

STEVENSON

SHORELINE MASTER PROGRAM



City of Stevenson Inventory & Characterization Report

December 2018

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Tasks 2.3



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1.0 Introduction

The purpose of this study is to conduct a baseline inventory of shoreline conditions within and adjacent to the City of Stevenson, Washington. This study includes an inventory and analysis of shoreline conditions related to land use, public access, environmentally sensitive areas and fish habitat, including habitat for species listed as threatened or endangered under the federal Endangered Species Act (ESA) (a comprehensive list of abbreviations and acronyms are found in Appendix A). More specifically, the shoreline inventory collected existing plans, surveys, studies, inventories, and other information applicable to the City's shorelines. In addition, Washington Administrative Code (WAC) 173-26-150 allows the City to pre-designate the shorelines of urban growth areas that are located outside of existing City boundaries, which the City has elected to do for areas in Skamania County. The study also conducted a physical inventory of land use, shoreline modifications, and public access and used the information that resulted to evaluate and characterize shoreline functions and ecological processes and to recommend enhancement and restoration projects.

This characterization report documents those ecosystem-wide processes that contribute to the structure and functions of Stevenson's shorelines and compares them to the human-based modifications that are working to change the same structure and functions. The descriptions in this report will be the basis upon which the City can continue the comprehensive update of the 1977 Shoreline Management Program (SMP), a revision process required of the City by the Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and Shoreline Master Program Guidelines, WAC 173-26, and Washington State Department of Ecology (Ecology) Grant G1200044. This report is intended to summarize the existing conditions for a wide audience and is not intended to be highly technical or analytical.

The information is organized in the following sections:

- **Section 1** introduces the report, defines and identifies the City's shoreline jurisdiction and the relationship of the City's SMP to other plans and programs, and describes the methods used to conduct the shoreline inventory and characterization.
- **Section 2** goes into detail on the ecosystem-wide processes that have set the stage on which Stevenson has been built. This section characterizes the geology, climate, hydrology, and game-changing processes associated with the Bonneville Dam, and describes the structures these processes have left behind.
- **Section 3** discusses what ecological functions are provided by the processes and structures along Stevenson's shorelines. The functions discussed in this section are categorized according to their importance to water quality, water quantity, and habitat. This section also introduces the indicators that will be used to measure ecological functions over time.
- **Section 4** analyzes how the processes, structures, and functions interact on a reach-by-reach basis along local shorelines. The information in this section is organized in tables characterizing the existing conditions of each indicator, the likelihood of impending land use changes along the reach, and the overall contribution of each reach to the ecological functions of the shoreline.
- **Section 5** analyzes the current uses of Stevenson's shorelines, defines whether these uses are preferred or water-oriented, analyzes potential future uses of shoreline areas, and recommends ways to accommodate such uses in the future.

- **Section 6** consists of preliminary shoreline environmental designation (SED) recommendations based on existing land uses, zoning, current ecological functions, and existing shoreline environmental designations.

45 The City will use this report in the next steps of the SMP update process, which will include developing proposed shoreline environment designations; preparing draft SMP goals, policies, and regulations; developing a restoration plan to take advantage of opportunities to improve degraded conditions in the City's shoreline jurisdiction; and evaluating anticipated cumulative impacts of the new program's implementation.

1.1 Study Area Boundary (Shoreline Jurisdiction)

50 The City's preliminary shoreline jurisdiction is identified in Appendix C, Map 1 and will be refined in the City's final Shoreline Management Program. This map includes the shorelines and shorelands of the Columbia River, Rock Creek, and a dam-flooded inlet of the Columbia called Rock Cove. These waterbodies and adjacent lands represent the "shorelines of the state," which include "shorelines", "shorelines of statewide significance," and "shorelands" in Stevenson, as are further described below. As established by state law
55 (RCW 35A.21.090 and 35.21.160) the waterward extent of the City's shoreline jurisdiction is the mid-line of the Columbia River, beyond the City limit boundary that mostly follows the land's edge. This report also includes information on the Columbia River and Rock Creek reaches and another dam-flooded inlet of the Columbia called Ashes Lake that currently lie outside the City's 2015 jurisdiction but within the boundary of the urban area established in the Columbia River Gorge National Scenic Area (NSA). Including an analysis of
60 these additional areas will allow the City to predesignate lands in the SMP so additional territory can be annexed unfettered by jurisdictional issues over shoreline management. While the City is opting to exercise its authority to predesignate, these areas remain under the jurisdiction of Skamania County until annexation occurs. The area outside the City's 2015 jurisdiction represents nearly 4.5 miles of the 10 total miles of shoreline characterized in this report.¹

65 1.1.1 Regulatory Overview and Definitions

This report limits its discussion to the Columbia River, Rock Cove, and Rock Creek based on the definitions and standards established by the state in the SMA and WAC.

