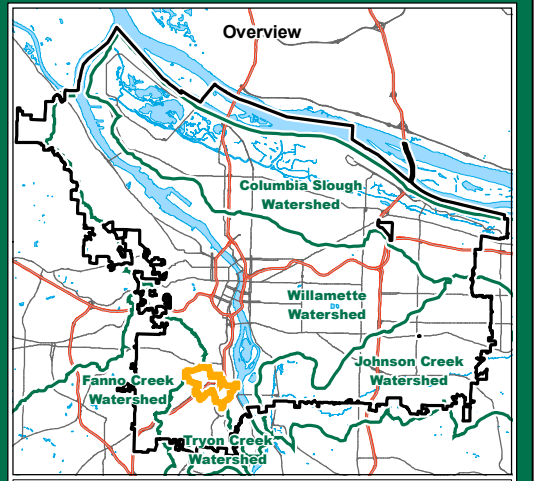
A detailed characterization of the watershed conditions in the Stephens subwatershed was compiled in 2003, and covered the following subject areas:

- Land use and population
- Landscape and hydrology
- Water quality
- Infrastructure
- Habitat and biological communities
- Stewardship

This information served as the foundation for a detailed assessment of the subwatershed (the IS process), with the ultimate goal of implementing projects and programs within the Stephens subwatershed that will improve watershed health.

The following sections detail each of the IS process subtasks conducted for the Stephens subwatershed and the products developed from each (as shown in Figure 1).





Legend

- City of Portland
- Subwatershed Boundary
- Neighborhood Boundaries
- Open Channel Streams
- Stormwater Pipe or Culvert
- Combined Stormwater/Sewer Pipe

1 inch equals 1,500 feet

N W E S

0 1,500 3,000 Feet

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Southwest Subwatersheds Improvement Strategies

Figure-1
Stephens Subwatershed Overview

Project No.	Date Printed:
8800	05/21/09

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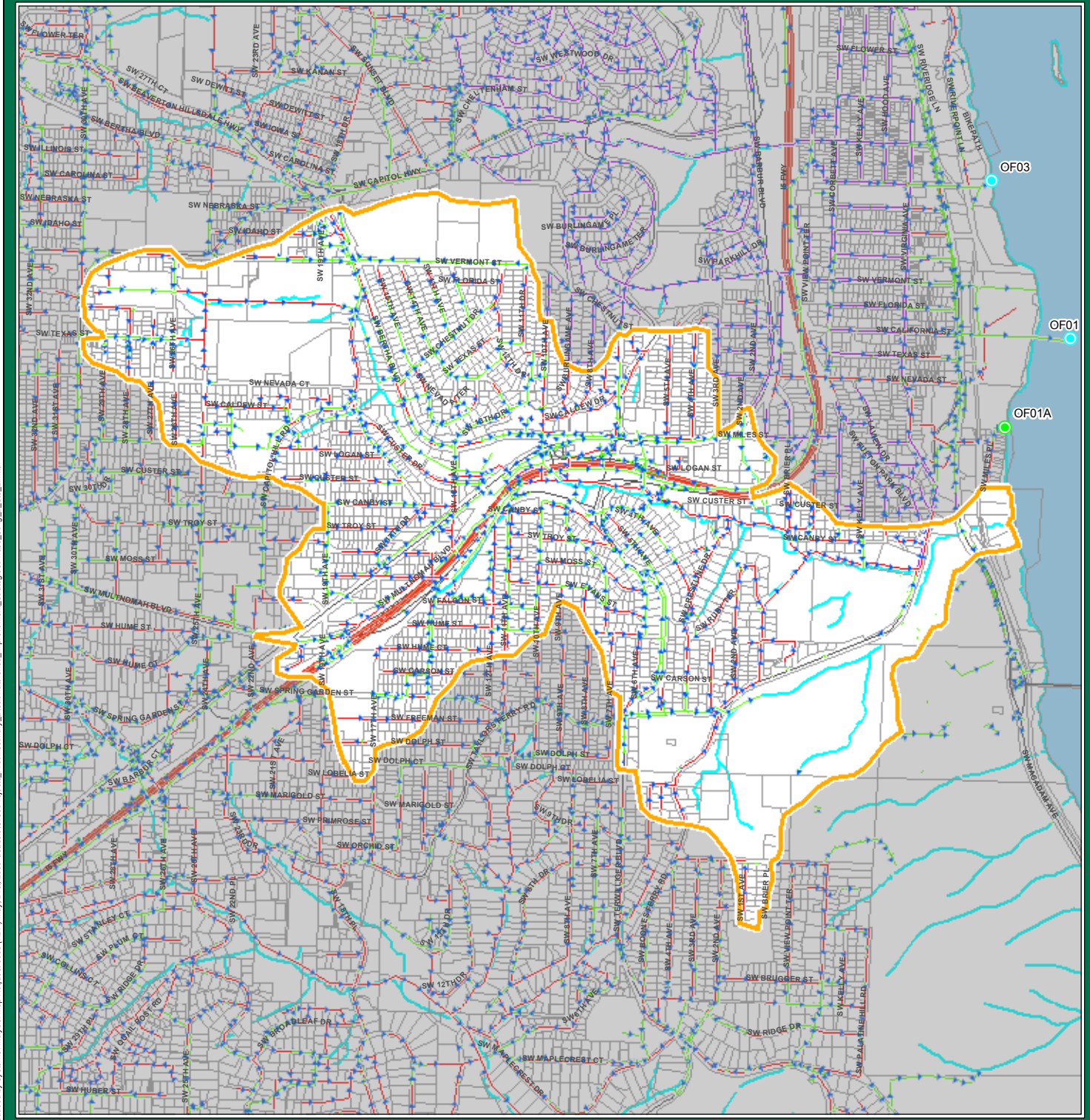

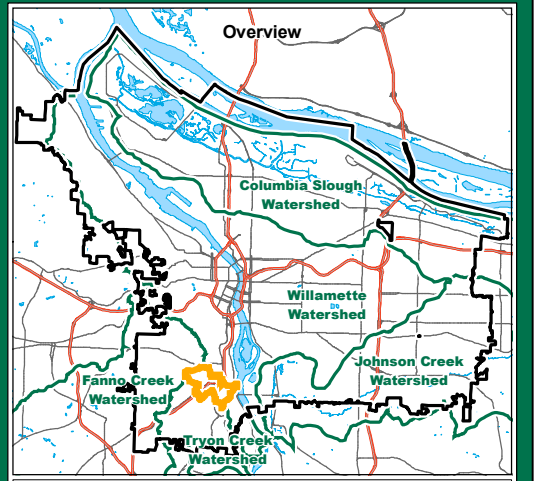

Legend

- City of Portland
- Subwatershed Boundary
- Existing Taxlots
- Freeways
- Open Channel Streams

Existing Sewer System

- Sanitary Sewer Pipes
- Sanitary Pressure Mains
- Combined Sewer Pipes
- Stormdrain Pipes
- Stormwater Only Outfalls
- CSO Outfalls With Stormwater
- Controlled CSO Outfalls With Stormwater
- Abandoned Outfalls

1 inch equals 1,500 feet

0 1,500 3,000 Feet

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Southwest Subwatersheds Improvement Strategies

Figure-2
Stephens Infrastructure

Project No.	*Date Printed:*
8800	05/21/09

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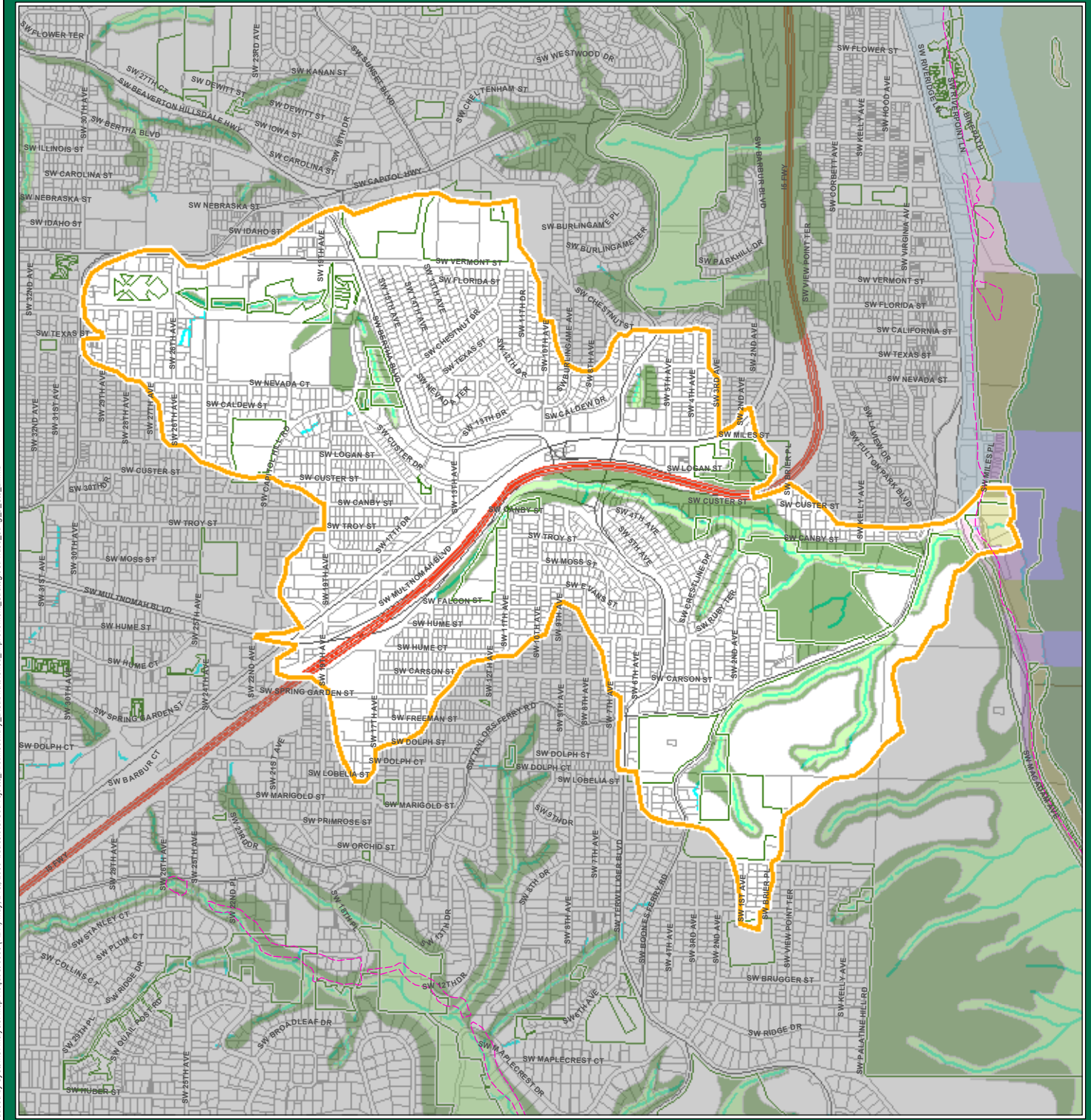

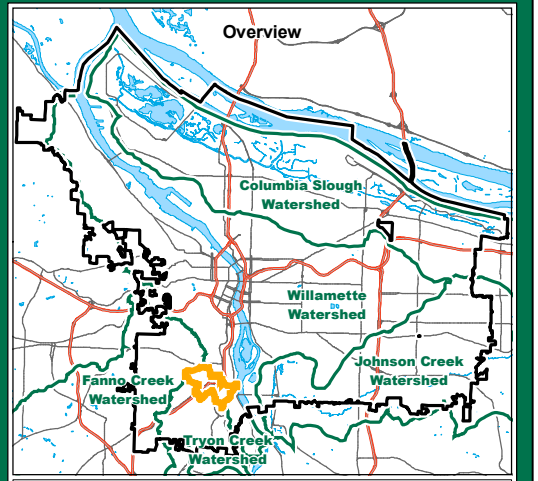

Legend

- City of Portland
- Subwatershed Boundary
- 100yr Floodplain
- Parks and Open Spaces
- Existing Taxlots
- Freeways
- Open Channel Streams

Environmental Zones

- Conservation
- Protection

Greenway Zones

- g *River General Overlay Zone*
- n *River Natural Overlay Zone*
- r *River Recreational Overlay Zone*
- q *River Water Quality Overlay Zone*
- gq *River General Overlay Zone* / *River Water Quality Overlay Zone*
- nq *River Natural Overlay Zone* / *River Water Quality Overlay Zone*
- rq *River Recreational Overlay Zone* / *River Water Quality Overlay Zone*

N W E S

1 inch equals 1,500 feet

0 1,500 3,000 Feet

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Figure-3
Stephens
Natural Resources

Project No.	Date Printed:
8800	05/21/09

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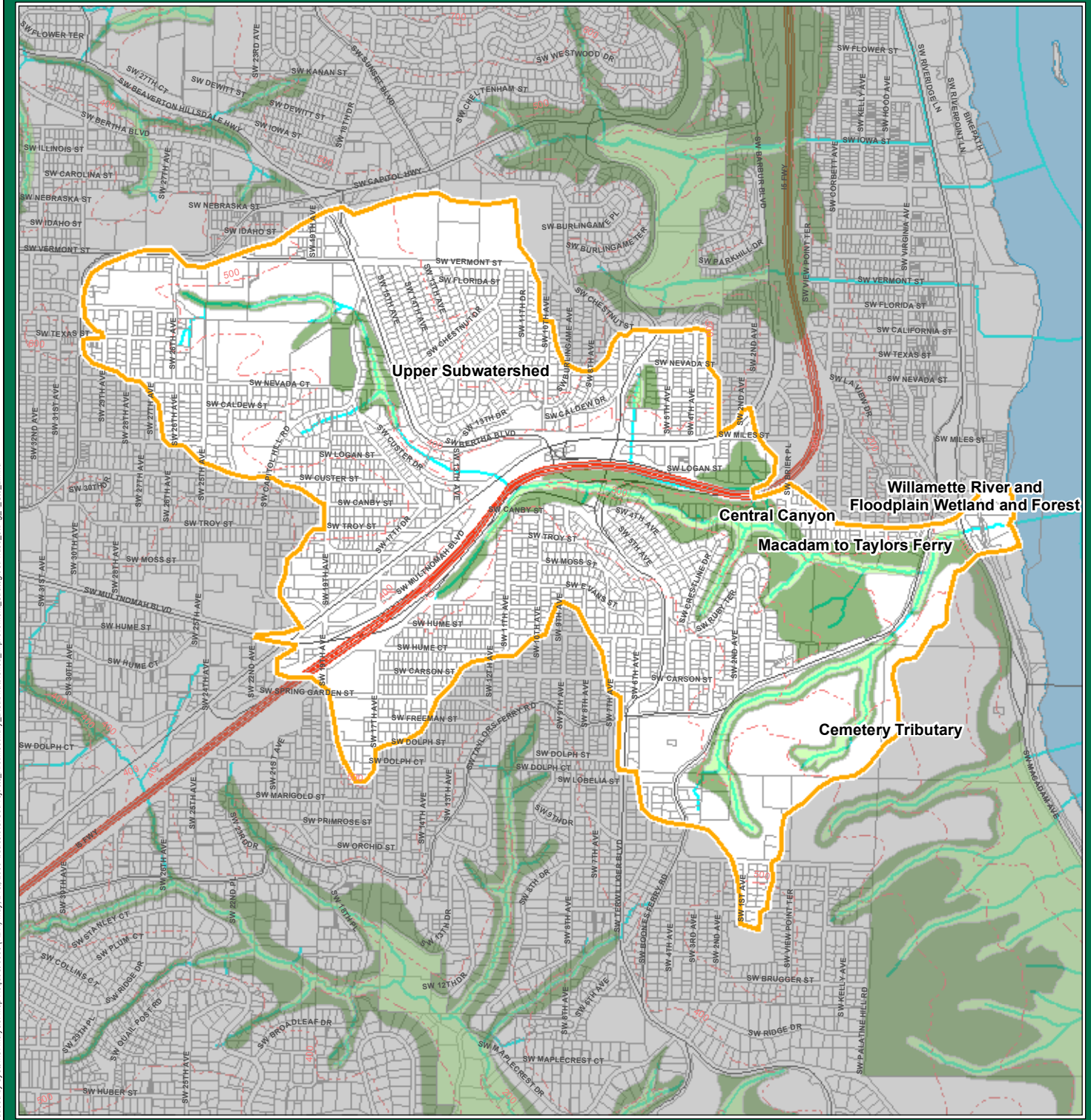

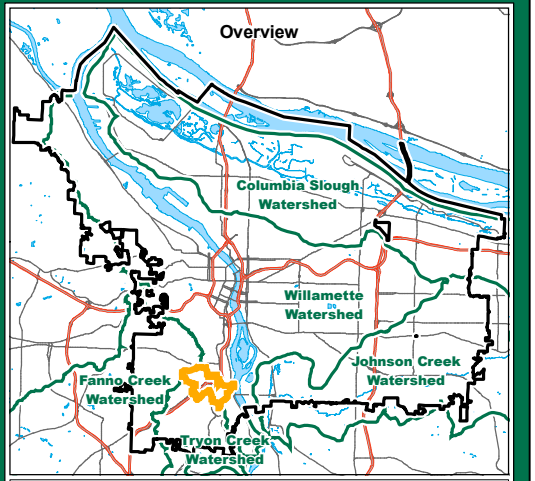

Legend

- City of Portland
- Subwatershed Boundary
- Existing Taxlots
- Freeways
- Open Channel Stream
- 100 ft Contours

Environmental Zones

- Conservation
- Protection

1 inch equals 1,500 feet

0 1,500 3,000 Feet

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Figure-4
Stephens Asset Areas

Project No.	Date Printed:
8800	05/21/09

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SECTION 3: SUBWATERSHED CONDITIONS

This section describes the third step involved in the IS process: Identifying subwatershed conditions. The first two steps, project management and public involvement, are important elements to developing the strategies, but are discussed in Appendix A. Subwatershed conditions are summarized into significant asset and problem areas that were identified during a thorough review of existing information, including the Characterization, staff input, and any additional sources were reviewed and summarized by the Willamette Watershed Team. Subwatershed assets, problems, causes, and data gaps were developed with Project Team input and review. Significant asset areas are shown in Figure 5, at the end of this section.

Stephens Subwatershed Significant Asset Areas

Willamette River and Floodplain Wetland and Forest

The Willamette River and its bottomland wetlands and forest have been extensively altered and developed throughout the City. This area in the Stephens subwatershed has natural riverbanks and high quality remnant bottomland wetlands. The floodplain and Stephens Creek have high habitat value and serve as important off-channel habitat for Willamette River fish communities. Studies show that this area is one of the most productive in the City for fish community diversity and abundance, for Chinook, coho and steelhead. This stream reach (reach 1) was rated marginal for fish habitat in the "Riparian and Stream Habitat Assessment of Stephens Creek" (HARZA 2000). This part of the subwatershed is in City ownership, managed by Portland Parks and Recreation (PP&R), and is zoned Open Space but does not have Environmental Zone overlays.

Macadam to Taylors Ferry Area

The cemetery-owned tract is densely forested and contains mainstem stream reaches 2 and 3. These reaches were rated optimal for fish habitat in the "Riparian and Stream Habitat Assessment of Stephens Creek" (HARZA 2000). The channel and riparian areas have Environmental Zone overlays.

Central Canyon Area

The middle canyon area is a large forested tract with steep ravines and limited floodplains. The stream channel is open and most of the stream reaches in this area have the best channel and riparian habitat in the subwatershed. These reaches (5 through 9) were rated optimal for fish habitat. This area has mixed zoning of Residential and Open Space, and is split between City, State, Riverview Cemetery, and private residential ownership. The main channel and riparian areas have Environmental Zone overlays, although some of the small tributaries do not.

Cemetery Tributary Area

The cemetery tributary basin east of Taylor's Ferry Road has a mix of forest and maintained grass with some overstory forest. The stream channel is mostly categorized as marginal habitat value. It is in various cemetery ownerships, almost entirely zoned Open Space. The stream and riparian areas are in Environmental Zone except for the upper southwest headwater fork.

Upper Subwatershed

The highest-quality remaining habitat in the upper subwatershed is the Stephens Creek Nature Park and adjacent private property natural areas. Reaches in and adjacent to the park (reaches 12 and 13) are rated sub-optimal and optimal habitat value, respectively. The upper most reaches (14 and 15) above the park, have erosion problems and are rated marginal and poor habitat value, respectively. Open portions of the main channel and riparian areas have Environmental Zone overlays, but many of the headwaters tributaries do not.

Stephens Creek Subwatershed Significant Problem Conditions

Implementation of IS opportunities is underway, but is not complete. The following problem conditions section of this report is a summary of the 2004 conditions.

Flow Regime

Problem: River and tributary stream flow regimes have been greatly altered. Associated water quality problems identified for Stephens Creek through water quality monitoring and stream surveys include temperature, sediment, and suspended solids. Reaches below the recreational trail culvert near the mouth, in the lower central canyon, and in the upper subwatershed have been identified specifically as having poor bank vegetation cover and erosion problems. The Riverview Cemetery tributary and the tributary along SW Crestline Drive also have significant bank erosion issues. Stephens Creek problem conditions are delivered to the Willamette River, potentially impacting water quality conditions in the river. The extent and degree of this issue makes it critical to implementing any enhancement opportunities.

Source of Problem Condition: The underlying source of the altered stream hydrograph is stormwater contributions from the developed portions of the subwatershed and is exacerbated by natural conditions such as shallow perched groundwater, steep slopes, and poor-draining and erodible soils. Transportation, residential, and commercial development have resulted in a loss of native understory and canopy vegetation, and increased impervious surface. These impacts lead to increased stream flashiness, resulting in higher velocities, reduced summer base flows, and increased bank and channel erosion. Stream temperatures can be elevated by runoff from impervious areas with high surface temperatures, and from increased solar heating of stream channels with elevated total suspended sediment levels. Suspended sediments can also act as a carrier for other pollutants, especially heavy metals and organic pollutants.

Impervious area covers 40% of this subwatershed. Streets comprise the largest portion of impervious area. Streets (26.3% of total subwatershed area) are distributed throughout most of the subwatershed, but concentrations occur in the center, including Interstate 5 and Barbur Boulevard.

North of Interstate 5, major streets include Bertha Boulevard, Vermont Street, and Custer Drive; and to the south, major streets include Terwilliger Boulevard and Taylor's Ferry Road. Much of the impervious area from parking lots (1.8% of total subwatershed area) is in the center of the subwatershed along Interstate 5 and Barbur Boulevard; the remainder is distributed throughout residential areas. Buildings make up 11.5% of the subwatershed and a number of large structures occur in the northwestern portion between Nevada and Vermont streets (including the Greater Portland Bible Church), along Interstate 5 and Barbur Boulevard in the center (including Fred Meyer), and the southeast (Riverview Abbey Mausoleum).

Development pressure in this subwatershed is predominantly from scattered individual developments on isolated undeveloped lots or redevelopment sites. There is a substantial amount of existing development in this subwatershed, with continual impacts on habitat and watershed functions. Hillside erosion around developments rimming the central canyon has been identified as an issue. The Stephens Creek headwaters near the isolated wetland at SW Texas and SW 26th has seen several new houses constructed and extensive filling since 1998. Some areas are experiencing basement flooding and soil erosion during the rainy months as a result of increased surface and groundwater flows from recent development upstream. In addition, about 10% of the road length in this subwatershed is unimproved, creating a large sediment source when subjected to stormwater flows.

Floodplain Function

Problem: Floodplain extent, function, and connectivity has been greatly reduced or eliminated in the upper subwatershed and is somewhat reduced in the Central Canyon and Willamette River bottomland areas.

Source of Problem Condition: Historic development in the Central Canyon and Willamette bottomland areas has resulted in limited filling, bank hardening, and three road-crossing culvert sections. In the upper subwatershed, large sections of the stream length have been piped, completely eliminating any floodplain function. Open stream sections have been generally cleared and armored and most of the limited historic floodplain and wetland areas have been filled.

Upland Resource Area Conditions

Problem: The watershed function and habitat value of the core habitat areas and the other isolated remnant habitats throughout the subwatershed are currently degraded.

Source of Problem Condition: Invasive species such as English ivy, Himalayan blackberry, clematis, laurel, morning glory, and reed-canary grass are the main threat to watershed function and habitat quality in these areas. Invasive plants crowd out native species and reduce habitat diversity. Native plants slow surface flows, encourage infiltration, filter stormwater pollutants, and provide important habitat opportunities. The Central Canyon area, cemetery and mausoleum properties in particular, have significant invasive species problems. PP&R surveys have quantified the extent of non-native species in Stephens Headwaters Park, the central canyon Nature Park parcel, and Fulton Park, and for the confluence with the Willamette River (City of Portland 2003).

Illegal dumping, adjacent landowner practices, and recreational overuse also contribute to the degradation of these vegetated areas. In the cemetery tributary, maintenance practices such as dumping of soil and landscaping waste, reduce the value of sensitive areas and increase erosion. The cemetery in the lower subwatershed is zoned Open Space but this does not prevent potential resource impacts resulting from cemetery related development, which can eliminate most of the tree canopy and nearly all native understory.

Data Gaps: Survey information does not exist of the rest of the Central Canyon area, but conditions are likely similar or worse than those identified in the PP&R-managed tracts.

Upland Resource Areas Extent and Connectivity

Problem: The quantity, connectivity, and distribution of high-value resource areas in the subwatershed are highly impacted by residential, commercial, and transportation development and continue to be threatened by development pressure.

Source of Problem Condition: Major transportation corridors include the Interstate 5/Barbur Boulevard corridor, Macadam Avenue, Bertha Boulevard, Terwilliger Boulevard, and Taylors Ferry Road. Continued residential and commercial construction throughout the subwatershed may result in further loss and fragmentation of forest canopy and native understory vegetation. Development pressure is predominately from scattered individual undeveloped lots or redevelopment sites. The majority of remaining habitat is riparian habitat associated with the very steep canyons, historically too expensive to develop. As development continues and flat vacant building sites are used up, it becomes more feasible to develop on these marginal lands. This development is chipping away at the edges of the remaining natural habitats and isolating or removing the scattered remnants such as the Central Canyon down to Macadam Avenue and the side ravines near SW Miles and 1st Avenue, and near SW Terwilliger Boulevard and Nevada Street.

Off-Channel Habitat and Channel Connectivity

Problem: Only the lowest 250 feet of Stephens Creek is accessible to Willamette River fish communities. No other off-channel habitat remains in the Willamette River floodplain.

Source of Problem Condition: Limited historic filling and bank hardening, as well as vegetation removal in the Willamette bottomland area for transportation and other development, have reduced floodplain connectivity and off-channel habitat extent. These activities and upstream hydrologic alterations have also caused channel incision and erosion. Upstream hydrologic alterations and water quality impacts have reduced off-channel habitat value. Invasive species have reduced watershed function and habitat value.

Both the culvert under the railroad and the culvert just upstream under Macadam Avenue are fish passage barriers. The culvert under Taylors Ferry, 700 feet above Macadam Avenue, is a barrier to the Central Canyon. Connectivity to the upper sections of the subwatershed is interrupted by a 2000–foot piped reach under the Barbur Boulevard and Interstate 5 commercial and transportation corridor.

Data Gaps: Additional study is needed to determine historic fish extent and benefits of linking the stream and habitat areas above the first culvert with the high quality habitat area in the floodplain.

Channel and Riparian Conditions

Problem: Channel and riparian habitat value has been greatly reduced or eliminated for much of Stephens Creek. For the Willamette River and banks, structural complexity from large wood accumulations has been greatly reduced.

Source of Problem Condition: Stephens Creek channel and banks have been extensively filled, cleared, armored, or piped for development, reducing channel and riparian conditions, channel structure, complexity, substrate retainment, and sources of large woody debris. These activities and upstream hydrologic alterations have also likely caused erosion, incision in the lower reaches, and water quality impacts such as increased stream temperatures that reduce in-channel habitat value.

Urban Stormwater Pollutants

Problem: Water quality monitoring data have identified pollutants such as phosphates, copper, lead, zinc, and chromium as potential water quality concerns for Stephens Creek. Pollutants detected in Stephens Creek are delivered to the Willamette River, potentially impacting water quality conditions in the river. These are also potential water quality concerns for groundwater.

Source of Problem Condition: The parameters identified as potential water quality concerns in this subwatershed are typical urban pollutants. Urban stormwater nonpoint-source pollution is likely a cause of some of the water quality problems in this subwatershed. The commercial and transportation corridors are likely the highest sources of these pollutants. Synthetic organic compounds, such as pesticides and fertilizers, are not produced naturally and are attributable to human activity. Metals are present naturally, but human activities have contributed to levels of these pollutants entering the stream. Runoff from various land uses (i.e., industrial, commercial, and residential properties) carries soil, metals, oil, grease, bacteria, and chemicals to the river. Transportation-related land uses (e.g., roads, parking lots, railroads) are also a source of metal and organic pollutants – from brake pad dust, tires, oil leaks, and diesel fuel.

Data Gaps: Additional monitoring and/or data analysis is needed to quantify the magnitude of contamination from these and other urban pollutants, as well as other specific sources of pollutants, their locations within the watershed, and their relative contributions.

Bacteria Contamination

Problem: Water quality data identified E. coli as a water quality concern for Stephens Creek, with levels exceeding the single-sample maximum for 68% of samples. Pollutants detected in Stephens Creek are delivered to the Willamette River, potentially impacting water quality conditions in the river. In addition to being a human health concern, high bacteria levels are a concern because Stephens Creek and the Willamette River are used by endangered fish species

Source of Problem Condition: These conditions are attributed to leaking parallel sanitary trunk lines along the creek between Interstate 5 and Taylors Ferry Road, potential illicit sanitary discharges and mistaken sanitary connections to the stormwater system, and pet waste throughout the subwatershed.

Data Gaps: While leaks in the sanitary mainline have been a documented problem along Stephens Creek, additional monitoring is needed to identify specific locations of maintenance needs, illicit or mistaken discharges, and the magnitude of human and pet waste inputs.

Update: In November 2006, BES completed repairs on the concrete, 36-inch diameter sewer line (circa 1953) that follows Stephens Creek through a forested canyon between Interstate 5 and Taylor's Ferry Road. Some portions of the sewer line were replaced and, where feasible, relocated further away from the creek, while the remaining portions were rehabilitated with a flexible resin liner. The Burlingame Sewer Repair Project has improved water quality by keeping bacteria out of the stream, although continued monitoring has detected elevated concentrations of E. coli during storm events. Since sampling during dry weather events did not produce high E. coli concentrations, it still remains unclear if there could be any possible sanitary line cross-connections or other leaks in the system.

In consultation with its Investigations and Monitoring Group, BES is considering the use of a Microbial Source Tracking analysis tool to provide a presence/absence result for human sources of E. coli. The intent is to use this test to determine if the City's sanitary system is a possible source for the bacteria. If the results are positive for human sources than we will continue to investigate for possible cross-connections and leaks via further dye-testing and line inspections. If the results are negative for human sources, we can focus efforts on animal sources, such as dog, bird, or rodent.

Native Biological Communities Quantity and Diversity

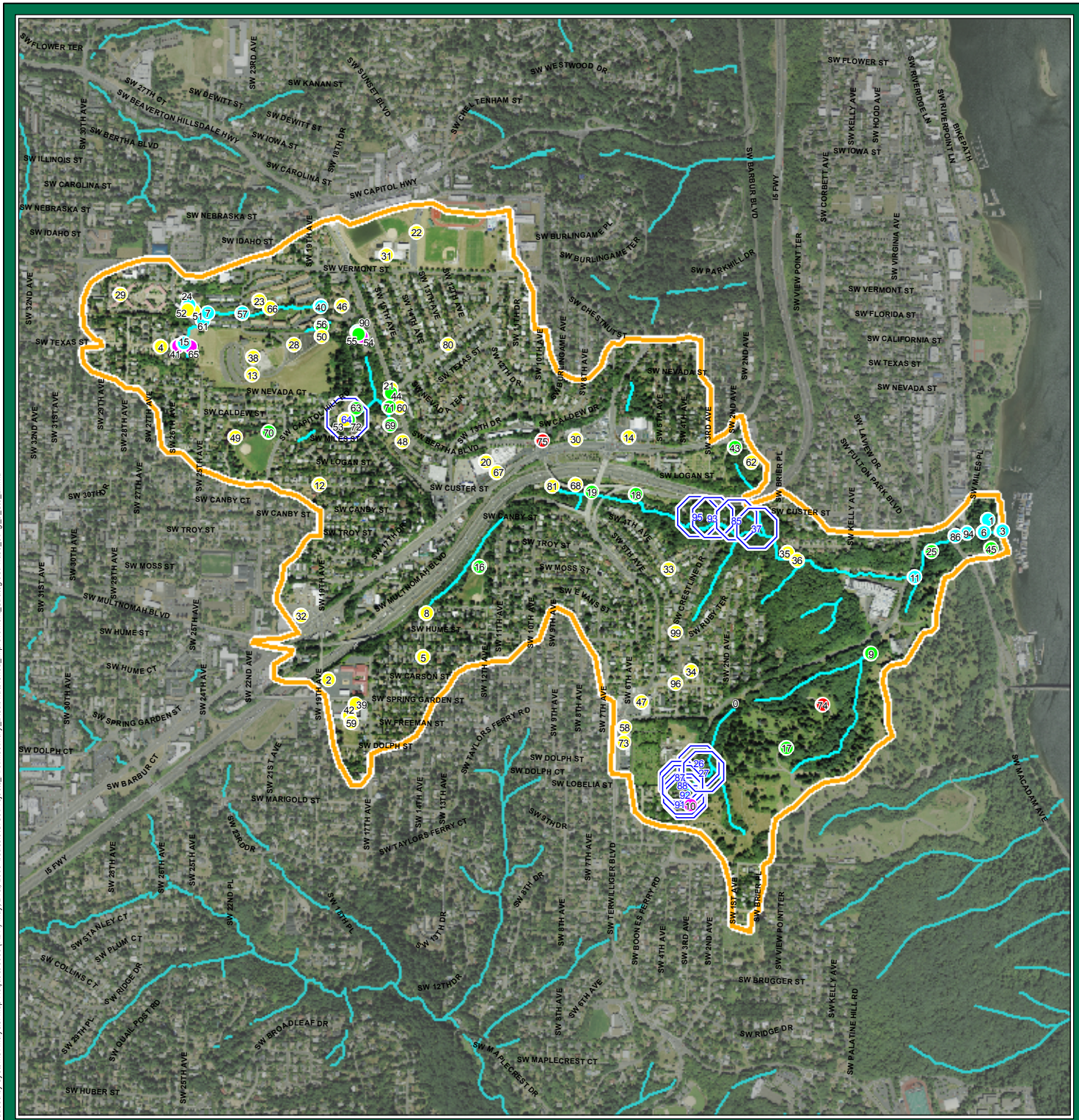
Problem: The native plant, wildlife, fish, and other biological communities in the subwatershed have been greatly reduced by extensive urban development.

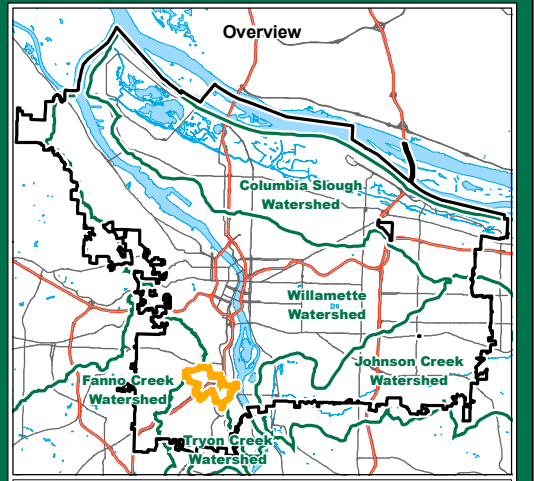
Source of Problem Condition: All of the hydrology, habitat, and water quality problems listed previously have contributed to adverse impacts on plant, wildlife, fish and other biological populations, as indicated by the state and federal species lists of concern. Introduction of exotic species that displace or prey on native species has had, and continues to have, significant impacts on those native species. Where the rate of predation on native species is low, the presence in key habitat, such as nearshore areas, may displace native species from occupying those areas.

Soil and Sediment Contamination

Problem: Two sites in the southern part of the subwatershed, near Taylors Ferry Road and Terwilliger Boulevard, have been identified by the Oregon Department of Environmental Quality (DEQ) as containing contaminated soils.

Source of Problem Condition: Soil contamination of the two identified sites is associated with commercial operations, one a gas station and the other a dry cleaning business that released toxic chemicals into soils. Toxic chemicals attach to small particles of soil that remain onsite or are transported through groundwater or stormwater. Transport of toxics from these sites could potentially contribute to contamination of Willamette River sediments.





Legend

- City of Portland
- Subwatershed Boundary
- Open Channel Streams
- Aquatic Terrestrial Enhancement
- Education Involvement Stewardship
- Protection and Policy
- Revegetation
- Storm Water Management
- Easements or Acquisitions

1 inch equals 1,500 feet

0 1,500 3,000 Feet

N W E S

CITY OF PORTLAND
ENVIRONMENTAL SERVICES
Systems Analysis
Spatial Analysis and Modeling

Southwest Subwatersheds Improvement Strategies

Figure-5
Stephens
Potential Projects

Project No.	Date Printed:
8800	05/21/09

Produced by Systems Analysis. Map Request 5038 (KDR) May. 21st, 2009 \\Cassio\GIS3\Projects_ArcMisc\Mary_B\Subwatershed_Improvement_Strategies\Phase_5\Fig_5_Ste_2.mxd

SECTION 4: OPPORTUNITY SELECTION AND RANKING

The watershed objectives developed in coordination with the other watershed teams served as the guide for the identification of potential subwatershed actions. For the Stephens subwatershed, the complete set of watershed objectives was reviewed, and, based on the subwatershed conditions, objectives that applied were selected to create a set of subwatershed objectives. Measures were developed to quantify the degree to which potential actions will help improve watershed conditions and meet each objective. These measures were weighted based on the specific subwatershed conditions, and were then used to determine the relative priority of each action. These rankings demonstrate relative value of each project towards improving watershed health conditions in the subwatershed and do not take into consideration any feasibility or implementation factors (Table 2).

The objectives, their weights, and their associated measures were then used to prioritize specific subwatershed improvement opportunities, using a multi-attribute utility analysis (MUA) tool. Detailed information on how the objectives were ranked to produce the subwatershed objectives and on how the MUA was applied to the improvement opportunities can be found in the Technical Memorandum included in Appendix B.

Helpful Definitions

Strategy: Broad categories of approaches to meet subwatershed objectives. There are six strategies in the PWMP. See Section 5 for more detail.

Action: Finer scale than strategy. Actions are projects or programs that are not site-specific.

Opportunity: Project or program that is site-specific. Opportunities are based on needs identified during field assessment.

The results of the MUA assigned scores to each subwatershed improvement opportunity. The opportunities with the highest scores for the highest-ranking objectives were identified as priorities. More information about how the opportunities were identified for evaluation is described in detail in Section 5.

Table 2: Results of Ranking Process for Stephens Subwatershed Objectives and Measures

Objectives	Measure	Rank	Weight
Restore a more natural flow regime to the river channel and tributary streams to protect and improve watershed function, channel and bank stability, habitat value, and future restoration projects.	Acres of reduced effective impervious area	1	0.185
Protect and increase the extent, connectivity and quality of areas with significant watershed function and habitat value throughout the watershed to improve stability, water quality, upland wildlife habitat conditions and watershed function.	Acres of significant natural resources protected from adverse development impacts	2	0.167
	Acres of vegetation communities improved	2	0.111
Protect and restore the extent, connectivity and function of Willamette River and tributary floodplains and mitigate for the impacts of development to improve natural hydrologic functions and associated habitat value and water quality.	Acres of improved floodplain hydrologic function	3	0.157

Objectives	Measure	Rank	Weight
Increase accessible off-channel habitat in the Willamette River floodplain and westside tributary streams to improve habitat connectivity and rearing of Willamette River salmonid communities.	Feet of channel made fish-accessible or off-channel habitat created	4	0.130
Establish and protect composition and structure of native vegetation communities in the Willamette River and in tributary floodplain and riparian areas to improve stability, water quality, watershed function, and habitat value.	Acres of significant natural resources protected from adverse development impacts	5	0.167
	Acres of vegetation communities improved	5	0.111
Improve degraded or replace eliminated channel habitat conditions for the Willamette River channel and westside tributary streams to support the quality and diversity of biological communities.	Feet of channel habitat improved	6	0.093
Reduce contributions of pollutants with established regulatory criteria in the Willamette River, tributaries, and groundwater to support beneficial uses designated by the State.	Opportunities for stewardship, education, partnership, programmatic actions exist? (Yes/No).	7	0.065
Improve watershed health by maximizing stewardship, education, partnership and programmatic opportunities.	Acres of stormwater runoff managed	8	0.056
Reduce City of Portland contribution to exceedances of bacteria limits in the Willamette River and tributary streams to assist in efforts to protect human health and wildlife.	Fecal inputs to stream reduced (Yes/No)	9	0.037

SECTION 5: STRATEGIES AND ACTIONS

For this step, all potential actions and project recommendations for the subwatershed were gathered from documentation from the Characterization, Project Team input, SAC recommendations, and other existing sources. The list of general strategies and actions used as the starting point for this subtask is in the Objectives and Measures Report. This information was the starting point for the evaluation of potential opportunities (specific actions at specific sites) by field assessments.

The field assessments were based on current subwatershed conditions (i.e., asset areas and problem conditions) identified with the Project Team and the objectives set previously. The assessments verified those conditions throughout the subwatershed and identified opportunities to address the problems or to protect these assets. The field assessments involved an overview of all streams, resource areas, and developed and undeveloped upland areas within the subwatershed, and resulted in detailed documentation of all potential action sites.

The field assessments were guided by map analyses conducted in the office, and by assessments of uniform land use units within the subwatershed. The map analyses were focused on identifying problem and opportunity sites from existing data sets and analysis of aerial photos and other GIS information, such as BPS and Metro resource inventories or large impervious areas and areas with unimproved streets. Field assessment involved identifying as many potential sites as possible using

maps that depict topography, resource areas, streams, buildings, roads, parking lots, location of existing stormwater management facilities, and location of existing stormwater outfalls. Dividing the subwatershed into units where similar watershed solutions may be implemented (e.g., evaluating a residential unit for downspout disconnection, swale, or stormwater retrofit opportunities) was a useful way to manage issues that extend beyond site-specific solutions. The fieldwork consisted of targeted site visits to areas identified through the map analyses and drive-through visits to each unit to identify specific sites for potential projects.