Shorelines of the State – The SMP update process begins with the identification of "shorelines of the state" which comprise the geographic area where the SMA applies within a local jurisdiction. Shorelines of the State
70 include "shorelines" and "shorelines of statewide significance.

Shorelines – "Shorelines" are described as certain water areas of the state along with the lands underlying them. The SMA applies to shorelines as follows:

- All marine waters.
- Rivers and streams with more than 20 cubic feet per second (cfs) mean annual flow.
- 75 • Lakes and reservoirs greater than 20 acres in area.
- Associated wetlands and river deltas.
- Shorelands adjacent to these waterbodies.

¹ Recommendation #1-1 for SMP Update: Evaluate and predesignate lands outside of the 2014 city limits as part of the final SMP.

Shorelines of Statewide Significance – The SMA provides special emphasis on certain waterbodies in addition to those described below. The Columbia River, as a river having a mean annual flow greater than 1,000 cfs, is considered a shoreline of statewide significance and is joined by others in the following categories:

- The harbors, bays, estuaries, and inlets of the Pacific Ocean.
- Several named and unnamed deltas, bays, and passages of the Puget Sound.
- Any lakes and/or reservoirs with a surface area greater than 1,000 acres.
- Any Western Washington river having a mean annual flow greater than 1,000 cfs.
- Any Eastern Washington river having a mean annual flow greater than 200 cfs or a drainage area greater than 300 square miles.
- Associated wetlands and river deltas.
- Shorelands adjacent to these waterbodies.

Shorelands – “Shorelines of the state” include more than just the waterbodies meeting the threshold. Its definition includes all lands extending landward for 200 feet from the ordinary high water mark (OHWM) as well as floodways and their landward floodplains within 200 feet.

Ordinary High Water Mark – The OHWM is used as the basis for identifying shoreline locations and can be found by examining the bed and banks of a waterbody to ascertain where the presence and action of waters are so common and usual that they have marked the land as distinctly different from the abutting uplands. Because the OHWM is not a fixed elevation and subject to change over time, it is difficult to map its location precisely. The shoreline jurisdiction depicted in Map 1 should be taken to represent the general location of shorelines in Stevenson, and the regulatory provisions established during this SMP update should require a case-by-case verification of the OHWM.²

Optional Areas – The City’s shoreline jurisdiction may also include areas outside of those mandated through the SMA – municipalities may elect to include certain optional areas as well. The most common cases involve the inclusion of 100-year floodplains and the buffers required to protect critical areas. Critical areas include aquifer recharge areas, frequently flooded areas, geologic hazard areas, habitat areas, and wetlands which are now required to be regulated by the City under the state Growth Management Act (GMA). Extending the shoreline jurisdiction to these areas increases efficiencies of the permitting process and minimizes confusion about what and how many regulations apply within shoreline areas.

1.1.2 Preliminary Shoreline Jurisdiction

Stevenson’s preliminary shoreline jurisdiction and predesignation areas are depicted in Map 1 and is based on the minimum jurisdiction for shorelines of statewide significance (Columbia River), shorelines (Ashes Lake, Rock Cove, and Rock Creek), associated wetlands, and their shorelands (areas within 200 feet of the OHWM of these waterbodies). Optional areas associated with wetland buffers and the 2007 Piper Road landslide are included in this preliminary determination of shoreline jurisdiction for future evaluation and consideration for

² *Recommendation #1-2 for SMP Update:* Include regulatory provisions requiring the OHWM be determined at the time of project review so that it is always based on the most recent information.

inclusion in the final SMP. The information in this report and the will of the public as it is identified during the update process will help guide the decision about the inclusion of the optional areas.³

115 1.2 Methodology

Ecology provided the City with guidance for conducting this inventory and characterization through meetings, correspondence, and written handbooks. Stevenson's Shoreline Inventory and Characterization Report incorporates this guidance and reviews shorelines through a lens involving Ecosystem-Wide Processes, Shoreline Ecological Functions, and Reach-Scale Indicators.

120 Through this lens, Ecosystem-Wide Processes refer to the dynamic physical and chemical interactions that form, maintain, and change natural landscapes. These processes are fairly predictable, and changes to them occur relatively gradually or with a great deal of human influence. As the outcome of these broad, landscape-scale processes, Shoreline Ecological Functions occur at the middle scale and are more prone to direct influence by human actions but the services they perform continue to operate to a greater or lesser extent
125 despite these influences.