For open stream channels, information was collected on specific problems (e.g., outfalls, trash and debris, erosion), and on specific assets (e.g., good riparian habitat) observed in the stream, as well as on identifying ways to address the problems or to protect the assets. In some cases, this information was collected from previous efforts (e.g., ODFW channel surveys, reports from consultants). Because much of the information in these reports was at a level of detail beyond what was collected in the field assessment, it was utilized as much as possible to guide or reduce the stream assessment work.

General strategies and actions were identified for the Stephens subwatershed. Specific actions were then identified and evaluated through field assessment. Specific action opportunities (i.e., specific actions at specific sites) were then developed and documented in the following section: Specific Action Opportunities.

SECTION 6: PROJECT OPPORTUNITIES

This section describes specific actions that were identified in 2004 to improve subwatershed health throughout the Stephens subwatershed. They are geographically specific applications of the potential actions outlined previously. Actions were ranked according to the process described in Section 4. Action opportunities have been identified through a comprehensive process that included data analysis, review of available information of current and historical subwatershed conditions, field assessments, stakeholder involvement, and City staff input. Some of these action opportunities have been implemented since this IS report was originally developed, and are documented in the Progress Report included in Section 7.

A single list of action opportunities was developed; however, for descriptive purposes, they are organized below into six categories[4]:

- Stormwater
- Outreach
- Revegetation
- Protection and Policy
- Maintenance
- Stream Enhancement

These rankings demonstrate relative value of each project towards improving watershed health

[4] These categories were subsequently updated with the strategies identified in the citywide PWMP.

conditions in the subwatershed and do not take into consideration any feasibility or implementation factors. The rankings are not intended to represent a set order in which to implement projects. Rather, they will inform the selection and implementation processes as to which projects to pursue as opportunities become available.

STORMWATER OPPORTUNITIES

These specific stormwater project and programs are designed to improve natural stormwater function and are the foundation for all other watershed protection and improvement efforts. These projects help minimize the effects of development on watershed processes and natural conditions, providing water quality treatment, and flow attenuation, interception and infiltration, reduced channel erosion, improved aquatic habitat conditions, and protection of downstream restoration projects. Projects include structural retrofits and other stormwater management measures that reduce effective impervious area by promoting interception, infiltration, retention, and detention, as well as by collecting and limiting contaminant transport.

These projects and programs relate directly to SAC recommendations (recommendations 4-7, 11-14, 17, and 31 in the October 2002 report). The SAC was appointed by Commissioner Dan Saltzman on behalf of City Council in September 2000 to guide City compliance with federal Clean Water Act regulations. The Willamette River is currently included on the federal 303(d) list as water quality limited for dieldrin, dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyl-dichloroethylene (DDE), polycyclic aromatic hydrocarbons (PAHs), temperature, mercury, aldrin, manganese, iron, and pentachlorophenol. Ecosystem Diagnosis and Treatment (EDT) analysis of the Willamette River channel has also identified chemical contamination as a key limiting factor for salmon populations using Portland's stretch of the river. The stormwater projects identified in this category will help improve the contamination levels of these various pollutants and ensure regulatory compliance.

Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of existing City programs. Critical existing programs include: National Pollutant Discharge Elimination System (NPDES), Underground Injection Controls (UICs), Total Maximum Daily Loads (TMDLs), Combined Sewer Overflows (CSOs), Clean River Rewards (stormwater discount) Program, Downspout Disconnection Program, Sustainable Stormwater Program, Portland Bureau of Transportation (PBOT), PBOT Maintenance Operations, Urban Forestry, and the Stormwater Management Manual (SWMM).

Potential actions from this category are listed below in Table 4 using the ranking number of each.

Three significant data gaps associated with the development of stormwater opportunities were also identified:

1) Modeling feasible locations for regional stormwater facility locations
2) Modeling for hydrologic system management of regional treatment facilities, and
3) Monitoring and data analysis to determine specific amounts, types, sources and pathways for subwatershed contribution to Stephens Creek and Willamette River channel water quality concerns.

Monitoring should span a 12-month period including two to three wet weather sampling events. This should coordinate with existing monitoring programs, including ongoing westside tributary monitoring programs, BES NPDES stormwater monitoring program for the City's collection system, and monitoring required of industries under the BES Industrial NPDES Program. Monitoring for parameters should be considered where appropriate based on locations of suspected sources and/or data gaps.

Data analysis should include a review of additional data on these parameters that can provide further understanding of sources and areas of concern and help develop effective projects within the subwatershed. Data analysis should also include:

- Coordination with Illicit Discharge Controls to cross-reference identified sources with identified parameters of concern
- Review of stormwater monitoring data from industrial permitees required by the BES Industrial Stormwater Program to evaluate industrial contributions to metals loadings and efficacy of required management practices in Stormwater Pollution Control Plans
- Evaluation of large commercial sites for pollutant contribution
- Development of analytical tools, such as computer models, to enable a quantitative understanding between identified sources and water quality impacts
- Coordination with other City programs [e.g., TMDL, Endangered Species Act (ESA), Superfund] to identify loading sources to determine if the planning area is a contributor of these 303(d)-listed parameters, and
- Careful evaluation of 303(d) listings and collection of monitoring data to support load allocation.

Table 3: Stephens Subwatershed Stormwater Opportunities

Rank	Project/Program	Location	Project/Program Description
2	Capitol Hill School Stormwater Retrofit	Capitol Hill School, SW 18th and Spring Garden	Remove pavement around outside edge of playground and north parking lot, redirect flow into pervious areas where possible
4	SW Texas Green Street	SW 26th and Texas	Develop green street facilities and landowner maintenance agreements
5	SW 14th Green Street	SW 14th between Spring Garden and Hume	Develop green street or curb bumpout facilities, sediment manhole, and landowner maintenance agreements. Vegetated swale area approximately 0.4 acres.
8	14th and Falcon Treatment Facility	SW 14th and Falcon	Disconnect downspouts draining to SW 14th and Falcon, build 0.25-acre water quality treatment swale in right of way (ROW) west of SW 14th at Falcon
12	SW Custer Green Street	SW Custer below 19th	Develop green street or curb bumpout facilities and sediment manhole. Vegetated swale area approximately 0.2 acres.
13	Greater Portland Bible Church Stormwater Retrofit	Greater Portland Bible Church	Improve island design and direct parking lot runoff into island

Rank	Project/Program	Location	Project/Program Description
14	Aboy/US Bank Stormwater Retrofit	Aboy/US Bank Parking lot on SW Barbur at Terwilliger	Stormwater treatment facility and runoff redirected from parking lot. Vegetated swales in current grassy area along SW Barbur add approximately 0.2 acres of treatment area.
20	Fred Meyer Ecoroof	Fred Meyer and Burger King Barbur at Bertha	Install ecoroof on Fred Meyer building.
21	North Nature Park Outfall Sediment Capture	SW Chestnut at 15th	Insert sediment manhole or stormwater vault in storm lines between nodes ACS092 and 109, between ACS 096 and ACS101, between ACS440 and ACS101, and between ACS 112 and ACS103
22	Rieke/Wilson Stormwater Retrofit	Rieke Elementary School/Wilson High School	Create vegetated island in Rieke/Wilson road to treat/dispose stormwater
23	Shadow Hills Apartment Disconnection	Shadow Hills Apartment, SW Vermont	Redirect roof runoff to grass areas
28	Greater Portland Bible Church Stormwater Retrofit2	Greater Portland Bible Church	Create stormwater islands in lower lot
29	Hillsdale Apartments Stormwater Retrofit	Hillsdale Apartments, SW Vermont	Disconnect apartment building downspouts to planter boxes or swales.
30	Hollywood Video Stormwater Retrofit	Hollywood Video and Cleaners on SW Barbur at Terwilliger	Add curb cuts to redirect parking lot runoff into existing landscaped areas. Add vegetated swale to existing landscaped area. Area of existing landscaped area is less than 0.1 acres.
31	Rieke Disconnection	Rieke Elementary School	Disconnect Rieke downspouts to vegetated areas
32	Safeway Stormwater Retrofit	Safeway parking lot on SW Barbur at Capitol Hill Rd.	Create stormwater planters in corner of parking lot, reconfigure drainage to vegetated areas (approximately 0.1 acre area)
33	SW 4th Green Street	SW 4th at Troy	Develop green street or curb bumpout facilities. Vegetated swale approximately 0.1 acres.
34	SW Third Green Street	SW 3rd between Carson and Taylor's Ferry	Develop green street or curb bumpout facilities and landowner maintenance agreements. Vegetated swale approximately 0.1 acres.
38	Greater Portland Bible Church Roof Disconnection	Greater Portland Bible Church	Disconnect appropriate roof areas to lawn or gravel vaults
39	St. Claire Parking Lot Retrofit	St. Clair Church and School, SW 18th and Spring Garden	Redirect parking lot and roof flows into landscaped areas, create islands in parking lot for stormwater disposal, remove impervious area and retrofit for stormwater disposal in church lot. Islands add less than 0.1 acres vegetated area
42	St. Claire Disconnection	St. Clair church and school, SW 18th and Spring Garden	Disconnect church and school downspouts where possible to vegetated areas
46	Capitol Hill Condominiums Disconnection	Capitol Hill Condos, SW Bertha and Capitol Hill Road, and Shadow Hills Apartments, SW Bertha and Vermont	Investigate disconnecting downspouts to vegetated areas
47	Chez Jose/Market Choice Stormwater Retrofit	Chez Jose and Market Choice Parking Lot at Terwilliger and Taylor's Ferry	Redirect parking lot flows to vegetated areas (approximately 0.1 acre area
48	Cloverleaf Apartments Stormwater Retrofit	Apartment complex abutting south edge of Nature Park	Investigate downspout disconnect opportunities for four southern buildings - discharge to lawn

Rank	Project/Program	Location	Project/Program Description
49	Custer Swale Inflow Expansion	Custer Park	Expand functioning and inflow to stormwater quality treatment facility, disconnecting homes along north side of park so stormwater drains to swale
50	Greater Portland Bible Church Stormwater Retrofit3	Greater Portland Bible Church	Create treatment swale for lot runoff at NE lot corner, address church dumping issue
51	Spring Creek Condos Disconnection	Spring Creek Condos, SW Vermont	Redirect downspout discharges directly to lawn areas
52	Spring Creek Condominiums Ecoroof	Spring Creek Condos, SW Vermont	Potential ecoroof opportunities
53	SW Capitol Hill Lot Treatment Facility	SW Capitol Hill Road	Construct stormwater quality treatment facility, conduct landowner maintenance practices education, develop landowner maintenance agreement
58	Starbucks Strip Stormwater Retrofit	Starbucks Strip Mall at Terwilliger and Taylor's Ferry	Construct planter boxes in parking area (area approximately 0.01 acres), and possible water feature by Starbucks seating.
59	SW Freeman Retrofit	SW Freeman between 17th and 19th	Remove impervious area and develop for stormwater disposal in SW Freeman Street (used as parking lot). Islands add less than 0.1 acres vegetated area
60	South Nature Park Outfall Sediment Structure	SW Bertha at Chestnut (nodes ACS 179 to ACS325)	Insert sediment manhole or stormwater vault in storm line above Bertha (at node ACS170)
62	Fulton Park Parking Lot Retrofit	Gravel Parking lot in NE corner of Fulton Park	Redirect flow to vegetated areas
66	Shadow Hills Apartment Parking Lot Drainage	Shadow Hills Apartment, SW Vermont	Redirect road and parking lot runoff from culvert fill, stabilize culvert fills with erosion problems
67	Fred Meyer Stormwater Retrofit	Fred Meyer and Burger King Parking Lots on Barbur at Bertha	Treat parking lot and roof runoff in stormwater vaults, potential hanging planters from upper lot.
68	Bertha/Terwilliger Overpasses Water Quality	Bertha and Terwilliger Overpasses in Upper Central Canyon, Oregon Department of Transportation (ODOT) ROW	Monitor water quality concerns of stormwater runoff, route overpass stormwater into planters or stormwater vaults to treat quality for needed contaminants. Potential series of tiered planters.
73	Starbucks Strip Sediment Capture	Starbucks Strip Mall at Terwilliger and Taylor's Ferry	Construct catch basin sediment manholes for parking lot inlets
80	Neighborhood Downspout Disconnection Opportunities	Subdivision between Wilson High School and Bertha Blvd.; Capitol Hill Condominiums	Coordinate individual residential property downspout disconnection
81	ODOT Regional Water Quality Treatment Facility	ODOT ROW under Bertha and Terwilliger Overpasses in Upper Central Canyon	Monitor water quality concerns of stormwater runoff, model potential regional SW treatment facility for Interstate 5 and area runoff
84	Stephens Street Tree Planting	Neighborhood between Bertha and Wilson High School; Neighborhood south of Interstate 5 and east of Terwilliger	Plant street trees in identified neighborhoods, coordinate with Urban Forestry
96	Carson Street Flow Improvement	SW Fourth and Carson	Add sediment manhole to treat runoff from Carson at Fourth, keep Terwilliger flow off of Carson
99	Crestline/Ruby Stormwater Retrofit	Crestline, Ruby Streets Neighborhood	Visit site during wet weather to develop stormwater flow or treatment retrofit options (likely vaults) for this neighborhood
107	Street Cleaning	Plan Area	Conduct street cleaning in high-concern areas to collect urban pollutants before they enter stormwater system

OUTREACH OPPORTUNITIES

Public and commercial education programs are necessary to reach out to watershed residents and businesses to help improve watershed conditions. Public outreach and education is especially important in this subwatershed where there is a high level of interface between developed and undeveloped areas. Projects and programs in this category relate to a range of issues, such as maintenance practices, commercial pollution control practices, public stormwater education, pet waste cleanup, yard design and invasive species education, and dumping prevention.

These potential actions relate directly to SAC recommendation 22 (in the October 2002 report).

Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of existing City programs. Critical existing programs include: Public Outreach for Youth and Community Groups Program, and the Community Watershed Stewardship Program.

Potential actions from this category are listed below in Table 5 using the ranking number of each.

Table 5: Stephens Subwatershed Outreach Opportunities

Rank	Project/Program	Location	Project/Program Description
74	Cemetery Maintenance Practices Outreach	Riverview Cemetery	Outreach and education to improve cemetery maintenance practices related to soil and vegetation dumping, stormwater routing, stream protection, landscaping practices, etc. along 4700 feet of tributary stream.
76	Dumping Outreach	Plan Area	Dumping education and signs, fences, etc.
77	Invasive Species Outreach	Plan Area	Landowner education throughout the Willamette Watershed to control the spread of existing problem species, to prevent introduction of new invasive species, and to provide educational opportunities particularly in parks and other public and open spaces.
78	Commercial Pollution Prevention Outreach	Barbur Blvd. from 5th to 15th	Develop a pollution prevention outreach project to reduce watershed impacts of commercial sites on Barbur Blvd.
78	Local Improvement District (LID) and Green Practices Outreach	Citywide	Promote low impact development and green practices in private development, business, and residential operations
79	Naturescaping and yard tree outreach	Plan Area	Landowner education throughout the Willamette Watershed to encourage yard trees, naturescaping, and backyard habitat. Provide educational opportunities particularly in parks and other public and open spaces.
82	Pet Waste Outreach	Plan Area	Pet waste education, signs, bag stations and trash bins
83	Residential Maintenance Practices Outreach	Apartments and Condominiums above Interstate 5 along Stephens Creek	Conduct outreach, training, education for apartment and condominium owners, managers, or maintenance workers to protect and improve conditions of stream and riparian areas.

REVEGETATION OPPORTUNITIES

Efforts to improve the environmental conditions of our City's watersheds through revegetation and preservation of existing vegetation will increase the City's ability to achieve and maintain healthy watersheds. Impacts from impervious surfaces associated with urban development are well known. The preponderance of scientific evidence indicates that revegetation will improve physical-biological elements of the urban environment such as water quality, stream integrity, and fish and wildlife habitat. Cost savings on infrastructure expenditures, aesthetic, economic, and other community benefits can all be expected to result from revegetation projects. Over 100 articles and papers of available scientific literature were reviewed to establish a defensible basis for restoring the functional value of vegetation in the urban landscape. Revegetation projects relate directly to SAC recommendation 31 and 32 (in the October 2002 report). The Willamette Team has worked closely with the BES Revegetation Program and the PP&R Natural Resources Program in identifying these potential projects.

Potential actions from this category are listed below in Table 6 using the ranking number of each.

Table 6: Stephens Subwatershed Revegetation Opportunities

Rank	Project/Program	Location	Project/Program Description
9	Cemetery Tributary Revegetation	Cemetery Tributary Canyon along Taylor's Ferry	Remove invasive species and replant with natives along 3000 feet of tributary stream
16	Interstate 5 Tributary Revegetation	ODOT and City Property	Remove invasive plant species and revegetate with natives along 1200 feet of Stephens mainstem
17	Interior Cemetery Fork Revegetation	Cemetery Tributary Fork in Interior of Cemetery	Remove invasive species in interior block of Cemetery along 1200 feet of tributary stream
18	Middle Central Canyon Revegetation	ODOT and Private Land from End of Custer St. Pavement	Remove invasive plant species and revegetate with natives along 2200 feet of Stephens Creek
19	West Central Canyon Revegetation	ODOT and Private Property from Custer St. to Interstate 5	Remove invasive plant species and revegetate with natives along 1300 feet of Stephens Creek
25	Reach 2 Revegetation	Stephens Creek and Cemetery Tributary from Macadam to Cemetery Drive	Remove invasive species and replant with natives along 1000 feet of Stephens Creek
43	Fulton Park Revegetation	Fulton Park Ravine	Remove invasive plant species and revegetate with natives
44	Stephens Nature Park Revegetation	Stephens Creek Nature Park	Remove invasive plant species and revegetate with natives along 800 feet of Stephens Creek
45	Stephens Mouth Floodplain Revegetation	City Properties below Macadam Avenue	Remove invasives, plant natives to improve Willamette River floodplain habitat, soil stability, and long-term source of large woody debris (LWD) for 500 feet of off-channel stream habitat
55	Bertha Property Revegetation	Property near SW Bertha and Capital Hill Road	Remove structures, revegetate site to restore natural site functions and conditions.
56	Shadow Hills Apartment Revegetation	Shadow Hills Apartment, SW Vermont	Remove invasives and revegetate along mainstem and stream in SE corner of property.

Rank	Project/Program	Location	Project/Program Description
63	Christensen Lot Revegetation	PP&R Christensen Lot, SW 17th and Capitol Hill Road	Remove invasive plant species and revegetate with natives on PP&R property
69	Cloverleaf Apartments Revegetation	Cloverleaf Apartment Complex abutting south end of Nature Park	Remove invasives and revegetate 130 feet of stream through center of apartments.
70	Custer Park Swale Revegetation	Custer Park	Expand vegetated width of Custer Park Swale by 10 feet on each side
71	South Nature Park Outfall Revegetation	Outfall at south end of Nature Park (node ACS325)	Revegetate 70 feet of stream below storm outfall (node ACS325) in Stephens Creek Nature Park
72	SW Capitol Lot Revegetation	SW Capitol Hill Road	Remove invasives, revegetate site along 50 feet of stream, conduct landowner maintenance practices education, develop landowner maintenance agreement

PROTECTION AND POLICY OPPORTUNITIES

Projects and programs in this category represent opportunities to protect and improve watershed function, and habitat value, and connectivity through acquisition, zoning overlay, resource tracts, riverside plan protections, development standards review, building code review, and other protection programs and measures. These approaches will ensure that the highest quality areas are protected, and development that does occur in and near resource areas is completed with the most environmentally sensitive design and with the least impact.

Protection of areas with the highest remaining function and value has been identified as a cornerstone for effective watershed management (City of Portland 2004). Areas for which protection and policy actions could be pursued include:

- Remaining forested areas and stream remnants and associated ravines that serve as key habitat area anchors and connections between larger habitat areas
- Any area where vegetated floodplain is accessible to the river or natural, gently sloped banks are present
- Willamette wetlands and forest areas, natural banks, and tributary confluences are some of the highest quality habitats and most sensitive portions of the watershed
- Citywide development issues related to the amount of hardened banks, shallow water habitat, and riparian or floodplain vegetation

These protection and policy potential actions relate directly to SAC recommendations 10, 15, 16, 21, and 34 (in the October 2002 report).

A number of policy and regulatory strategies have been effectively used by the City to protect watershed resources. Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of existing City programs. Critical existing programs include: BPS Plan Districts, Regulatory Improvement Program, PBOT Planning, Urban Forestry Program, SWMM, development standards review, building code review, environmental review, Metro natural resources planning, and Portland Development Commission (PDC).

Potential actions from this category are listed below in Table 7 using the ranking number of each.