At the finer level, Reach-Scale Indicators are easily measured proxies used to describe how well or poorly Ecosystem Processes and Ecological Functions are working. Such indicators are helpful both because they describe performance of multiple and interacting Ecological Functions, and because they are variable and highly subject to changes based on human influence. Discreet and manageable, Reach-Scale Indicators can
130 be addressed more precisely at the site-scale during a permitting process, and their variability can therefore be made more predictable. As a result, human investments in shoreline areas can continue with greater certainty, and subject to changes based on the slower moving processes of the wider ecosystem and economy. This "status quo" of existing conditions is what Ecology requires us to maintain with the phrase "No Net Loss of Ecological Functions". The characterizations of this report describe the current state of these
135 processes, functions, and indicators so that Stevenson can protect local assets and achieve Ecology's standard.

Additional description of the methodology used to characterize specific reaches is included in ICR Section 4.0, including the qualitative scale used for each reach-scale indicator.

1.2.1 Data Sources

140 The data used in this characterization of the City's shorelines comes from the most current, accurate, complete, applicable and available information from existing reports, site visits, and remote sensing data. A number of state and federal agency data sources and City records, maps, aerial photos, and technical reports were compiled as the basis for the shoreline inventory. Section 7.0 lists the data sources. The following were among the most helpful:

- 145 • Stevenson Comprehensive Plan (City of Stevenson, 2013)
- Biological Assessment of the Effects of the Rock Creek Debris Removal, Bridge Protection and Fish Habitat Improvement Project (SWCA Environmental Consultants, 2007)
- Lower Columbia Fish Recovery Plan (Lower Columbia Fish Recovery Board, various dates, including 2010)

³ Recommendation #1-3 for SMP Update: Evaluate and consider extending shoreline jurisdiction during later stages of the SMP update, paying special attention to the benefits of eliminating redundancy in the permitting process.

Table 1.2-1 Stevenson’s Ecosystem-Wide Processes, Ecological Functions, and Reach-Scale Indicators

Characterization Methodology		Ecosystem-Wide Processes	Geology	Climate	Hydrology	Bonneville Dam		
	<p>Shoreline Ecological Functions</p>	<p>Reach-Scale Indicators</p>						
			<p>Water Quality Functions</p>	<p>Sediment Transport</p>	<p>303(d) Listings, Fish-Blocking Culverts, Impervious Surface Area, Permanently Protected Areas, Riparian Vegetation, Shoreline Stability, Urban Runoff, Wetland Acreage</p>			
				<p>Nutrient & Toxic Filtration</p>	<p>303(d) Listings, Available Floodplain Area, Impervious Surface Area, Permanently Protected Areas, Riparian Vegetation, Setbacks to OHWM, Urban Runoff, Wetland Acreage</p>			
				<p>Temperature Regulation</p>	<p>303(d) Listings, PHS Listings, Permanently Protected Areas, Riparian Vegetation, Setbacks to OHWM, Urban Runoff</p>			
			<p>Water Quantity Functions</p>	<p>Water Storage & Flow Regulation</p>	<p>Available Floodplain Area, Fish-Blocking Culverts, Impervious Surface Area, Overwater Roads & Structures, Riparian Vegetation, Urban Runoff, Wetland Acreage,</p>			
				<p>Input of Organics & LWM</p>	<p>Available Floodplain Area, Impervious Surface Area, PHS Listings, Permanently Protected Areas, Riparian Vegetation, Shoreline Stability</p>			
<p>Habitat Functions</p>	<p>Connectivity to Suitable Habitat</p>	<p>Fish-Blocking Culverts, Impervious Surface Area, Overwater Roads & Structures, PHS Listings, Permanently Protected Areas, Riparian Vegetation, Setbacks to OHWM, Shoreline Stability, Wetland Acreage</p>						

- Wind/White Salmon Watershed (WRIA 29) Level 1 Technical Assessment (Envirovision, 2003)
- Rock Creek Watershed Analysis (U.S. Forest Service, 2000)
- Rock Cove Environmental Evaluation and Comprehensive Plan (Fishman Environmental Services, 1997)

1.2.2 Shoreline Reaches

Map 1 displays the shoreline waterbodies in the Stevenson area. The Columbia River is a shoreline of statewide significance with annual flows over 1,000 cfs, Rock Creek, Rock Cove and Ashes Lake are shorelines with annual flows of more than 20 cfs or an area of greater than 20 acres. Therefore, the Columbia River, Rock Creek, Rock Cove, and Ashes Lake and their associated "shorelands" comprise the geographic area where the SMA applies in the City.