Table 7: Stephens Subwatershed Protection and Policy Opportunities

Rank	Project/Program	Location	Project/Program Description
10	Environmental Land Use and Zoning Program	Citywide and Stephens	Complete update to the City's natural resource inventories and the Environmental Overlay Zoning Program (BPS) to ensure that the highest quality habitats and most sensitive portions of the watershed (e.g., headwater drainages, steep slopes) are sufficiently protected and that development proposed in valuable resource areas meets standards to avoid, minimize, and if necessary, mitigate for adverse impacts. The update of this program is needed to reflect recent science and better data and to enhance protections for streams and drainages, wetlands, riparian areas and upland wildlife habitat. Coordinate this update with Metro's regional Goal 5 Fish and Wildlife Habitat Protection Program, and with an update of the Willamette River Greenway Program.
26	Cemetery Tributary 1 Easement Acquisition	Property along Taylor's Ferry	Acquire easement along 660 feet of headwater streams for area with no current e-zone protection
27	Cemetery Tributary 1 Property Acquisition	Property along Taylor's Ferry	Acquire property or easement with 660 feet of headwaters streams for area with no current e-zone protection
37	Central Canyon Property Acquisition	Property on SW Custer St.	Acquire 2.1 acre undeveloped residential property with high resource value along Stephens Creek
41	SW Texas 2 Property Acquisition	Property near SW Texas	Purchase property
54	Bertha Property Acquisition	Property near SW Bertha and Capital Hill Road	Purchase property
64	SW Capitol Hill Lot Easement Acquisition	SW Capitol Hill Road	Purchase resource easement for channel/riparian protection or treatment facility development
65	SW Texas Property Acquisition	Lot near SW Texas	Purchase lot along 500 feet of Stephens Creek headwaters
85	Central Canyon 2 Property Acquisition	Property along SW Custer St.	Acquire 1.1 acre undeveloped residential property with high resource value along Stephens Creek
85	Central Canyon 4 Property Acquisition	Property along SW Custer St	Acquire 0.3 acre undeveloped residential property with high resource value along Stephens Creek
87	Cemetery Tributary 2 Easement Acquisition	Property along SW Taylor's Ferry	Acquire resource easement along 100 feet of headwaters streams for area with no current e-zone protection
88	Cemetery Tributary 2 Property Acquisition	Property along SW Taylor's Ferry	Acquire property with 100 feet of headwaters streams for area with no current e-zone protection
91	Cemetery Tributary 3 Easement Acquisition	Property along SW Taylor's Ferry	Acquire resource easement along 150 feet of headwaters streams for area with no current e-zone protection
92	Cemetery Tributary 3 Property Acquisition	Property along SW Taylor's Ferry	Acquire property with 150 feet of headwaters streams for area with no current e-zone protection
93	Central Canyon 3 Property Acquisition	Property along SW Custer St.	Acquire 0.4 acre undeveloped residential property with high resource value along Stephens Creek
97	Acquisition Strategy	Citywide	Develop a long-term City acquisition/conservation easements/resource tracts strategy and program for applicable sites.5
98	City Policy Consistency	Citywide	Address conflicting City policy to improve effectiveness of watershed protection.6

[5] Just as the Olmstead plan at the beginning of the last century guided park property acquisition and management based on a long-term vision and specific goal, the City has an opportunity to prepare a prioritized and targeted strategy for acquisition as a central piece in the management and recovery of its watersheds. The City could set a goal for acquisition of the properties containing all important watershed function. Like the Olmstead plan, this would be a very long-term plan, requiring 50 to 60 years or more. Subwatersheds would be prioritized and within each subwatershed, acquisition targets could be based on a hierarchy of designations including: 1) existing high quality habitats as the top priority down through lower quality existing habitat; 2) enhancement sites; 3) undeveloped restoration sites to critical developed sites that would provide greatest benefit if acquired and restored.

[6] The City should consider a citywide policy on dealing with natural resource and housing issues. For example, having high-density multi-dwelling residential development (43.5 units per acre) on some of the steepest terrain in the City needs to be re-evaluated. Particularly since the state housing goal specifically allows land included in the local Goal 5 natural resource inventory to be excluded from the inventory of land used for determining housing density and housing type targets.

Rank	Project/Program	Location	Project/Program Description
100	Implementation and Enforcement of City Policies, Codes, and Rules	Plan Area	Evaluate implementation and enforcement of environmental and other existing regulations (such as stormwater, erosion control regulations, tree cutting on public property) and review of their effectiveness. City permit review and administration staff needs clear policy direction and conflict resolution mechanisms. Enforce all sites that have stormwater exposure and that should be included in the industrial/commercial NPDES stormwater permit program.
101	Low Impact and Green Development Practices	Citywide	Develop interbureau City policy and create or modify programs to promote low impact and green development/redevelopment design, construction, and practices citywide
102	NPDES Coordination	Plan Area	Coordinate NPDES permit-related efforts within the City for opportunities to provide input on future modifications to the City's NPDES permit, allow earlier identification of potential impacts of permit modifications on watershed restoration planning, and provide opportunity to recommend modifications of the NPDES monitoring program to optimize data collection efforts.
103	River Bank Treatment Policy	Citywide	Develop City policy to eliminate construction of new vertical walls, minimize use of pilings, encourage alternative and bio-engineered bank treatments, and protect existing beach, off-channel, vegetated, and shallow water habitats
104	ROW Runoff Policy	Citywide	Change City policies as needed to allow ROW runoff to be co-mingled with private water and be treated by either the public property owner or a private property owner, as appropriate
105	Stephens-Specific Stormwater Management Manual	Stephens subwatershed	Develop subwatershed-specific stormwater manual guidelines for new and redevelopment sites with Bureau of Development Services (BDS). Develop effective impervious area (EIA) targets for new and existing development with Stephens subwatershed. Pursue City policy and codes that would limit EIA to a maximum level.
106	Stormwater Management Manual Update	Plan Area	Develop subwatershed-specific stormwater manual guidelines for new and redevelopment sites with BDS. Develop EIA targets for new and existing development watershed-wide and for each subwatershed. Pursue City policy and codes that would limit EIA to a maximum level.
108	Transportation infrastructure development, operations, and maintenance	Citywide	To be developed
109	Tree Canopy Management	Citywide	Develop interbureau city policy to manage citywide tree canopy, develop tree canopy targets for subwatersheds
110	Update Willamette River Greenway Program	Plan Area	To be developed
111	Wood Retention Policy	Citywide	Develop an interbureau wood retention policy

MAINTENANCE OPPORTUNITIES

Maintaining a functional sewer infrastructure is a BES core charge. Opportunities in this category include sewer maintenance actions related to the protection and improvement of watershed conditions.

These maintenance potential actions relate directly to SAC recommendation 1 from in the October 2002 report.

Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of existing City programs. Critical existing programs include: PBOT Maintenance Operations; and BES Wastewater Maintenance, Spill Protection and Citizen Response Section, Illicit Discharge Controls, Industrial Pretreatment Program, and the Industrial Stormwater Program.

Potential actions from this category are listed below using in Table 8 the ranking number of each.

Table 8: Stephens Subwatershed Maintenance Opportunities

Rank	Project/Program	Location	Project/Program Description
35	Central Canyon Sanitary Line Relocation	Central Canyon above Taylor's Ferry	Relocate sanitary line away from Stephens Creek channel in Central Canyon above Taylors Ferry
36	Central Canyon Sanitary Line Maintenance	Sanitary Mainline along Stephens Creek in Central Canyon	Identify and repair sanitary line leaks to Stephens Creek
89	Maintenance Inspection Program	Citywide	Conduct maintenance inspections of existing facilities, illicit discharges, etc.

STREAM ENHANCEMENT OPPORTUNITIES

These specific stream enhancement projects are designed to improve the amount and quality of important habitat conditions in the Willamette River channel and Stephens Creek. The lower Willamette functions as a critical salmonid migration corridor and rearing grounds, and the ecological effects of local conditions impact Chinook, coho, and steelhead populations throughout the entire Willamette basin. EDT analyses indicate that conditions in the lower Willamette River are an important bottleneck for populations throughout the Willamette basin. Although the lower Willamette is not typically the highest priority reach for restoration in any of the analyses of individual focal species populations, it is a relatively important reach for many of the populations. The fact that all the populations in the Willamette basin must pass through the lower river makes the lower Willamette's cumulative effect on the basin's populations a high priority. These projects also relate directly to SAC recommendation 33 from the October 2002 report.

Projects in this category will increase habitat extent and diversity by daylighting stream channels, reducing bank hardening, creating shallow water and off-channel habitat, increasing tributary stream accessibility, adding channel complexity, and increasing channel stability.

Selection, design, and implementation of these projects will be coordinated with or rely directly on a variety of existing City and other agency programs. Critical existing programs include: Superfund, Water Resources Development Act, River Renaissance, BPS and Metro habitat

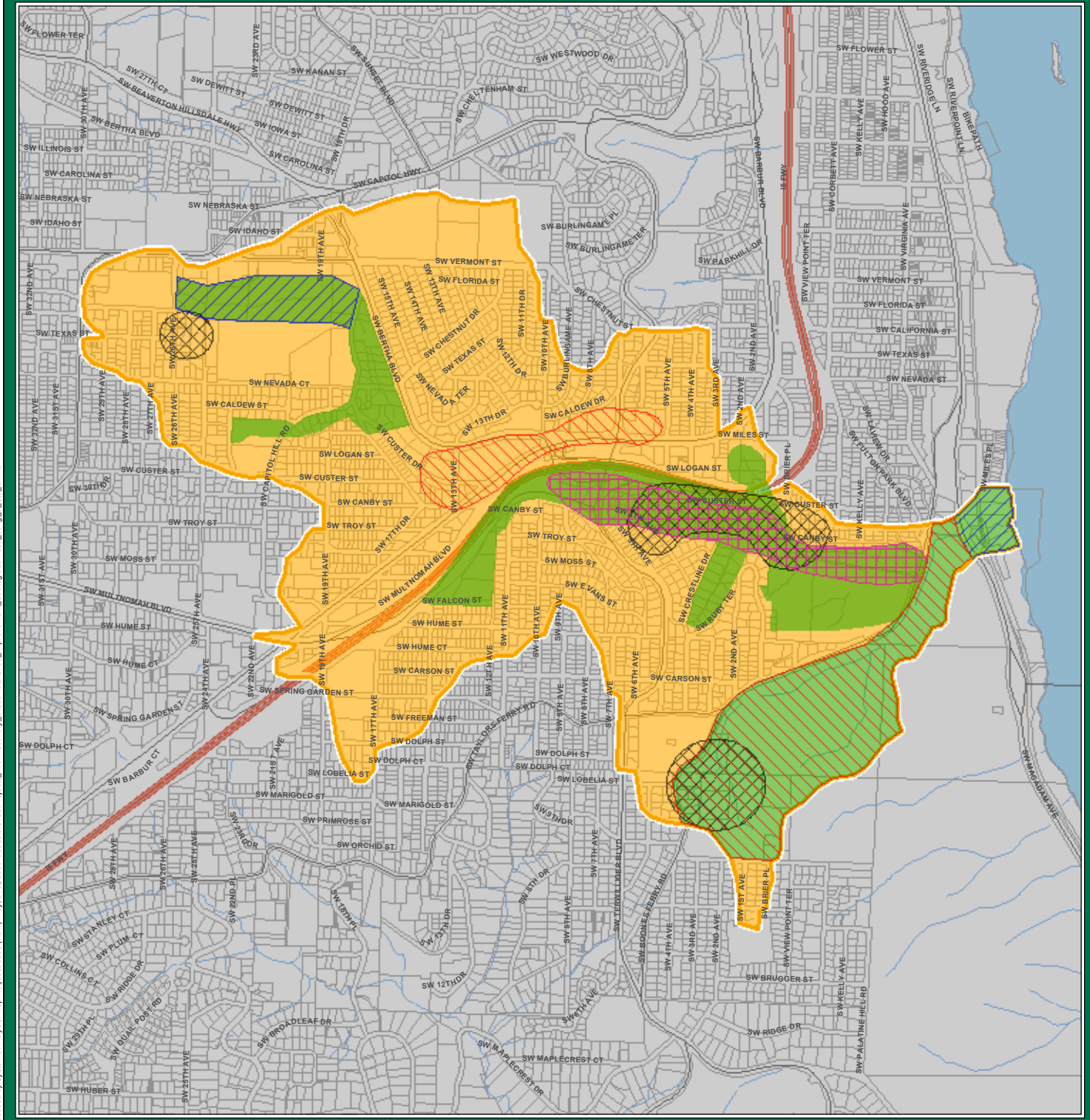
inventories, ESA, PP&R Natural Resource Program, Oregon Department of Fish and Wildlife Restoration and Enhancement Program, Oregon Watershed Enhancement Board, the Oregon Plan for Salmon and Watersheds, Metro Title 3 Project, the Northwest Power Planning Council Columbia Fish and Wildlife Program, Oregon Subbasin Planning Coordination Group, and the Willamette River Initiative.

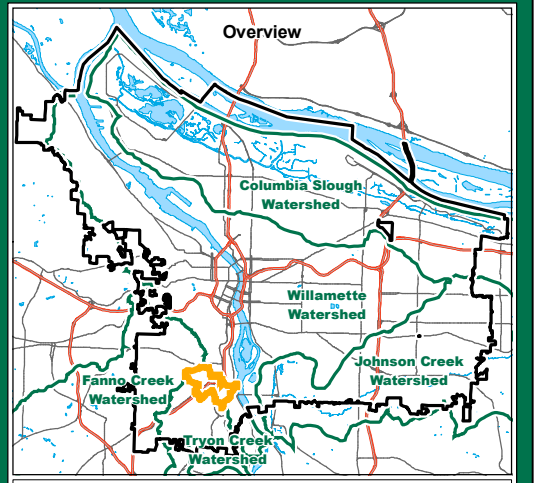
Potential actions from this category are listed below in Table 9 using the ranking number of each.

Table 9: Stephens Subwatershed Stream Enhancement Opportunities

Rank	Project/Program	Location	Project/Program Description
1	Willamette River Floodplain Off-Channel Habitat	Willamette River Floodplain	Develop side channel and wetland habitat with connectivity to Stephens Creek and the Willamette River
3	Willamette Bank Redesign	Willamette Riverbank	Redesign and restore banks of the Willamette River to increase floodplain connectivity and habitat for fish (including large woody debris)
6	Reach 1 Redesign and Revegetation	Stephens Creek Reach 1 - Railroad Bridge to Mouth	Re-design and restore Stephens streambanks to increase floodplain connectivity and habitat for fish (including large woody debris)
7	Shadow Hills Apartment Stream Restoration	Shadow Hills Apartment, SW Vermont	Re-design banks to increase floodplain connectivity. Improved floodplain function based on a 6-foot width
11	Taylor's Ferry Culvert Replacement	Taylor's Ferry Crossing of Stephens Creek	Replace crossing to allow fish passage to Stephens Creek Central Canyon. Based on total crossing and steam length of 4200 feet and improved floodplain function for a 10-foot width for culvert length. Will require analysis of feasibility of fish passage and use above current extent to identify maximum fish use possible. Anecdotal information suggests natural stream gradient near location of Macadam crossing and above may be an impediment to fish passage regardless of man-made barriers.
15	SW Texas Wetland Restoration	Property near SW Texas	Restore wetland functions
24	Spring Creek Condominiums Stream Restoration	Spring Creek Condos, SW Vermont	Re-design and revegetate 500 feet of steambanks and widen buffer of stream through apartments. Improved floodplain function based on a 4-foot width
40	Capitol Hill Condominiums Stream Daylighting	Capitol Hill Condos, SW Bertha and Capitol Hill Rd, and Shadow Hills Apartments, SW Bertha and Vermont	Daylight stream through condominiums. Five-foot wide improved floodplain function assumed.
57	Shadow Hills Apartment Culvert Replacement	Shadow Hills Apartment, SW Vermont	Remove invasives and revegetate along mainstem and stream in southeast corner of property.
61	Spring Creek Condominiums Tributary Daylighting	Spring Creek Condos, SW Vermont	Remove piped section of stream south and east of building. Improved floodplain function based on a 4-foot width
86	Macadam Culvert Replacement	Macadam Crossing of Stephens Creek	Replace crossings to allow fish passage in Stephens Creek to Taylors Ferry. Based on a crossing and stream length of 800 feet and improved floodplain function for a 10-foot width for culvert length. Will require analysis of feasibility of fish passage and use above current extent to identify maximum fish use possible. Anecdotal information suggests natural stream gradient near location of Macadam crossing and above may be an impediment to fish passage regardless of man-made barriers.

Rank	Project/Program	Location	Project/Program Description
90	Bertha Property Stream Restoration	Property near SW Bertha and Capital Hill Road	Daylight and restore 360 feet of stream. Improved floodplain function based on a 6-foot width
94	Railroad Culvert Replacement	Railroad Crossing of Stephens Creek	Replace crossings to allow fish passage in Stephens Creek to Macadam. Based on a crossing and stream length of 170 feet (cemetery tributary not included) and improved floodplain function for a 10-foot width for culvert length. Will require analysis of feasibility of fish passage and use above current extent to identify maximum fish use possible. Anecdotal information suggests natural stream gradient near location of Macadam crossing and above may be an impediment to fish passage regardless of man-made barriers





Legend

- City of Portland
- Subwatershed Boundary
- Existing Taxlots
- Freeways
- Open Channel streams

Stephens Subwatershed Concept Strategies

- Education, Involvement & Stewardship
- Maintenance
- Aquatic & Terrestrial Enhancement
- Protection & Policy
- Revegetation
- Stormwater

1 inch equals 1,500 feet

N W E S

0 1,500 3,000 Feet

CITY OF PORTLAND
ENVIRONMENTAL SERVICES
Systems Analysis
Spatial Analysis and Modeling

Southwest Subwatersheds Improvement Strategies

Figure-6
Stephens Concept Plan

Project No.	Date Printed:
8800	05/21/09

Produced by Systems Analysis, Map Request 5038 (KDR) May. 21st, 2009 \\Cassio\GIS3\Projects_Arc\Misc\Mary_B\Subwatershed_Improvement_Strategies\Phase_5\Fig_6_Ste_2.mxd

SECTION 7: RECOMMENDATIONS

Stephens Creek from Headwaters to Confluence – Progress Report

Between 2004 and 2009, the City of Portland (City) invested considerable resources to improving watershed function in the Stephens Creek subwatershed from the headwaters to the confluence. Large projects were implemented that addressed eleven of the improvements that were identified in the 2004 draft Stephens Subwatershed Improvement Strategies report.

Southwest Texas Street – Green Street and Wetland Enhancement Project

The SW Texas Street project at the headwaters of Stephens Creek was completed in 2007. Localized flooding from unimproved streets around SW Texas Street caused significant erosion and led many property owners to improvise stormwater systems. Property owners formed a local improvement district (LID) to fund street and stormwater improvements. Project elements include construction of street swales and the acquisition and restoration of a 0.62 acre wetland to manage stormwater runoff from a 17 acre basin. Project partners included the BES Watershed Revegetation Program (WRP), the Portland Bureau of Transportation (PBOT), the Portland Water Bureau, and the U.S. Environmental Protection Agency (EPA). The opportunities that were implemented as part of this project include:

- SW Texas Green Street (4)
- SW Texas Wetland Restoration (15)
- SW Texas 2 Property Acquisition (41)

Burlingame Sanitary Trunk Sewer Repair and Stephens Creek Central Canyon Stream Restoration

Phase I of this project, completed in 2006, repaired a leaking 52-year-old concrete sanitary line that parallels the creek in the central canyon at a very shallow depth. High stream flows generated by stormwater runoff from impervious surfaces had eroded the stream bank and exposed parts of the sewer. Phase II of the project, completed in 2008, involved reconstructing the stream channel and bank further south in some locations to direct the flow away from the sewer to protect it. Both phases included removing non-native, invasive vegetation and planting native plants and trees. Project partners included: WRP, PBOT, the Oregon Department of Environmental Quality (DEQ), the Oregon Division of State Lands (DSL), the Oregon Department of Fish and Wildlife (ODFW), EPA, and the U.S. Army Corps of Engineers (USACE). The opportunities that were implemented as part of this project include:

- Central Canyon Sanitary Line Relocation (35)
- Central Canyon Sanitary Line Maintenance (36)

To augment the pipe repair and stream enhancement projects, the WRP team is currently working to restore over 10,500 linear feet of stream bank by partnering with 25 private property owners, Portland Parks and Recreation (PP&R), Metro, and Oregon Department of Transportation (ODOT) to remove invasive ivy and revegetate with native plants on over 56 acres. Funding for monitoring and maintenance is secure for five years. The revegetation projects that were implemented between 2004 and 2009 include:

- Middle Central Canyon Revegetation (18)
- West Central Canyon Revegetation (19)

Stephens Creek Confluence Aquatic and Terrestrial Habitat Enhancement
The Stephens Creek confluence provides critical rearing and refuge habitat for native, ESA-listed Chinook and coho salmon and steelhead trout, rainbow and cutthroat trout, and Pacific and brook lamprey. The Stephens Creek Confluence Habitat Enhancement project, completed in 2009, improves in-stream, stream bank, and floodplain wetland habitat for native fish and wildlife. Project elements included removing a decommissioned combined sewer overflow (CSO) pipe on the north side of the stream, grading the bank to reconnect the flood plain to the river, reclaiming the historic side channel by excavating on the south side of the stream, placing large wood structures along the stream channel and the river, removing invasive plants, and revegetating wetland and riparian areas. Project partners included: WRP, PP&R, Friends of Trees, Macadam Bay Homeowners Association, DEQ - Volunteers In Action, South Portland Neighborhood Association, and Willamette Riverkeeper. The opportunities that were implemented as part of this project include:

- Willamette River Floodplain Off-Channel Habitat (1)
- Willamette Bank Redesign and Revegetation (3)
- Reach 1 Redesign and Revegetation (6)
- Stephens Mouth Floodplain Revegetation (45)

Stephens Creek from Headwaters to Confluence – Next Steps

The three previously mentioned groups of projects were critical advancements in addressing the health of Stephens Creek. However, the progress made will be temporary unless additional impaired subwatershed functions are addressed and remedied. Thus, BES will continue to work to partner with stakeholders to implement additional projects identified in the 2004 Draft Stephens Subwatershed Improvement Strategies Report. Particular importance will be placed on programs that will insure that the public investments in existing projects are enhanced and protected from degradation.

Central Canyon Recommendations

Background
In 2007 and 2008, the City invested considerable resources at Stephens Creek in the central canyon. A leaky sanitary pipe adjacent to the channel was repaired in 2007, and in 2008, BES constructed a stream channel restoration project. The projects improve water

quality by repairing and protecting critical sewer infrastructure, reducing stream bank erosion, and restoring gravel and sediments to the stream channel. A number of projects and programs are described here that would continue to enhance the central canyon and would protect the investments made in 2007-08.

Site Description
The Stephens Creek Central Canyon area is a large forested tract with steep ravines. The stream channel is open and has some of the best channel and riparian habitat in the subwatershed. Stephens Creek is one of the few streams along the Willamette River within Portland City limits that reaches the river in an open channel. Just beyond the forested tract, the creek is paralleled by Interstate 5 at the Terwilliger Curves. This stream channel reach is approximately 4,500 feet long, and the riparian area is comprised of approximately 10 acres.

Constraints
Stormwater inputs to the canyon are contributed directly from a highly developed commercial and transportation corridor. The high density of impervious surface in the drainage basin delivers high volume storm flows and urban pollutants directly to Stephens Creek. Stormwater runoff from Interstate 5 and adjacent drainage basins is concentrated in this section of the canyon causing erosive flood events and inputs of pollutants from a wide variety of non-point sources. The canyon walls adjacent to this section of Stephens Creek are steep, limiting the ability to construct best management practice (BMP) improvements to address the problems relative to the adjacent land use. Additionally much of the land that could provide restoration value adjacent to the creek is in private ownership.

Partnerships
The Willamette Watershed team will partner with staff from other City bureaus, agencies, citizens' groups, and private property owners to protect the area's natural resources and implement stormwater solutions that integrate the urban area with the natural environment. Potential partners include: PP&R, WRP, Sustainable Stormwater team, PBOT, and ODOT.

Potential Funding Sources
Potential funding sources include: BES 1% for Green Program, Watershed Investment Fund (WIF) , Capital Improvement Program (CIP) funds, Grey to Green, Oregon Department of Agriculture (ODA), Oregon Watershed Enhancement Board (OWEB), ODFW, and National Fish and Wildlife Foundation (NFWF).

Benefits
The projects grouped below provide a number of watershed health benefits including:

- Permanently protected riparian corridor and stream channel from urban development.
- Protected habitat connectivity that is unique in Portland's urban environment.
- Protected city and community restoration and enhancement investments.
- Continued investment in restoration of unique habitats for priority species.

- Expanded opportunity to build stormwater treatment facilities to improve water quality and hydrologic function of the stream.

Opportunities for Potential Projects and Programs
Opportunities are organized by the following improvement strategies: Stormwater retrofits, aquatic and terrestrial enhancements, and policy and protection.

Stormwater Management Projects

All stormwater management projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Bertha/Terwilliger Overpasses Water Quality (68)
- ODOT (Interstate 5) Regional Water Quality Treatment Facility (81)

Stream Restoration

All stream restoration projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Taylors Ferry Culvert Replacement (11)

Protection and Policy Projects

All protection and policy projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Four Central Canyon Property Acquisitions (37), (85), (93), (95)

Stephens Creek Natural Area Recommendations

Background
Stephens Creek Natural Area acts as a refuge for native plant and wildlife resources. The park is used for walking and nature observation. The park is the recipient of community stewardship, neighborhood voluntary revegetation efforts, and clean up projects. Enhancement and revegetation efforts have been ongoing in this park since 2000.

Site Description
Stephens Creek Natural Area is located to the south of Bertha Boulevard. It is a neighborhood open space approximately four acres in size. The natural area acts as a refuge for native plant and wildlife resources. The adjacent areas are important to enhancing and protecting the function of the refuge.

Constraints
Project constraints include costs and potential conflicts with recreational park users during construction.

Partnerships
The Willamette Watershed team will partner with staff from other City bureaus, agencies, citizens' groups, and private property owners to protect the area's natural resources and implement stormwater solutions that integrate the urban area with the natural

environment. Potential partners include: PP&R, WRP, Sustainable Stormwater team, PBOT, and ODOT.

Potential Funding Sources
Potential funding sources include: BES 1% for Green Program, WIF, CIP funds, Grey to Green, ODA, OWEB, ODFW, and NFWF.

Benefits
The projects grouped below provide a number of watershed health benefits including:

- Permanently protected riparian corridor and stream channel from urban development.
- Protected habitat connectivity that is unique in Portland's urban environment.
- Protected city and community restoration and enhancement investments.
- Continued investment in restoration of unique habitats for priority species.
- Expanded opportunity to build stormwater treatment facilities to improve water quality and hydrologic function of the stream.

Opportunities for Potential Projects and Programs
Opportunities are organized by the following improvement strategies: Stormwater retrofits, aquatic and terrestrial enhancements, revegetation, and policy and protection.

Stormwater Management Projects

All stormwater management projects will require agreements with property owners. Potential projects and their rankings are as follows:

- North Nature Park Outfall Sediment Capture (21)
- SW Capitol Hill Lot Treatment Facility (53)
- South Nature Park Outfall Sediment Structure (60)

Stream Restoration

All stream restoration projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Bertha Property Restoration Project (90)

Revegetation Projects

All revegetation projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Stephens Creek Nature Park Revegetation (44)
- Bertha Property Revegetation (55)
- Christensen Lot Revegetation (63)
- Cloverleaf Apartments Revegetation (69)
- South Nature Park Outfall Revegetation (71)
- SW Capitol Lot Revegetation (72)

Protection and Policy Projects

All protection and policy projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Bertha Property Acquisition (54)
- SW Capitol Hill Lot Easement Acquisition (64)

Texas Wetland Recommendations

Background

The Texas Wetland and Green Street project at the headwaters of Stephens Creek was constructed in 2007. The wetland was restored with native plants, making it a wildlife sanctuary and educational resource. BES acquired the wetland property as a key element of the project design and function. Expanding the restoration area and buffering City investments through property acquisition are goals of the expanded recommendations.

Site Description

The project area is a 17-acre basin bounded by SW California Street, SW Nevada Court, SW Capitol Highway, and SW 26th Avenue. The existing area includes swales and a reconstructed wetland detention area designed to manage stormwater runoff at the North Branch of Stephens headwaters.

Constraints

Expansion of the wetland at the headwaters of Stephens Creek may be constrained by adjacent developed properties. Where expansion is feasible (in rights of way and with private landowner agreements), construction may be constrained by costs. Acquisition will be constrained by landowner willingness to sell their property and costs.

Partnerships

The Willamette Watershed team will partner with staff from other City bureaus, agencies, citizens' groups, and private property owners to protect the area's natural resources and implement stormwater solutions that integrate the urban area with the natural environment. Potential partners include: PP&R, WRP, Sustainable Stormwater team, PBOT, and ODOT.

Potential Funding Sources

Potential funding sources include: BES 1% for Green Program, WIF, CIP, Grey to Green, ODA, OWEB, ODFW, and NFWF.

Benefits

The projects grouped below provide a number of watershed health benefits including:

- Permanently protected riparian corridor and stream channel from urban development.
- Protected habitat connectivity that is unique in Portland's urban environment.
- Protected city and community restoration and enhancement investments.
- Continued investment in restoration of unique habitats for priority species.
- Expanded opportunity to build stormwater treatment facilities to improve water quality and hydrologic function of the stream.

Opportunities for Potential Projects and Programs
The primary recommended opportunity is within the policy and protection strategy:

Protection and Policy Projects

All protection and policy projects will require agreements with property owners. Potential projects and their rankings are as follows:

- SW Texas Property Acquisition (65)

Terwilliger Corridor Stormwater Recommendations

Background
Stormwater runoff from roadways and other impervious surfaces in the Terwilliger Corridor is routed into pipes that discharge into Stephens Creek (Figure 3). This leads to various problems such as pollutants entering the creek, significant increases in flow during rain events, and erosion of the creek bed. Water quality monitoring data have identified pollutants such as phosphates, copper, lead, zinc, pH, and chromium as potential water quality concerns for Stephens Creek. Pollutants are delivered to the Willamette River, potentially impacting water quality conditions in the river. These are also potential water quality concerns for groundwater.

The parameters identified as potential water quality concerns in this subwatershed are typical urban pollutants. Urban stormwater nonpoint-source pollution is likely a cause of some of the water quality problems in this subwatershed. Commercial and transportation corridors are likely the highest sources of these pollutants. The goal of this project is to reduce these non-point source pollutants and reduce the underlying source of the altered stream hydrograph. These may be achieved through outreach to private property owners, PBOT, and ODOT, to inform them of City programs to encourage the reduction of untreated stormwater inputs to Stephens Creek.

Site Description
High volume stormwater runoff events occur in the Terwilliger Corridor. Impervious surface sources include Interstate 5 and Barbur Boulevard. North of Interstate 5, major streets include Bertha Boulevard, Vermont Street, and Custer Drive; and to the south, major streets include Terwilliger Boulevard and Taylor's Ferry Road. Much of the impervious area from parking lots (1.8% of total subwatershed area) is in the Terwilliger corridor.

Constraints
Establishing a funding source for staff time to implement the outreach project may constrain implementation. Some potential stormwater project sites may be constrained by geotechnical (soils/infiltration) concerns and other environmental issues as a result of the area's former land uses.

Partnerships

The Willamette Watershed team will partner with staff from other City bureaus, agencies, citizens' groups, and private property owners to protect the area's natural resources and implement stormwater solutions that integrate the urban area with the natural environment. Potential partners include: PP&R, WRP, Sustainable Stormwater team, PBOT, and ODOT.

Potential Funding Sources
Potential funding sources include: BES 1% for Green Program, WIF, CIP, Grey to Green, ODA, OWEB, ODFW, and NFWF.

Benefits
The projects grouped below provide a number of watershed health benefits including:

- Permanently protected riparian corridor and stream channel from urban development
- Protected habitat connectivity that is unique in Portland's urban environment
- Protected city and community restoration and enhancement investments
- Continued investment in restoration of unique habitats for priority species
- Expanded opportunity to build stormwater treatment facilities to improve water quality and hydrologic function of the stream

Opportunities for Potential Projects and Programs
Opportunities are organized by the following improvement strategies: Stormwater retrofits, and education, involvement and stewardship.

Stormwater Management Projects

All stormwater management projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Cloverleaf Apartments Stormwater Retrofit (48)
- Aboy/U.S. Bank Stormwater Retrofit (14)
- Fred Meyer Ecoroof (20)
- Hollywood Video Stormwater Retrofit (30)
- Safeway Stormwater Retrofit (32)
- Fulton Park Parking Lot Retrofit (62)
- Fred Meyer Stormwater Retrofit (67)

Education, Involvement and Stewardship Projects

Potential projects and their rankings are as follows:

- Commercial Pollution Prevention Outreach (75)

Stephens Creek Aquatic Connectivity Recommendations

Background
The Stephens Creek confluence with the Willamette River provides critical rearing and refuge habitat for native, ESA-listed Chinook and coho salmon and steelhead trout, rainbow and cutthroat trout, and Pacific and brook lamprey. A project was constructed at the confluence in the summer of 2008 to improve in-stream, stream bank, and floodplain

wetland habitat for native fish and wildlife. Culverts in Stephens Creek are a limiting factor in connecting the "optimal" aquatic habitat of the lower reach of Stephens Creek to the confluence area. The goal of this project is to remedy the aquatic connectivity barrier.

Site Description
This area in the Stephens subwatershed has natural riverbanks and high quality remnant bottomland wetlands. The floodplain at the confluence of the Willamette River and Stephens Creek has high habitat value and serves as important off-channel habitat for Willamette River fish communities. Studies show that this area is one of the most productive in the City for fish community diversity and abundance, for Chinook, coho and steelhead. The reach of Stephens Creek from Macadam Avenue to Taylors Ferry was rated optimal for fish habitat in the "Riparian and Stream Habitat Assessment of Stephens Creek" (HARZA 2000).

Constraints
Project constraints include costs and potential conflicts with high volume traffic corridors during construction. Design and permitting of culvert replacement projects will require considerable staff time on the part of project managers.

Partnerships
The Willamette Watershed team will partner with staff from other City bureaus, agencies, citizens' groups, and private property owners to protect the area's natural resources and implement stormwater solutions that integrate the urban area with the natural environment. Potential partners include: PP&R, PBOT, and ODOT.

Potential Funding Sources
Potential funding sources include: BES 1% for Green Program, WIF, CIP, Grey to Green, ODA, OWEB, ODFW, NFWF, and ODOT.

Benefits
The projects grouped below provide a number of watershed health benefits including:

- Permanently protected riparian corridor and stream channel from urban development
- Protected habitat connectivity that is unique in Portland's urban environment
- Protected city and community restoration and enhancement investments
- Continued investment in restoration of unique habitats for priority species
- Expanded opportunity to build stormwater treatment facilities to improve water quality and hydrologic function of the stream

Opportunities for Potential Projects and Programs
Opportunities are organized by the following improvement strategies: Aquatic and terrestrial enhancements and revegetation.

Stream Restoration

All stream restoration projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Macadam Culvert Replacement (86)
- Railroad Culvert Replacement (94)
- Taylors Ferry Culver Replacement (11)

Revegetation Projects

All revegetation projects will require agreements with property owners. Potential projects and their rankings are as follows:

- Reach 2 Revegetation (25)

SECTION 8: REFERENCES

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City of Portland. 2005a. Portland Watershed Management Plan.

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Schueler, Thomas R. and Heather K. Holland, Eds. 2000b. Crafting Better Watershed Protection Plans, from The Practice of Watershed Protection. pp. 162 – 170.

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Appendix A. Improvement Strategies Process Steps

This appendix provides detail about the subwatershed improvement strategy (IS) steps. Discussion of the first two steps in particular, Project Management and Public Involvement, were removed from the main text to focus on the steps critical to developing improvement opportunities. The following complete set of steps was used to identify priority IS opportunities for the Stephens subwatershed in 2005, and can be replicated for future use:

Step 1: Project Management

Project Management includes preparing for and sustaining the IS process, which includes directly involving other City programs and bureaus. General project management should continue throughout the process, but much of the coordination, scheduling, and development of materials (Appendix C) occurs early in the process. The following work items are included in the Project Management step:

1.1. Project Scheduling and Coordination

- Schedule project work periods, meeting/workshop dates, product deadlines
- Assign staff responsibilities and review schedule and responsibilities with staff team
- Update schedule throughout IS process to reflect current status
- Update managers (weekly or bi-weekly) throughout IS process

1.2. Project Team Set-Up and Coordination

- Coordinate a Project Team for review, input, and workshops – Willamette Watershed Team plus appropriate representatives, such as Portland Parks and Recreation (PP&R), PBOT Maintenance Operations, Combined Sewer Overflow (CSO) staff, Source Control, etc.
- Coordinate schedule, roles, and responsibilities with Project Team and all appropriate staff
- Update coordination log to document conversations throughout IS process

1.3. Protocol Review and Update

- Review protocol and field forms as they pertain to specific subwatershed conditions, and update as necessary
- Review and update protocol and field forms as needed at beginning and end of process

Step 2: Public Involvement

Public involvement provides stakeholder input to the IS process. These efforts also served as a longer-term effort towards coordinating the implementation of opportunities with local residents.

Specific activities were conducted for the Stephens subwatershed. First, the Willamette Team worked with residents in the upper headwaters vicinity of SW 26th and Texas to evaluate stormwater and stream enhancement opportunities in this area. This effort was prompted by the citizens and has resulted in multiple potential projects identified in subtask 7 of this report.

Second, two presentations were given at the Hillsdale and Multnomah Neighborhood Association meetings. These meetings were opportunities for the Willamette Team to talk with residents about watershed planning in general, but also specifically about their watershed, and the process of developing improvement opportunities. Several detailed suggestions came out of these meetings, which were captured as potential projects in this report or will relate to project implementation. Materials from the Hillsdale Neighborhood Association meeting can be found in Appendix D.

In addition, the Willamette Watershed Team has developed a public involvement strategy to guide future efforts. Public involvement activities should be coordinated with other watershed plans and related projects [e.g., Bureau of Planning and Sustainability's (BPS) natural resource inventory (NRI) update and Metro's Goal 5 Fish and Wildlife Habitat Protection Program].

The following general work items are included in the Public Involvement step:

2.1. Public Involvement Planning
- Identify public involvement goals and opportunities for the subwatershed

2.2. Public Meetings
- Develop informational materials
- Give presentations to neighborhood associations and interest groups
- Incorporate public input into the IS process and products

Step 3: Subwatershed Conditions

Subtask work items include:

3.1. Review and Compilation of Existing Information
- Review Subwatershed Characterization to identify asset areas, areas of concern, causes, and data gaps
- Compile and review additional information that is not integrated into the Characterization, from sources including (but not limited to):
    - Public input
    - Bureau of Environmental Services (BES) staff (e.g., public and private facilities maps, previous Incentive and Sustainable Stormwater program work with properties within the subwatershed)
    - PP&R (e.g., draft NRI)
    - BPS (e.g., BPS/Metro surveys)
    - Metro (e.g., Inventory of regionally significant resources)
    - Oregon Department of Fish and Wildlife (ODFW) surveys
- Document subwatershed assets, problems, causes, and data gaps, with Project Team input and review at Integration Exercise (See Subtask 3.3)

3.2. Subwatershed Reconnaissance
- Conduct half-day field assessment visit to subwatershed to become familiar with identified assets and problems and to identify additional information (appropriate Staff Team members or potentially Project Team as well). Also look for general areas where potential actions

might apply (e.g., downspout disconnect), efficient driving routes, and any information that will directly affect the field assessments.
- Update assets and problems information as necessary

3.3. Integration Exercise
- Schedule Integration Exercise with Project Team (up to 3 hours), send out draft problem and asset memo for review one week before meeting
- Prepare materials – process summary, problem and asset memo, aerial photography and theme maps of subwatershed
- Conduct Integration Exercise with Project Team. The exercise is to review the IS process and Project Team role, review known problems and assets information, review accuracy and completeness of problems and assets information, and identify initial potential action concepts, sites, and specific considerations.

Step 4: Subwatershed Objectives

Subtask work items include:

4.1. Objectives Review and Measures Development
- Review watershed objectives
- Identify measures for each objective by which to assess potential actions with Project Team input and review

4.2. Objectives and Measures Review and Weighting
- Schedule Objectives Review Meeting with Project Team. Send out objectives and potential measures for review ahead of meeting
- Prepare meeting materials – objectives and measures copies, large aerial photo and theme maps of subwatershed for walls.
- Conduct Objectives Review Meeting with Project Team:
    - Review significance of each objective based on subwatershed conditions
    - Assign weights to objectives and measures based on magnitude of problems in the subwatershed. List the objectives, and have the Project Team rank them in order of importance (1-X, with 1 being the most important, X being the least important). Assign the highest-ranked objective a rate of 100 points. Ask the question, "The top objective gets 100 points; what fraction of this number is each of the other objectives worth?" Assign a rate to each, then calculate weights by dividing each rate by the sum of all rates. The weights should add to 1.

Step 5: Strategies and Potential Actions

Subtask work items include:

5.1. Compile Potential Actions
- Review and compile identified potential actions and recommendations from the Characterization, Integration Exercise, the Willamette River restoration projects database,

stakeholder and public involvement input, Partnership Opportunities Memo, other City plans, completed/planned projects, or other sources

5.2. Document Potential Actions

- Document potential protection, restoration, retrofit, and programmatic actions compiled in Subtask 5.1 for the subwatershed. Identify sites to assess for each action, and additional research needed to guide field assessment evaluation of sites or actions.

5.3. Update Strategies and Actions List

- Update the list of strategies and general action types in the Portland Watershed Management Plan (PWMP).

Step 6: Field Assessment

Subtask work items include:

6.1. Mapping Exercise

- Identify areas and sites to visit during the field assessments and what actions might apply in these locations.
- Delineate and number the assessment units. Divide the subwatershed into units (e.g., residential, open space, PP&R properties, schools and churches)
- Supplies:
    - Paper maps (see above), one copy for each group
    - Laptop with ArcMap software to project electronic map onto wall
    - InFocus projector
    - Markers in multiple colors
    - Chart pack and easel
    - List of potential actions from previous subtask
- Create a map in ArcMap with following layers (plus any other pertinent):
    - Aerial photos
    - Parks and open space
    - Tax lots
    - Vacant land
    - Public land
    - Contour lines
    - Streets
    - Zoning
    - Buildings
    - Stream gradient
    - Capital Improvement Program project locations
    - Neighborhoods
    - Planning districts

    - Historic air photo
    - Depth to groundwater
    - Willamette subwatersheds
    - Environmental overlay zones (both existing and proposed)
    - BPS refined streams layer
    - Sewer infrastructure (including storm, sanitary, combined, and surface systems)
    - Willamette River (river miles, riverbank composition, current & historic depth)
    - Problem, asset or opportunity areas identified in previous reports
    - Impervious surface area
    - Superfund study area
    - Brownfield locations
    - Water quality sampling locations
    - Bureau Revegetation projects
    - Systems Analysis Geographic Information Systems (GIS) grid model results
    - Sewer basins (storm, sanitary, and combined)
    - Hydrology features (wetlands, waterbodies)
    - Soils (including hydric soils)
    - Metro's inventory of regionally significant riparian and wildlife resources
- Create large paper (D or E size) maps showing the streams, subwatershed boundary, and:
    - Aerial photo
    - Tax lots and Zoning
    - Impervious surface
    - Vacant land, E-zones, and Parks and Open Space
    - Institutional land (schools, churches, etc.)
    - Contour lines and Stream gradient
    - Unit boundaries
- Mapping Exercise
    - Designate a note-taker for the meeting
    - Split into groups of 2-3 (if there are enough participants)
    - Each group marks on the maps and chart pack what potential actions may apply and where, for each unit
    - Groups then compare results at end of meeting

6.2. Prepare for Field Assessments

- Schedule one half-day for each unit (or more if needed), plus two additional half-days for follow-up (in Stephens Creek a group of four covered six PP&R properties in one half-day). Each field assessment visit begins with a 30-minute meeting to review maps and the plan for the day.
- One to two Staff Team members should be scheduled for each field assessment visit. Also invite one or two pertinent Project Team members for each visit. For example, BOM staff for residential and industrial areas, Regulatory/Policy staff for institutional areas, and PP&R and BES Revegetation staff for parks and open space areas.
- Book one vehicle for each field assessment. Project Team staff (particularly BOM and PP&R staff) often have their own vehicles
- Contact landowners for access to private property in areas that cannot be assessed from public property or rights-of-way

- Compile a list of potential actions and locations identified in the Mapping Exercise, organized by unit for each field assessment visit
- Prepare field assessment kits: print field forms on write-in-rain paper, charge Geographic Positioning System (GPS) and camera batteries, extra clipboards, pencils, markers (see Field Assessment Checklist – Appendix F)

6.3. Field Assessments

- Create 11 x 17 maps showing aerials, tax lots and sewer infrastructure, parks, and E-zones for areas to be visited during the day's field assessments. Maps should be at a scale and size that is useful for notes and field drawings.
- At the meeting before heading into the field, look at maps and review the characteristics of the unit and the potential actions (and locations) that have been identified. Fill out as much of the UNIT form as possible (but not the Summary Data Sheet).
- In the field, visit previously identified sites for potential projects, look for new sites for potential projects, and note any new problem or opportunity sites and corresponding projects to address them. Fill out the appropriate forms (for forms, see Appendix F):

Potential Project	Form
Stream/Riparian protection or restoration	WPR – Watershed Protection/Restoration Data Sheet
Stream daylighting	SDY – Stream Daylighting Data Sheet
Stream bank stabilization	SBS – Stream Bank Stabilization Data Sheet
Upland protection or restoration	WPR – Watershed Protection/Restoration Data Sheet
Upland retrofit	URE – Upland Retrofit Data Sheet

Observation	Form
Upland source of pollutants	SOURCE – Upland Source Data Sheet
Stream reach general characteristics.	SREACH – Stream Reach Data Sheet
Stream structural crossing	SSC – Stream Structural Crossing Data Sheet
Stream erosion	SER – Stream Erosion Data Sheet
Stream utility impact	SUT – Stream Utility Impact Data Sheet
Stream bank engineering	SBE – Stream Bank Engineering Data Sheet

- Take GPS points and photos each time a new form is filled out. GPS points should be named using identification numbers that do not exceed six characters, as follows: XX#-01, where XX is a two-character initialization for the subwatershed, # is the unit number, and the point number is recorded as 01, 02, etc. (e.g., Stephens unit 3, point 8 is represented as: SP3-08).

6.4. Download and Store Data

- Download GPS data and digital photos. Check photos into FileNet.
- Fill out Unit Summary Data Sheet, listing projects identified during the field assessments
- Enter project information into Access database
- File field forms in appropriate folders

Step 7: Specific Action Opportunities

Subtask work items include:

7.1. Develop Complete Opportunities List

- Go through the database and fill out all applicable values for each opportunity
- Create a map showing all opportunity locations, labeled with appropriate GPS points
- Meet with appropriate staff (particularly BPS) to develop potential Protection and Policy category and Outreach category opportunities

7.2. Rank Opportunities based on Contribution to Watershed Health

- Using values for each opportunity and weights assigned by the Project Team, calculate overall score for each opportunity, using the analysis presented in Appendix B.

7.3. Review Opportunity List Content and Rankings

- Schedule Opportunity Review Meeting with Project Team. Send opportunity information (one summary sheet for each) to the Project Team, and ask for input on opportunities and suggestions for additional projects or programs. Allow at least one week for Project Team review. Print and distribute to the Project Team a list of the opportunities in rank order, a map showing locations, and a summary sheet for each.
- Prepare meeting materials and PowerPoint presentation of all opportunities, ranked with photos and maps for each
- Meet with the Project Team (less than 3 hours), to review subwatershed objectives, measures, and weights and review comments on the content and ranking of list of opportunities

APPENDIX B

Southwest Subwatersheds Improvement Strategies

Memo

To:	S.W. Subwatershed Project Team
From:	Willamette Watershed Planning Team
Task ID:	IS Evaluation: Opportunities Ranking Process
Date:	4/28/2009 5:43:00 PM
Subject:	**Improvement Strategies Task 5.1**

The subwatershed improvement strategy opportunity ranking process demonstrates how to assign a relative value to each opportunity (i.e., a project or program in a specific location) for improving subwatershed health conditions. The process does not take into consideration any feasibility or implementation factors. The rankings are not intended to represent a set order in which to implement projects or programs. Rather, they will inform the selection and implementation processes to guide which projects to pursue as opportunities become available.

The following steps were used to complete the ranking of improvement strategy opportunities for the Marquam-Woods, California, and Carolina-Terwilliger subwatersheds in 2008-2009, and can be replicated for future use:

1. **Develop a list of assets and problem areas** for the subwatershed based on literature review, inventories, and stakeholder input.

2. **Conduct field assessments to evaluate actions** (i.e., potential projects and programs) in areas identified through Step 1 for watershed improvement strategies. The necessary information for each action is stored in a database maintained by Willamette Watershed staff. Information collected and recorded for each action includes:
   - General information on the site assessed, staff involved, ownership, location, zoning, etc.
   - Description of the type of action proposed - size, location, potential actions etc.
   - Implementation considerations – limitations, coordination factors, etc.

   The field information documented for each site is used in the steps that follow to help quantify the degree to which potential actions will help improve watershed conditions.

3. **Select opportunities** from the identified actions based on the following objectives in the 2005 Portland Watershed Management Plan (PWMP):
   1. Stream Flow and Hydrologic Complexity
   2. Channel and Floodplain Function
   3. Stormwater Conveyance
   4. Aquatic Habitat
   5. Terrestrial Habitat
   6. Stream Temperature
   7. Human Pathogens

8. Urban Pollutants
9. Fish and Other Aquatic Organisms
10. Terrestrial Wildlife and Vegetation

4. **Rank PWMP objectives** based on their contribution to subwatershed health through a review of results in Steps 1-3, and the Willamette Watershed technical team's best professional judgment. Use the following process to rank the PWMP objectives to show which are most important for improving subwatershed conditions. First, each team member assigns a grade for the current subwatershed condition associated with each PWMP objective. Five grade levels are possible
   - low = 1 point
   - low average = 2 points
   - average = 3 points
   - high average = 4 points
   - good = 5 points

   Second, obtain a consensus grade based on group discussion for the current subwatershed condition associated with each objective. Some of the chief considerations leading to the graded results in the Southwest subwatersheds were:
   - These subwatersheds are part of the combined sanitary and stormwater infrastructure.
   - The characterization results provided by the BES Systems Analysis team determined that the combined system infrastructure in these subwatersheds has problems related to capacity.
   - There are large natural areas that provide habitat for wildlife and likely for aquatic organisms (not fish).
   - The streams in the subwatersheds do not reach the Willamette River, stormwater is directed to the Columbia Treatment Plant.
   - There are 25 Environmental Cleanup Site Inventory (ECSI) sites in the South Waterfront redevelopment area.
   - The natural areas are degraded by invasive plant species [Portland Parks and Recreation (PP&R), Ecohealth assessment.

   The grade levels assigned are the inverse of the Final Ranks. That is, objectives that received the lowest grade ware given the highest rank of importance for their contribution to Southwest subwatershed improvement. The following table lists the final ranked objectives for the Southwest subwatersheds:

SW Subwatersheds Objectives Ranking Results

SW Subwatersheds Health Objectives	Final Rank
Stream Flow and Hydrologic Complexity: Protect and increase rainfall interception areas, create infiltration and detention areas to normalize stream hydrographs, reduce stormwater flow to sewer systems, and reduce basement flooding.	1
Aquatic Habitat: Protect and improve aquatic, riparian, and floodplain	2

SW Subwatersheds Health Objectives	Final Rank
habitat extent, quality, and connectivity that supports the persistence of native fish and wildlife communities.	
Urban Pollutants: Manage the sources and transport of urban stormwater and industrial pollutants and nutrients to limit surface water, groundwater, soil, and sediment contamination to levels that protect ecological and human health and achieve applicable water quality standards.	3
Channel and Floodplain Function: Protect and restore the extent, connectivity, and function of streams, other open drainageways, wetlands, riparian areas and floodplains to improve bank stability and natural hydrologic functions and reduce risk to development and human safety.	4
Fish and Other Aquatic Organisms: Implement watershed actions to maximize the persistence of native Willamette and Columbia River fish and other aquatic organisms and assist with species recovery and potential population productivity by protecting and improving hydrology, habitat, and water quality.	5
Terrestrial Wildlife and Vegetation: Implement watershed actions to restore populations of terrestrial organisms to healthy, self-sustaining levels, protect and restore the composition and structure of native vegetation communities, and reduce populations of non-native plants and organisms to levels that do not compete with native species.	6
Terrestrial Habitat: Protect and improve upland habitat extent, quality, and connectivity that support the persistence of native terrestrial communities and connectivity to aquatic and riparian habitat.	7
Human Pathogens: Maintain and manage sewer infrastructure and stormwater inputs and runoff to limit sewage overflow and the delivery of pathogens to waterways and achieve applicable water quality and sewer design manual standards.	8
Stream Temperature: Protect and improve stream temperatures, dissolved oxygen, and pH levels that protect ecological health and achieve applicable water quality standards.	9
Stormwater Conveyance: Maintain stormwater collection and conveyance infrastructure capacity.	10

5. **Assign a weight to each objective**. Weights were calculated by applying a formula based upon the objectives' assigned ranks, to refine the analysis for determining their benefits towards improving subwatershed conditions [i.e., improving stream flow (which is ranked number 1) is not necessarily twice as beneficial as improving aquatic habitat (which is ranked number 2)] in the subwatershed.

6. **Assign a metric to each objective**. Each PWMP objective listed in Step 3 is assigned a metric that, when measured, would indicate a positive improvement in subwatershed health. Metrics are chosen based on the assets and problems specific to the subwatershed. Metrics are assigned based on PWMP objectives. In the Southwest subwatersheds the metrics have been assigned as follows:

   Objective/Measure

   1. Stream Flow and Hydrologic Complexity/ Effective impervious area (EIA) reduced (acres)

2. Channel and Floodplain Function/ Channel Floodplain restored or enhanced (acres)
3. Stormwater Conveyance/ Substandard stormwater pipes maintained (Y/N)
4. Aquatic Habitat/ Aquatic habitat restored/enhanced (linear feet)
5. Terrestrial Habitat/ Terrestrial Habitat protected through acquisition (acres)
6. Stream Temperature/ Stream temperature maintained/reduced (Y/N)
7. Human Pathogens/ Fecal inputs reduced (Y/N)
8. Urban Pollutants/ Urban pollutants reduced in soils or water (Y/N)
9. Fish and Other Aquatic Organisms/ Biotic measures improved (Y/N)
10. Terrestrial Wildlife and Vegetation Terrestrial/ native vegetation enhanced, restored protected through revegetation projects (acres)
11. Improve watershed health by maximizing stewardship, education and partnerships/ Opportunities for education, involvement and stewardship (Y/N)

Each objective is assigned at least one measure (i.e., there can be more than one) based on the predicted ability of the recommended action(s) to improve subwatershed health. As indicated above, measures can be based on acres, linear feet, or the detectable accomplishment (Y/N) for the recommended actions.

7. **Analyze opportunity projects using a multi-attribute utility analysis tool.** Multi-Attribute Utility Analysis (MUA) is a formal, analytic approach for evaluating and comparing alternatives for decisions with multiple objectives. This decision-making tool allows the decision-maker to incorporate objectives that are measured on different scales, and to generate a prioritized list of alternatives based upon scores.

   Scores are calculated using anticipated measurable improvements (i.e., metrics) for each opportunity, and the final ranks and weights assigned to each objective by the Project Team. Each action is first assigned a value for each measure.

   For example:

   Action: Create a vegetated stormwater infiltration facility that could receive water from a 0.5 acre catchment area
   Measure: Reduce Effective Impervious Area (EIA)
   Value associated with one measure: 0.5 acres

   The following formula is then applied:

$$Score = \sum_{i=1}^{m} k_i U_i$$

   where m = the initial value for the measure identified in Step 6 (in the example above, 0.5 acres)
   k = the weight assigned to each objective
   U = the normalized value for the measure[7]

[7] Values for the metrics associated with each action were normalized to a 0 to 1 scale using the following formula, where *U* is the action's normalized score for each measure:

$$U = \frac{X}{Best} - \frac{Worst}{Worst}$$

The final score for each opportunity (i.e., project or program in a specific location) demonstrates a relative value towards improving subwatershed health conditions and does not take into consideration any feasibility, implementation, or cost factors. The scores are not intended to represent a set order in which to implement opportunities. Rather, they will inform the selection and implementation processes to pursue as resources become available.

8. A draft version of the complete scored and prioritized list of opportunities is then developed by Willamette Watershed staff and sent to the Technical Advisory Team for review. The team includes:
    - Willamette Watershed Team
    - Shannon Buono, Bureau of Planning and Sustainability
    - Andi Curtis, BES Revegetation Program
    - Steve Hazzard, BES Maintenance
    - Dawn Hottenroth, BES Regulatory/Policy
    - John Houle, BES Engineering Services
    - Jill Jacobsen, Bureau of Maintenance
    - Roberta Jortner, Bureau of Planning and Sustainability
    - Deb Lev, Portland Parks and Recreation
    - Michael Pronold, BES Source Control
    - Dawn Sanders, Superfund Program
    - Cindy Studebaker, Science, Fish and Wildlife Program
    - Ron Widmer, Bureau of Maintenance

    The opportunities list is reviewed by city stakeholders and the Willamette Watershed Team, and is then finalized based on consideration of comments received.

Appendix C. Project Management Materials

Improvement Strategies Schedule – TEMPLATE

Task Name	Lead	Addl	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20	Wk 21	Wk 22	Wk 23	Wk 24	Wk 25
Project Management																											
Project scheduling and coordination with Staff Team																											
Project Team set up and coordination																											
IS Process and protocol review and update																										U	
Public Involvement																											
Public involvement planning – goals and opportunities				D		F																					
Online dialog site																											
ONI opinion research																											
Public Involvement meetings – stakeholders, neighborhoods, etc.																											
Identify Known Concerns																											
Problems and Assets Memo development					D		U													F							
Subwatershed reconnaissance – review of conditions																											
Integration Exercise - review P/A memo, identify potential actions						M																					
Develop Subwatershed Objectives																											
Subwatershed Objectives and Measures Development								D			U												F				
Objectives and Measures Review and Weighting										M																	
Identify Potential Actions																											
Potential Actions Compilation																											
Potential Actions Memo								D		F																	
Field Assessments																											
Mapping Exercise																											
Prepare for field assessments																											
Stream and Upland Assessments																											
Download and store data																											
Identify/Rank Opportunities																											
Develop complete project list																				D			U				
Rank projects based on contribution to watershed health																				D			U				
Review Project List Content and Rankings																						M					
Explore opportunities to implement projects																											
Develop Report																											
Develop early action project details for report																											
Develop report with summaries of process and all products																								D			F
Follow-Up																											
Update data and online documents																											>
Evaluate monitoring needs																											>
Review coordination needs (e.g., Public Facilities Plan updates)																											>
Set up a GIS database of all projects within the subwatershed																											>

U = Update D = Draft product

F = Final product M = Project Team meeting

Appendix D. Public Involvement

EXAMPLE Stephens Creek Watershed Management Handout

Stephens Creek Watershed Management

Willamette Watershed Planning Environmental Services, City of Portland March 2004

Stephens Creek begins at a steep ridge south of Hillsdale and flows about two miles to the Willamette River just north of the Sellwood Bridge. Its drainage area, called the Stephens subwatershed, covers 754 acres of southwest Portland. The subwatershed is mostly residential neighborhoods but also includes the commercial areas around the Burlingame Fred Meyers store, part of the I-5 corridor, and the canyon that holds SW Taylors Ferry Road.

Natural Resources

The mouth of Stephens Creek, a short stretch of the creek between SW Macadam and the Willamette River, provides important shelter for steelhead and salmon as they travel up or down the river. Some of the middle section flows through forested patches near Riverview Cemetery. The Stephens Creek Nature Park on SW Bertha Boulevard includes a wetland area. While the creek has suffered from decades of urban development and significant parts of it flow through buried pipes, these stretches of open stream offer valuable potential for improvement. The City of Portland and Metro together have identified many acres if significant natural resources (streams, vegetation, steep slopes, etc.) in the Stephens Creek subwatershed. .

The single biggest issue for most urban watersheds is stormwater runoff, and Stephens is no exception. Roads, parking lots, roofs, and other hard, impervious surfaces concentrate and accelerate runoff. Urban runoff increases erosion, damages the stream channel, destroys habitat, and adds to the pollution load in the river. Reducing the impacts of stormwater runoff is the first step toward a healthy watershed.

Over the next few months Environmental Services will conduct a field assessment of the Stephens subwatershed. We'll be looking at the urban landscape to find sites for stormwater retrofits. Retrofits are structural stormwater management measures for existing development designed to help improve watershed function. Most retrofits consist of landscape improvements that prevent runoff from reaching the creek too quickly or allow it to soak into the ground.

The Watershed Approach

In *A Place in Space*, Gary Snyder wrote: "A watershed is a marvelous thing to consider...this process of rain falling, streams flowing, and oceans evaporating causes every molecule of water on earth to make the complete trip once every two million years. …We who live in terms of centuries rather than millions of years must hold the watershed and its communities together, so our children might enjoy the clear water and fresh life of this landscape we have chosen. From the tiniest rivulet at the crest of a ridge to the main trunk of a river approaching the lowlands, the river is all one place and all one land."

The watershed approach acknowledges that improving the condition of the Willamette River requires improving the watershed. A healthy, functioning watershed allows rain to soak into the ground, reducing erosion caused by runoff. Trees, shrubs, and other plants filter the runoff and help control pollution. Fish and wildlife habitat are a critical part of a healthy watershed, and protecting existing natural areas is a high priority.

Environmental Services' watershed approach expands the notion of stormwater management to include its impacts on water quality, hydrology, habitat, and biological communities. In an urban area like Portland, multiobjective restoration projects adapting the built environment to work more like the natural environment offer the most potential for making the watershed healthy.

Important Areas for Watershed Health

Stephens Creek Confluence with the Willamette River Just north of the Sellwood Bridge, the confluence is one of the few remnants of high quality bottomland wetland and riparian forest in the City. The short stretch of stream between Macadam and the river provides important habitat for salmon and steelhead.

Macadam Culverts Three impassable culverts near Macadam cut off most of Stephens Creek to Willamette River fish.
SW Macadam to Taylors Ferry This short, steep stream reach is densely forested and contains good fish habitat.

Central Taylors Ferry Canyon The central canyon area has steep ravines and limited floodplains, but the stream channel is open and includes the best channel and riparian habitat in the subwatershed.

Riverview Cemetery Tributary This small tributary stream east of Taylor's Ferry Road is highly eroded and is a significant source of sediment to the mainstem and river, but the stream basin includes a mix of forest and lawn that offer potential for watershed health improvements.

Pipes around I-5 and Barbur The upper and middle sections of the subwatershed are separated by a 2000–foot piped reach under commercial and transportation development.

Stephens Creek Nature Park This small park and the adjacent privately owned natural areas include the highest-quality remaining habitat area in the upper subwatershed.

Texas Street Homes in the area are experiencing basement flooding and soil erosion during the rainy months as a result of increased surface and groundwater flows from recent development upstream.

Other Watershed Issues

Impervious Area Streets, parking lots, roofs, and other hard surfaces cover 40% of the subwatershed.

Invasive species English ivy, Himalayan blackberry, clematis, morning glory, and reed-canary grass have degraded habitat quality in the Stephens Headwaters Park, the Nature Park, Fulton Park, and the Willamette confluence.

Urban Stormwater Pollutants Bacteria and other pollutants typically found in urban areas have been identified as potential water quality concerns in Stephens Creek.

How You Can Help
Some of your neighbors have already begun to make improvements. Residents of SW Texas Street are working with Environmental Services to improve conditions at the headwaters of Stephens Creek. We need your help to find more retrofit opportunities and identify other community issues.

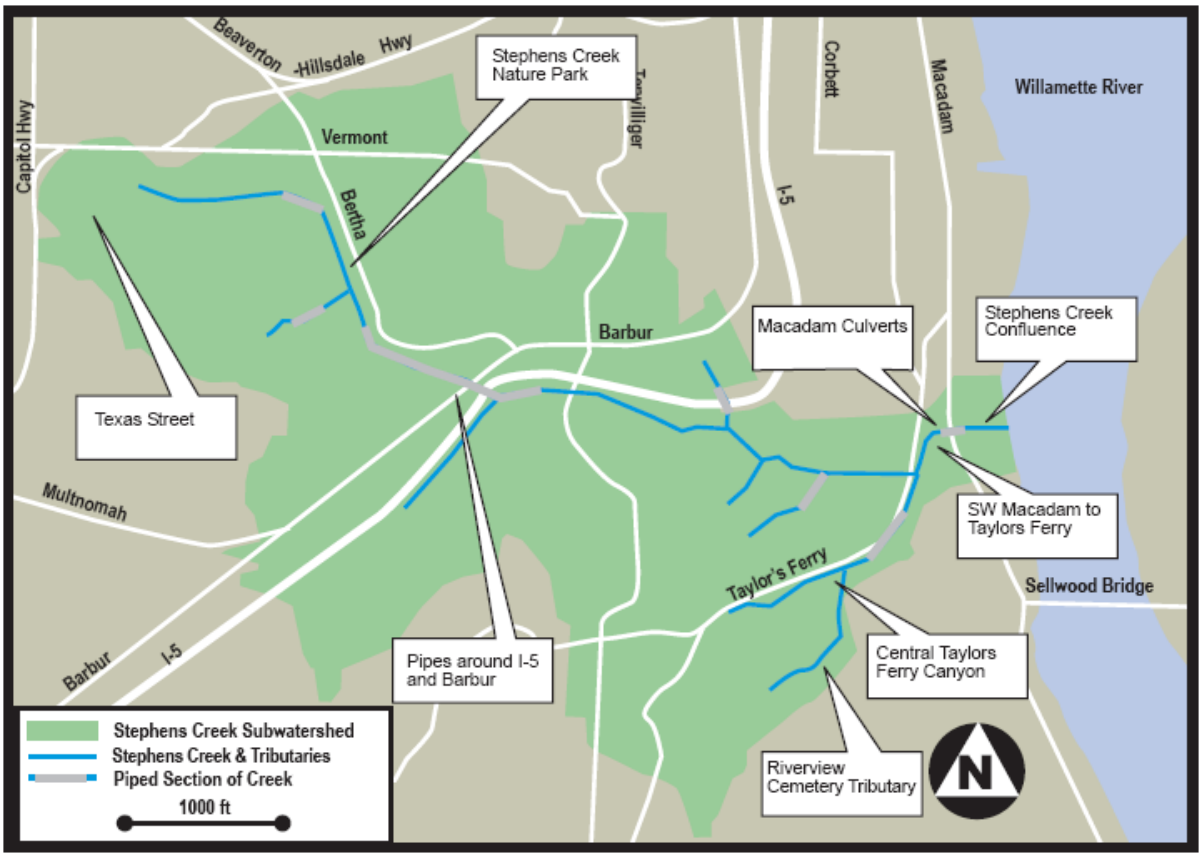
For more information

contact Carolyn Sharp, Environmental Services.

Telephone: 503-823-0548
Email: carolyns@bes.ci.portland.or.us

EXAMPLE Stephens Creek Watershed Map and Potential Project Handout

Stephens Creek Subwatershed



March 2004

Environmental Services
City of Portland
Willamette Watershed Planning

Multnomah Neighborhood Association Meeting
Tuesday, May 11, 2004 – 7pm
Multnomah Arts Center, Williams Room

Willamette Staff: Dawn Uchiyama, Naomi Tsurumi
Audience: Multnomah Neighborhood Association

Agenda:

Background

- What is a watershed? An area of land that drains into a body of water [MAP: Stephens Subwatershed].
- What does BES do? Manages the City's sanitary waste and stormwater. CSO prevention program.

The Willamette team

- Bureau of Environmental Services, Watershed Planning Group
- Willamette is one of four teams within the Watershed Planning Group (others are Columbia Slough, Johnson Creek, and Fanno/Tryon).
- Most of the Multnomah Neighborhood is in the Fanno and Tryon watersheds. A small portion of the neighborhood is in the headwaters of Stephens Creek [See Stephens Neighborhood Map].

What is watershed planning?

- Why do watershed planning?
    - The Willamette watershed within the City of Portland is highly urbanized. Most of the floodplain has been filled and developed. Many of the natural surface streams have been diverted into the sewer system. Impervious surfaces cover a large portion of the watershed.
    - As a result, a large proportion of the rain that falls in Portland lands on roofs, parking lots, and pavement. It runs off of these surfaces, picking up pollutants along the way, and enters the sewer system. Most of the water and associated pollutants end up in the Willamette River.
    - The goal of watershed planning is to return some of the natural function to the watershed, which will reduce the quantity and improve the quality of water entering the Willamette River.
    - To lead by example.
    - To protect our quality of life.
- Goal of watershed planning is to improve hydrology, water quality, habitat and biological communities within the Willamette watershed [MAP: watershed overview].
- This is accomplished by:
    - Identifying and implementing projects throughout the watershed, such as:
        - Revegetation- removing invasive plants and planting native plants to reduce erosion, provide habitat, and improve preserve ecosystems.
        - Stormwater retrofit- installing swales, planters, ecoroofs to capture and treat water before it enters the streams.
        - Outreach and education.
    - Coordinating with other City Bureaus (e.g., Parks, Planning) on projects and practices.
    - Coordinating with other BES programs (e.g., engineering, revegetation) on projects and practices.
- Willamette watershed is split into 27 subwatersheds and four River segments [MAP: watershed overview]. We will visit each subwatershed to develop a list of projects and actions to improve watershed health- a process we refer to as Improvement Strategies.

Improvement Strategies

- The Willamette Team modified an approach developed by the Center for Watershed Protection- a national nonprofit organization dedicated to protecting streams, lakes, and rivers.

- We will visit each subwatershed within the Willamette watershed. Stephens is first.
- Goal is to identify projects and actions to improve watershed health.
- Process, generally:
    - Gather existing information on problem areas and opportunity areas.
    - Develop objectives for the subwatershed.
    - Identify potential actions to address problems and opportunities.
    - Conduct site visits throughout the subwatershed, looking for areas to protect, restore, or retrofit to improve watershed function.
    - Develop a list of recommendations, and work with other BES and City programs to implement them.
- An example of a stormwater retrofit- SW Texas Green Street:

Texas Green Street Project

- BES received money from the US Environmental Protection Agency to do "Innovative Wet Weather Program" projects.
- BES allocated the money to priority stormwater projects throughout the City.
- Texas Green Street is one of these projects.
    - Street is currently unimproved.
    - Street is the headwaters of Stephens Creek.
    - History of erosion and flooding associated with stormwater runoff.
    - 10-year process to develop a Transportation Local Improvement District (LID) to improve the road and address stormwater, which led to frustration and no changes.
    - Neighbors approached BES to address problems with stormwater runoff in the street.
    - BES watershed planning was interested in finding a good way of handling the stormwater without resorting to infrastructure-intensive solutions.
    - Current plan is to re-grade and pave the street to drain into swales along the north side of the street. This will:
        - Improve the street, but maintain the original character (no traditional curbs and gutters, no sidewalks),
        - Reduce stormwater impacts to private properties,
        - Route runoff out of the street and into vegetated areas,
        - Slow the flow of water, so that more time passes between rain events and large pulses of water entering the stream system,
        - Treat the runoff, preventing pollutants (e.g., bacteria, motor oil) from entering the stream system, and
        - Create habitat areas.

<u>Questions for NA:</u>

- Any problems or issues related to streams or stormwater in your neighborhood that we should be aware of?
- Any projects that are going on (e.g., trails) that we could collaborate with?

Materials Needed:

- Business cards – Dawn, Naomi, Jennifer Devlin (for Fanno/Tryon people)
- Push pins and Tape
- Maps
    - Aerial of Stephens
    - Watershed Overview Map
    - Stephens showing Neighborhoods, Watersheds
- Post-It notes for comments on maps
- Comment forms
- Two handouts from Jim – Stephens map showing project areas, Stephens Watershed Management handout.

Questions to Anticipate:

- Healthy Portland Streams – status and relationship:
    - HPS and our efforts are aimed at improving stream health. They pay more attention to habitat and biological communities; we focus more on stormwater flow and quality.

- We share our data from the watershed Characterization and from this Improvement Strategies work with BOP.
- The status of HPS work is delayed due to Metro mapping of Regionally Significant Habitat.

Appendix E. Identify/Rank Opportunities

EXAMPLE: Project Prioritization Worksheet

Objective Number - Measure	Weight	Max	Min		14th and Falcon Treatment Facility	330 SW Custer Acquisition	Aboy/US Bank Stormwater Retrofit	Barbur Commercial Pollution Prevention Outreach	Bertha/Terwilliger Overpasses Water Quality	Capitol Hill Condos Stream Daylighting	Capitol Hill School Stormwater Retrofit	Carson Street Flow Improvement	Cemetery Maintenance Practices Outreach	Cemetery Tributary Revegetation	Central Canyon Sanitary Line Relocation
Waypoint1					SP4-05	SP4-07	SP6-01		SP4-04	SP7-07	SP6-09	SP5-07	SPC04	SPC706	None
1-EIA reduced (acres)		5.5	0	**Value**	3	0	2	0	0	0.5	5	0	0	0	0
	0.19			**Score**	**0.55**	**0.00**	**0.36**	**0.00**	**0.00**	**0.09**	**0.91**	**0.00**	**0.00**	**0.00**	**0.00**
2-Area of improved floodplain function (acres)		1.3	0	**Value**	0	0	0	0	0	0.04	0	0	0	0	0
	0.16			**Score**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
3-Area revegetated (acres)		13	0	**Value**	0	0	0	0	0	0	0	0	0	13	0
	0.11			**Score**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.00**	**0.00**
4-Area of land protected (acres)		2.3	0	**Value**	0	0.3	0	0	0	0	0	0	0	0	0
	0.17			**Score**	**0.00**	**0.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5-Added fish habitat (ft)		4200	0	**Value**	0	0	0	0	0	0	0	0	0	0	0
	0.13			**Score**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
6-Channel habitat improved (ft)		1240	0	**Value**	0	0	0	0	0	340	0	0	0	0	0
	0.09			**Score**	**0**	**0**	**0**	**0**	**0**	**0.27**	**0**	**0**	**0**	**0**	**0**
7-Stormwater runoff treated (acres)		42	0	**Value**	3	0	2	0	1.5	0	5	0.2	0	0	0
	0.06			**Score**	**0.07**	**0.00**	**0.05**	**0.00**	**0.04**	**0.00**	**0.12**	**0.00**	**0.00**	**0.00**	**0.00**
8- Fecal inputs reduced? (Y/N)				**Value**	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
	0.04			**Score**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
9-Opportunities for stewardship, education, partnership, and programmatic actions? (Y/N)				**Value**	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	FALSE
	0.06			**Score**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**0**
			FINAL SCORE		0.170	0.022	0.135	0.065	0.067	0.112	0.240	0.000	0.065	0.176	0.000

Appendix F. Field Assessments

Field Assessment Checklist

The purpose of the field assessments is to identify, evaluate, and document the conditions of opportunity sites in the subwatershed. The work will focus on information needed to develop recommendations.

Before leaving for the field
Meet to discuss:

- ❑ Unit characteristics
- ❑ Plan for site visits
- ❑ Objectives and Potential Actions

Field Assessment supplies

- ❑ Clipboards (one for each person)
- ❑ Pencils (one for each person)
- ❑ GPS Units (one for each team)
- ❑ Field forms – Stream
- ❑ Field forms – Upland
- ❑ Flashlight
- ❑ Measuring tape – X ft
- ❑ Extra pencils
- ❑ Extra paper (write-in-rain)
- ❑ Map – aerial showing open channel and piped reaches
- ❑ Map – reach delineations
- ❑ Map – unit map showing unit delineation, tax lots
- ❑ Field form – stream dimension cheat sheet
- ❑ Description of past and current efforts / projects at the site(s)
- ❑ Cameras (one for each team) + multiple disks
- ❑ Driving directions and Thomas Guide

On return to the office

- ❑ Download GPS points
- ❑ Download photos and delete from disks
- ❑ Charge batteries – Camera and GPS
- ❑ Summarize potential projects, programmatic recommendations identified

UNIT Summary Data Sheet

UNIT

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Unit ID:	**Weather:**	**Assessed by:** (list all names)
GPS (SubwshedUnit#-PointID, e.g., SP1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Dominant Vegetative Cover

__ None __ Forest __ Turf __ Landscaped __ Meadow __ Wetland __ Other:

Physical Description:

Imperviousness (note type)

__ 0-10% __ 30-50% __ 70-90%
__ 10-30% __ 50-70% __ 90-100%
__ Other:

General Landscape Features

Unit Land Use:

Type

__ Residential
__ Commercial

__ Parks / Open Space

__ Industrial

__ Institutional
__ Other:

Development (describe)

Other Description (not covered above)**:**

Action ID	Potential action	Action *may* apply?		Forms to fill out
		Yes	**No**	
PT1	Property and easement acquisition			WPR
RS1	Redesign banks and remove bank hardening			WPR **and** SBE **and** SBS

UNIT Summary Data Sheet

RS2	Stabilize and revegetate streams and banks			WPR **and** SBS
RS3	Daylight piped stream reaches			WPR **and** SDY
RS4	Evaluate fish access barriers			WPR **and** SSC
RS5	Stream habitat enhancement: place large woody debris, create natural long-term sources of large woody debris.			WPR
RS6	Remove exotic plants and plant native species.			WPR **or** SPR and SBS
RF1	Stormwater retrofits – for quantity and quality			URE
RF2	ODOT stormwater treatment			URE
RF3	Evaluate options for stormwater pipe at mouth			WPR
RF4	Upgrade culverts with erosion problems			WPR **and** SSC
RF5	Sanitary trunkline maintenance improvements			WPR **and** SUT

UNIT Summary Data Sheet

UNIT

Summary Table: Potential actions identified during the field assessment. (To be filled out upon return from field assessment).

Action ID	GPS ID	Location	Description	Follow-Up	PG11 – Education, Stormwater	PG13 – Education – Pet Waste	PG1 – Acquisition	PG2 – Update Overlay Zone	PG7 - Enforcement

WATERSHED Protection/Restoration Data Sheet

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Unit:	**Weather**	**Assessed by:** (list all names)
GPS (SubwshedUnit-PointID, e.g., SP3-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Site location, approximate area:

Site Identified: __ Prior to field assessment __ During field assessment

Stream Description (for stream sites):

Left Bank	*Dimensions*	Right Bank
_____	***Length (ft)***	_____
_____	***Bank angle***	_____
_____	***Slope***	_____
_____	***Aspect***	_____
	Bankfull height	_____
	Bankfull width	_____
	Wetted width	_____

Left Bank	*Restorable Width*	Right Bank
__	***< 25ft***	__
__	***25-50ft***	__
__	***50-75ft***	__
__	***75-100ft***	__
__	> 100ft	__

Left Bank	**Land Use**	Right Bank
_____	Residential	_____
_____	Municipal	_____
_____	Commercial	_____
_____	Institutional	_____
_____	Industrial	_____
_____	Park / Open Space	_____

Left Bank	*Land Cover*	Right Bank
_____%	***Impervious***	_____%
_____%	***Bare Ground***	_____%
_____%	***Turf/lawn***	_____%
_____%	***Tall grasses***	_____%
_____%	***Shrub/Scrub***	_____%
_____%	***Trees***	_____%
_____%	***Invasives***	_____%
_____%	***Wetland***	_____%

_____ Other:	_____	_____% ***Other:***	_____%

General stream description:

Upland Description (for upland sites):

Slope	***Imperviousness (note type)***	***Aspect***	***General Landscape Features***
__0° **__ 0° – 10°** **__10° – 20°** **__ > 20˚**	__ 0-10% __ 30-50% __ 70-90% __ 10-30% __ 50-70% __ 90-100% __ Other:	__ North __ East __ South __ West __ Other:	

Land Use Type and Density

Open Space	*Private Institution*	*Right-of-Way*	*Dominant Vegetative Cover*	*Other Land Use (describe)*
__ Public __ Private __ Other:	__ College/University __ Hospital __ Religious Institution __ School __ Other:	__ Yes __ No ***Vacant Lot*** __ Yes __ No	__ None __ Forest __ Turf __ Landscaped __ Meadow __ Wetland __ Other:	__ Residential: __ Municipal: __ Industrial: __ Commercial:

Stormwater Management: Are large continuous areas of impervious cover (> 1 acre) present? __ Y __ N	Is stormwater being actively managed for quality and/or quantity? __ Y __ N __ Don't know __ N/A Describe existing control (if any):

WATERSHED Protection/Restoration Data Sheet

Site Sketch:

Description of key reasons to protect and/or restore (Check box AND give more detailed description)**:**

__ Forested area or other sensitive areas present?
__ Wetlands present?
__ Optimal in-stream habitat: quality or connectivity (circle one or both)
__ Optimal riparian habitat: quality or connectivity (circle one or both)
__ Optimal upland habitat: quality or connectivity (circle one or both)
__ Lack of invasive species
__ Other:

Description of most feasible actions (Check box AND give more detailed description)**:**

Upland

__ Property or easement acquisition
__ Invasive plant removal
__ Native planting
__ Other:

Stream

__ Stabilize and revegetate streams and banks - ***Also fill out form SBS***
__ Daylight piped stream reaches
__ Evaluate fish access barriers – ***Also fill out form SSC***
__ Stream habitat enhancement
__ Remove exotic plants and plant native species - ***Also fill out form SBS***
__ Redesign banks and remove bank hardening - ***Also fill out forms SBE and SBS***
__ Other:

WATERSHED Protection/Restoration Data Sheet

Programmatic Opportunities (Check all that apply)

__ PG1 – Develop a long-term City acquisition strategy
__ PG2 – Update environmental overlay zones
__ PG3 – Report illicit connections to storm system
__ PG4 – Develop EIA targets
__ PG5 – Plant trees throughout the subwatershed
__ PG6 – Develop subwatershed-specific SWMM guidelines
__ PG7 – Monitor and enforce compliance with existing regulations
__ PG8 – Coordinate NPDES permit-related efforts
__ PG9 – Develop coordinated revegetation prioritization
__ PG10 – Regulatory site protection opportunities
__ PG11 – Education/outreach for stormwater treatment
__ PG12 – Education/outreach for moorage pollution prevention
__ PG13 – Education/outreach for pet waste
__ PG14 – Education/outreach for resident maintenance practice
__ PG15 – Education/outreach for illegal dumping
__ PG16 – Invasive plant species education and program efforts
__ PG17 – Improve cemetery maintenance practices
__ PG18 – Address conflicting City policies
__ PG19 – Develop wood retention policy
__ PG20 – Downspout disconnection
__ PG21 – Evaluate impacts of non-native animal populations
__ PG22 – Develop Stephens monitoring plan
__ PG23 – Improve pollutant source identification

Threats to important resources on the site (Check box AND give more detailed description)**:**

__ Invasive species (*specify*)
__ Development
__ Overuse
__ Uncontrolled stormwater runoff
__ Other:

Public involvement and/or education opportunities:

Opportunities to meet other objectives (Check box AND give more detailed description)**:**

__ Improve a parking lot
__ Green space
__ Recreation area
__ Habitat value
__ Other:

Possible conflicts with adjacent land use, existing utilities, other:

Construction and maintenance access (immediate and long-term considerations):

Additional notes:

Should feasible actions be pursued as potential recommendations?

__ Y __N __ Maybe, with further information:

Follow-up items (in office):

Additional information needed:

UPLAND Retrofit Data Sheet

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Unit:	**Weather:**	**Assessed by:** (list all names)
GPS (SubwshedUnit#-PointID, e.g., SP3-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Site Identified: __ Prior to field assessment __ During field assessment

Site location, approximate area:

Site Description:

Slope

__0°

__ 0° – 10°

__10° – 20°

__ > 20˚

Imperviousness (note type)

__ 0-10% __ 10-30%
__ 30-50% __ 50-70%
__ 70-90% __ 90-100%
__ Other:

Aspect

__ North __ East
__ South __ West
__ Other:

General Landscape Features

Land Use Type and Density

Open Space

__ Public
__ Private
__ Other:

Right-of-Way

__ Yes __ No

Vacant Lot

__ Yes __ No

Dominant Vegetative Cover

__ None __ Forest __ Meadow
__ Turf __ Landscaped __ Wetland
__ Other:

Industrial

__ Light __ Industrial Park
__ Heavy __ Other:

Residential (circle avg SF lot size):

__ Single Family Attached (Duplexes, Row Homes) <1/8 1/8 1/4 1/3 > 1/3 acre
__ Singe Family Detached <1/4 1/4 1/2 1 >1 acre
__ Multifamily (Apts, Twn)
__ Trailer Park

Commercial

__ Strip __ Downtown Business
__ Shopping Mall
__ Business Park
__ Other:

UPLAND Retrofit Data Sheet

Municipal	*Private Institution*
__ Park __ School __ Public Park Lot __ Hospital __ Govt __ Fleet Storage Facility __ Maintenance Yard __ Golf Course __ Other:	__ School __ Hospital __ College/University __ Religious Institution __ Other:

Stormwater Management:	
Are large continuous areas of impervious cover (> 1 acre) present? __ Y __ N	Is stormwater being actively managed for quality and/or quantity? __ Y __ N __ Don't know __ N/A Describe existing control (if any):
Sensitive Areas: ***Wetlands present?*** __ Y __ N __ Maybe Describe:	 ***Forested area or other sensitive area present?*** __ Y __ N Describe:

Current Site Sketch:

UPLAND Retrofit Data Sheet

What makes this site a good candidate for stormwater retrofit?

Description of most feasible retrofit (Check box AND give more detailed description)**:**

__ Redirect flows into existing surface vegetation
__ Install onsite infiltration system
__ Remove pavement to create a pervious area
__ Other:

Programmatic Opportunities (Check all that apply)

__ PG1 – Develop a long-term City acquisition strategy
__ PG2 – Update environmental overlay zones
__ PG3 – Report illicit connections to storm system
__ PG4 – Develop EIA targets
__ PG5 – Plant trees throughout the subwatershed
__ PG6 – Develop subwatershed-specific SWMM guidelines
__ PG7 – Monitor and enforce compliance with existing regulations
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__ PG20 – Downspout disconnection
__ PG21 – Evaluate impacts of non-native animal populations
__ PG22 – Develop Stephens monitoring plan
__ PG23 – Improve pollutant source identification

Project Sketch:

UPLAND Retrofit Data Sheet

Public involvement and/or education opportunities:	**Opportunities to meet other objectives** (Check box AND give more detailed description)**:** __ Improve a parking lot __ Green space __ Recreation area __ Upland habitat value __ Other:
Possible conflicts with the site and/or adjacent land use (Check box AND give more detailed description)**:** __ Traffic – vehicle and foot __ High-use areas __ Utilities __ Other:	**Construction and maintenance access (immediate and long-term considerations):**
Additional Notes:	
Should feasible retrofits be pursued as potential recommendations? __ Y __N __ Maybe, with further information:	
Follow-up items (in office): *Additional information needed:* __ Concern for soil contamination __ Other (explain):	

UPLAND Source Data Sheet

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Unit:	**Weather:**	**Assessed by:** (list all names)
GPS (Subwshed-Unit-PointID, e.g., STE-1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Site Description (location, area, general description)**:**

Land Use Type and Density:
Residential (circle avg SF lot size):
__ Single Family Attached (Duplexes, Row Homes) <1/8 1/8 1/4 1/3 > 1/3 acre
__ Singe Family Detached <1/4 1/4 1/2 1 >1 acre
__ Multifamily (Apts, Twn)
__ Trailer Park

Municipal
__ Park __ School __ Public Park Lot
__ Hospital __ Govt __ Fleet Storage
__ Maintenance Yard __ Golf Course Facility
__ Other:

Industrial
__ Light
__ Heavy
__ Industrial Park
__ Other:

Commercial
__ Strip __ Business Park
__ Downtown Business
__ Shopping Mall
__ Other:

Private Institution
__ School __ Hospital
__ College/University __ Religious Institution
__ Other:

Open Space
__ Public
__ Private
__ Other:

Right-of-Way
__ **Yes**
__ No

Vacant Lot
__ **Yes**
__ No

Dominant Vegetative Cover
__ None __ Forest __ Turf __ Landscaped __ Meadow __ Wetland __ Other:

Stormwater Management
Are large continuous areas of impervious cover (> 1 acre) present?
__ Y __ N

What are on-site retrofit and/or source control potential?
__ High __ Med __ Low __ Don't know

Is stormwater being actively managed for quality and/or quantity?
__ Y __ N __ Don't know __ N/A

Describe existing control (if any):

Describe retrofit or source control options (if any):

UPLAND Source Data Sheet

Notes and Sketch:

Check % of OR presence of indicator or depending on applicability and/or site complexity	N/A	Complete for Grouped Sites 0%	25%	50%	75%	100%	Individual Sites Observed
Rooftops							
Discharges to impervious surface							__ Y __ N
Discharges to pervious area or cisterns, rain barrels, etc.							__ Y __ N
Directly connected to storm drains							__ Y __ N
Parking Lots							
Parking lots/cul-de-sacs with vegetated islands							__ Y __ N
Vegetated islands designed to capture stormwater							__ Y __ N
Perimeter vegetation designed to capture stormwater							__ Y __ N
Flow diversion practices (drains, channels, dikes) & grading to prevent stormwater flow onto hotspot areas							__ Y __ N
Roads							
Roads with curb and gutter							__ Y __ N
Roads with open channel conveyance							__ Y __ N
Roads with median strips							__ Y __ N
Median strips designed to capture stormwater							__ Y __ N
Outdoor Storage							
Evidence of leakage from trash dumpsters							__ Y __ N
Dumpsters covered and located away from storm drains							__ Y __ N
Trash/debris present (streets, drains, lots, open areas)							__ Y __ N
Covered outdoor storage, fueling areas, loading docks							__ Y __ N
Secondary containment for outdoor storage present							__ Y __ N
Storage containers labeled and in good condition							__ Y __ N
Spill cleanup materials present							__ Y __ N
Dedicated wash site for equipment cleaning *Drains to:*							__ Y __ N
Dedicated hazardous waste handling area present							__ Y __ N
Evidence of leakage or spills from vehicles							__ Y __ N
Drip pans used in vehicle storage areas							__ Y __ N
Lawn and Landscape Care							
% of site with vegetated cover							
% of vegetated area in turf grass							

Evidence of frequent irrigation (*sprinklers, hoses*)	__NA	__ Y	__ N	"No spray zones" clearly marked	__NA	__Y __N
Evidence of "non-target" irrigation (*onto sidewalks, parking lots*)	__NA	__ Y	__ N	Evidence of frequent mowing	__NA	__Y __N
Evidence of chemical treatment of lawns (*signage, bright green lawns, containers*)	__NA	__ Y	__ N	"No-mow" areas clearly marked	__NA	__Y __N
Evidence of pest management	__NA	__ Y	__ N	Eroded soil, bare spots on lawns	__NA	__Y __N

UPLAND Source Data Sheet

Other Stewardship Indicators							
Pet waste found along sidewalks, in open space areas or lawns	__NA	__ Y	__ N	Green Business signs	__NA	__Y	__N
Evidence of vehicle washing in driveways, streets, parking lots	__NA	__ Y	__ N	Community greening projects	__NA	__Y	__N
Drains to:				Trash and debris collection	__NA	__Y	__N
Recycling	__NA	__ Y	__ N	Compost piles/bins	__NA	__Y	__N
Storm drains stenciled	__NA	__ Y	__ N	Existence of community assoc.	__NA	__Y	__N

STREAM Reach Data Sheet

Watershed: Willamette	**Date:**	**Start Time:**	# / Description: **Photo ID**
Subwatershed:		**End Time:**	# / Description:
Reach ID:	**Weather:**	**Assessed by:** (list all)	# / Description:
GPS (Subwshed-Unit-PointID, e.g., STE-1-01)**:**			# / Description:

Land Use (predominant) __ Industrial __ Multifamily Residential __ Single-family Residential __ Commercial __ Forested __ Other:

Major Impacts __ Not impacted __ Impacted buffer __ Severe erosion __ Utility impact __ Outfall __ Trash/Debris __ Channel modification __ Stream Crossing __ Other:

Overall Stream Condition (circle #)

In-Stream Aquatic Habitat			
No habitat present; uniformity in substrate, cover, & instream features	Limited habitat; some substrate diversity, limited mix of cover/features	Noticeable habitat thru reach; some mix of cover and features, but not optimal	Good mix of substrate and optimal diversity in features/ cover
1	2	3	4

Vegetative Bank Protection			
<50% of bank surfaces and immediate buffer covered; significant vegetative disruption	50-70% covered; disruption obvious; bare soil and mowed grass common	70-90% covered by native veg, but missing major class of plant (tree, shrubs, or non-woody); some disruption	>90% covered by diverse native veg; Disruption minimal.
Rt Bank 1	2	3	4
Lt Bank 1	2	3	4

Bank Stability			
Unstable; many eroded areas frequent along straight section; obvious bank failure; >60% reach affected	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods	Moderately stable; infrequent, small areas of erosion mostly healed over 5-30% of reach	Banks stable; evidence of erosion or bank failure absent or minimal; <5% of bank affected
Rt Bank 1	2	3	4
Lt Bank 1	2	3	4

Channel Stability / Floodplain Connectivity			
Stream deeply entrenched; High flows (>than bankfull) **not** able to enter floodplain	Entrench-ment evident; flows rarely escape to floodplain	Some scouring or sediment buildup; migration appears minor; moderately active floodplain	Natural channel conditions; High flows enter floodplain often

Site Tracking Diagram

Upstream

Downstream

Overall Riparian Condition (circle #)

Riparian Vegetative Zone Width			
Width of riparian zone < 20ft; little or no riparian vegetation due to human activities (i.e. parking lots, roads, lawns)	20-40ft; human activities have impacted zone a great deal	40-60ft; human activities have impacted zone only minimally	> 60ft; human activities have not impacted zone
Rt Bank 1	2	3	4
Lt Bank 1	2	3	4

Floodplain Vegetation			
Predominant floodplain vegetation type is turf	Predominant floodplain vegetation type is shrub	Predominant floodplain vegetation type is young forest	Predominant floodplain vegetation type is mature forest
Rt Bank 1	2	3	4
Lt Bank 1	2	3	4

Floodplain Encroachment			
Significant encroachment in the form of fill material, development, or manmade structures. Significant effect on floodplain function	Moderate encroach-ment; some effect on floodplain function	Minor encroach-ment; but not affecting floodplain function	Not evident
Rt Bank 1	2	3	4
Lt Bank 1	2	3	4

Presence Observed			
Deer browse	__Y	__N	__Unknown
Beaver impacts	__Y	__N	__Unknown
Invasive species	__Y	__N	__Unknown
Floodplain wetlands	__Y	__N	__Unknown

Average Reach Dimensions (ft)	
Bank ht: _____Rt _____Lt	Bank full ht: _____

STREAM Reach Data Sheet

1	2	3	4		Wetted width: _____	Bottom width: _____

STREAM Structural Crossing Data Form

SSC

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Reach ID:	**Weather:**	**Assessed by** (list all names)**:**
GPS (Subwshed-Reach-PointID, e.g., STE-R1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Type: __ Road crossing __ Railroad crossing __ Private drive crossing __ Manmade dam __ Beaver dam __ Geological formation __ Other:

For Road / Railroad Crossings only

Shape	**# Barrels**	**Material**	**Alignment**	**Dimensions** (include in sketch):
__ Elliptical __ Box	__ Single	__ Concrete	__ Flow-aligned	Barrel diameter: _____ft
__ Circular __ Arch	__ Double	__ CMP	__ Not flow-aligned	Height (for box): _____ft
__ Bottomless	__ Triple	__ Smooth metal	__ Don't know	Width (for box): _____ft
__ Other:	__ Other:	__ Other:		Culvert length: _____ft
				Roadway elevation: _____ft
				Slope: _____ft

Condition (evidence of…) __ Cracking/spalling/corrosion __ Scouring downstream __ Sediment deposition __ Failing embankment __ Failing culvert __ Other (describe):

For Potential Fish Blockages

Extent

__ Total __ Partial __ Temporary __ Unknown

Blockage

__ Too high Outlet drop ___ in

__ Too shallow Pipe depth ___ in

__ Other:

Severity

5	4	3	2	1
A structure such as a dam or road culvert on a 3rd order or greater stream that would totally block the upstream movement of anadromous fish and there is no fish passage device present.	A total fish blockage on a tributary that would isolate a significant reach of stream or a partial blockage that could interfere with the migration of anadromous fish.		A temporary fish barrier such as a beaver dam or a blockage at the very head of a stream with very little viable fish habitat above it. Natural fish barriers such as waterfalls.	

STREAM Structural Crossing Data Form

SSC

Bottom Material		**Action Necessary**	
__ Bare culvert	__ Sediment	__ Fill stabilization	__ Culvert upsize / Bridge
__ Gravel / cobble	__ Other:	__ Culvert replacement	__ Other:

Notes and Sketch

STREAM Erosion Data Sheet

SFR

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Reach ID:	**Weather:**	**Assessed by:**
GPS (Subwshd-Reach-PointID, e.g., STE-R1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Description

__ Downcutting __ Bed Scour

__ Widening __ Sloughing

__ Headcutting __ Undercut Bank

__ Unknown __ Slope Failure

__ Other:

Dimensions

	Left and/or Right	
Bank of Concern		Bankfull ht (ft):
Length (ft)		Bottom width (ft):
Bank height (ft)		Top width (ft):
Bank angle (°)		Wetted width (ft):

Loss of Property? __ No __ Potential __ Yes, currently (describe):

Threat to Infrastructure? __ No __ Potential __ Yes, currently (describe):

Location __ Meander bend __ Straight section __ Steep slope/valley wall __ Other:

Existing Riparian Width __ ≤ 25ft __ 25-50ft __ 50-75ft __ 75-100ft __ > 100ft

Land Use

Left Bank	Land Use	Right Bank
_____	Residential	_____
_____	Municipal	_____
_____	Commercial	_____
_____	Institutional	_____
_____	Industrial	_____
_____	Park / Open Space	_____
_____	Other:	_____

Sketch and Notes

STREAM Erosion Data Sheet

SFR

Site Severity (Circle #)	Major incision (>2in rill), with very high banks on both sides of the stream that are unstable and eroding at a fast rate; erosion contributing significant amount of sediment to stream; obvious threat to property or infrastructure.		High banks, evidence that the stream is eroding at a fast rate; no threat to property or infrastructure.		Erosion is limited to small area; is being caused by a pipe outfall and the area affected is fairly limited
	5		4	3	2 1
Access	**Easily accessible by car and on foot** (an open area inside a public park where there is sufficient room to park safely near the site; heavy equipment could easily access using existing roads or trails).		**Easily accessible by foot only** (stream section that could be reached by crossing a large field or a site accessible on by 4-wheel drive vehicle).		**Difficult to reach** (e.g., site on private land with no roads or trails nearby; hike over a mile to reach site; need to build access road for equipment over a long distance through rough terrain).
	5		4	3	2 1
Source of Erosion (e.g., outfall, instream flows, etc.)					

STREAM Bank Stabilization Data Sheet

SBS

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Reach ID:	**Weather:**	**Assessed by:**
GPS (Subwshed-Reach-PointID, e.g., STE-R1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Impacted Bank
__ Left
__ Right
__ Both

Evidence of Existing Impacts
__ Buffer patchy/fragmented
__ Hill slope erosion
__ Lawn maintenance
__ Trash/rubble
__ Dying/diseased vegetation
__ Stormwater impacts
__ Bank erosion
__ Construction
__ Other:

Land Use

Left Bank	Land Use	Right Bank
_____	Residential	_____
_____	Municipal	_____
_____	Commercial	_____
_____	Institutional	_____
_____	Industrial	_____
_____	Park / Open Space	_____
_____	Other:	_____

Land Cover (project area)

Left Bank	Land Cover	Right Bank
_____%	Impervious	_____%
_____%	Bare Ground	_____%
_____%	Turf/lawn	_____%
_____%	Tall grasses	_____%
_____%	Shrub/Scrub	_____%
_____%	Trees	_____%
_____%	Invasives	_____%
_____%	Wetland	_____%

Dimensions

Left Bank		Right Bank
_____	Slope	_____

Buffer recently established? (< 5 yrs) __ N __ Y __ Unknown

Dominant plant species and percent cover (if known):
1.
2.
3.
4.
5.

Stream shade provided? __ None __ Partial __ Full

Vegetation Potential (circle #):

Impacted area on public land where the riparian area does not appear to be used for any specific purpose. Easily accessible by foot or by heavy equipment.	Impacted area on either public or private land that is presently used for a specific purpose, where use could be accommodated on an adjacent land.	Impacted area on private land where roads and buildings encroachment prevents any significant reforestation.

5 4 3 2 1

Wetland Potential (circle #):

Areas with low banks (<2ft) and fairly flat open land adjacent to stream		High banks (>5ft) and narrow steep floodplain.

5 4 3 2 1

Sketch and Notes:

STREAM Bank Stabilization Data Sheet

SRS

_____	Aspect	_____	
_____	Length (ft)	_____	
	Restorable width		
__	< 25ft	__	
__	25-50ft	__	
__	50-75ft	__	
__	75-100ft	__	
__	> 100ft	__	

STREAM Utility Impact Data Sheet

SUT

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Reach ID:	**Weather:**	**Assessed by:**
GPS (Subwshd-Reach-PointID, e.g., STE-R1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Type	**Material**	**Location**	**Potential Fish Barrier?**	**Dimensions**
__ Leaking sewer __ Exposed pipe __ Exposed manhole __ Other:	__ Concrete __ CMP __ Smooth metal __ PVC __ Other:	__ Floodplain __ Stream bank __ Above stream __ Stream bottom __ Other:	__ Yes __ No Water Drop: _____ (in)	Diameter: _____ ft Length exposed: _____ ft

Condition	__ Joint failure __ Protective covering broken __ Other:
__ Pipe corrosion/cracking __ Manhole cover absent	

Bank	__ Lt __ Rt __ Both
Flow __ None __ Trickle __ Mod __ Substantial __ Other:	**Shape** __ Circular __ Single __ Elliptical __ Double __ Other __ Triple
Veg. Density	__ Inhibited __ None __ Normal __ Excessive __ Other:
Pipe Benthic Growth	__ None __ Brown __ Orange __ Green __ Other
Submerged	__ No __ Partially__ Fully

Evidence of Discharge		
	Color	__ None __ Clear __ Dk Brown __ Lt Brown __ Yellowish __ Greenish __ Other:
	Odor	__ None __ Sewage __ Oily __ Sulfide __ Chlorine __ Other:
	Turbidity	__ None __ Slight cloudiness __ Cloudy __ Opaque Other:
	Floatables	__ None __ Spalling/cracking __ Peeling paint __ Corrosion __ Other
	Deposits	__ None __ Toilet Paper, etc. __ Lime __ Surface oils __ Stains __ Other:

Severity (circle #)				
Strong discharge with a distinct color and/or a smell. The amount of discharge is large compared to the amount of normal flow in receiving stream, & the discharge appears to have a significant downstream impact.	Discharge small, usually clear and has no odor associated with it. If the discharge has a color and/or odor, the amount of discharge is very small compared to the stream's base flow and any impact appears to be minor/localized.	Storm water outfall pipes or other channels and/or pipes that appear to be designed to carry runoff and does not have dry weather discharge nor does it appear to be causing any erosion problems.		
5	4	3	2	1

Other Concerns	__ Excess trash (paper/plastic bags) __ Dumping (large items) __ Excessive sedimentation __ Needs regular maintenance __ Bank erosion __ Other:
Refer for local compliance? __ Y __ N	**Description of necessary actions:**

Notes and Sketch:

STREAM Bank Engineering Data Sheet

SBE

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Reach ID:	**Weather:**	**Assessed by:**
GPS (Subwshd-Reach-PointID, e.g., STE-R1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Type: __ Straightening __ Bank Stabilization __ Channel Protection __ Underground __ Other:

Material and Dimensions			Left	Right	
__ Concrete	__ Gabion	Bank of Concern			Bankfull ht (ft):
__ Rip Rap	__ Earthen	Length (ft)			Bottom width (ft):
__ Other:		Bank height (ft)			Top width (ft):
		Bank angle (°)			Wetted width (ft):

Land Use

Left Bank	**Land Use**	Right Bank
_____	Residential	_____
_____	Municipal	_____
_____	Commercial	_____
_____	Institutional	_____
_____	Industrial	_____
_____	Park / Open Space	_____
_____	Other:	_____

Channel Information

Does channel have perennial flow? __ Y __ N

Is there evidence of channel deposition? __ Y __ N

Is vegetation growing in channel? __ Y __ N

Severity (circle #)	A significant section of concrete stream (i.e., >500ft) channel where water is very shallow (<inch deep) with no natural sediments present in the channel.		A moderate length of stream (i.e., >200ft), but the channel has stabilized over time and is beginning to show signs that it is functioning as a natural stream channel. Bars may have formed in channel and vegetation may be present on the bar.		An earthen channel of less than 100ft with good water depth, a natural sediment bottom, and size and shape similar to the unchannelized stream reaches above and below impacted area.
	5	4	3	2	1

Sketch and Notes

Watershed: Willamette	**Date:**	**Start Time:**
Subwatershed:		**End Time:**
Reach ID:	**Weather:**	**Assessed by** (list all)**:**
GPS (Subwshed-Reach-PointID, e.g., STE-R1-01)**:**		

Photo ID	# / Description:
# / Description:	# / Description:
# / Description:	# / Description:

Covering Material __ Concrete __ Asphalt __ Turf __ Vegetation- shrubs __ Vegetation- trees __ Other:
Covering Use __ Residential __ Park/Open space __ Commercial __ Institutional __ Industrial __ Other:
Location __ Meander bend __ Straight section __ Steep slope/valley wall __ Other:
Project Area Dimensions (include in sketch) Length _____ ft Width _____ ft
Existing Riparian Width __ None __ ≤ 25ft __ 25-50ft __ 50-75ft __ 75-100ft __ > 100ft

Access	**Easily accessible by car and on foot** (an open area inside a public park where there is sufficient room to park safely near the site; heavy equipment could easily access using existing roads or trails).	**Easily accessible by foot only** (stream section that could be reached by crossing a large field or a site accessible on by 4-wheel drive vehicle).	**Difficult to reach** (e.g., site on private land with no roads or trails nearby; hike over a mile to reach site; need to build access road for equipment over a long distance through rough terrain).
	5	4 3	2 1

Sketch and Notes