To assess the physical and biological resources of the shorelines of these waterbodies, this inventory and characterization breaks them into seven relatively homogeneous and manageable units based on geographic location. The character of these reaches has been assessed and is described generally according to the level of ecological functions they provide and by existing and projected land uses. Table 1.2-2 describes the reach boundaries with greater detail found in the text sections for each reach.

1.3 Relationship to Other Plans and Programs

The SMA requires local governments and state agencies to review the plans, regulations, and ordinances applying to areas of shoreline jurisdiction and modify them to ensure they are consistent with the SMP. Waterfront lands are regulated by various local, state, and federal policies, and the SMP update needs to ensure these are integrated to avoid inconsistencies or conflicts between the regulations.

1.3.1 Local Plans and Programs

Stevenson's SMP intersects with its comprehensive plan, municipal code, and other regulatory plans and programs to manage and regulate development in shoreline areas. Local plans and regulations that relate to shoreline management include those discussed in the next sections.

Comprehensive Plan – The Stevenson Comprehensive Plan (April 2013) uses the cornerstone principles of high quality of life, natural/scenic beauty, healthy economy, and active waterfront to frame goals for growth, development, and change in the city. The plan contemplates the use of area plans, such as the SMP, as components of Stevenson's overall system of plans and one way to implement its strategies. The comprehensive plan is intended to be acted upon, and Goal 4A addresses the waterfront when it lays out a future where "the waterfront is an extension of the downtown core and a place where people live, work, and play." The objectives and tactics adopted to advance the City toward that goal provide instrumental guidance for the SMP update, as do the future land use map and several objectives and tactics associated with other goals in the comprehensive plan. The SMP update process will also provide a feedback loop for the continued relevance of the 2013 comprehensive plan, and that plan should be revisited and amended to reflect the new SMP as an area plan to be implemented under the aegis of the comprehensive plan.⁴

⁴ *Recommendation #1-4 for SMP Update:* SMP update should include a list of desirable comprehensive plan changes to bring the two documents into alignment. Specific recommendations should be made regarding the 1975 SMP's references in Chapter 2 and Goal 4A.

Table 1.2-2 Shoreline Waterbodies & Reach Designations

Streams & Rivers	Reach Name	Description	Approximate Length	
			Predesignated	City Jurisdiction
Columbia River	Reach 1— Pre-designated East Urban Area	North bank of river from the eastern Urban Area boundary at the mouth of Nelson Creek downriver to city limits at the mouth of Kanaka Creek. Note: While the shoreline of this reach is outside of city limits and pre-designated, some shorelands and associated wetlands are within the City's current shoreline jurisdiction.	5,550 LF	0 LF
	Reach 2— Downtown Waterfront	North bank of river within city limits from the mouth of Kanaka Creek downriver to the mouth of Rock Creek	0 LF	4,175 LF
	Reach 3— Pre-designated West Urban Area	North bank of river from the mouth of Rock Creek downriver to the Urban Area boundary at SR 14 west of Stevenson Co-Ply site.	8,000 LF	0 LF
Rock Creek	Reach 1—City Reach	West/South bank of stream from its mouth upstream to city limits at Ryan Allen Road. East/North bank of stream from its mouth upstream to city limits near Lasher Street.	0 LF	10,375 LF
	Reach 2— Pre-designated Upper Rock Creek	West/South bank of stream from Ryan Allen Road upstream to Urban Area boundary. East/North bank of stream from city limits near Lasher Street upstream to Urban Area boundary.	5,325 LF	0 LF
Streams & Rivers Subtotal			18,875 LF (3.6 mi)	14,550 LF (2.8 mi)
Lakes	Description		Approximate Length	
			Pre-designated	City Jurisdiction
Rock Cove	Rock Cove—City Reach	Entire bank of lake, islands, and SR 14/ railroad berm.	0 LF	18,800 LF
Ashes Lake	Ashes Lake— Pre-designated	Extreme Northeast end of Ashes Lake within Urban Area boundary.	425 LF	0 LF
Lakes Subtotal			425 LF (0.1 mi)	18,800 LF (3.6 mi)
TOTAL			19,300 LF (3.7 mi)	33,350 LF (6.3 mi)

190

Appendix B of this report provides a complete list of current comprehensive plan statements, objectives, and tactics that interrelate with the SMP.

195

Zoning Code – The City and County zoning codes provides use, design, and procedural standards adopted for all areas of the City, including those within the shoreline jurisdiction. The City's zoning code contains clear but imperfect attempts to reconcile its design-based regulations with the existing SMP, especially within the Commercial (C1), Commercial Recreation (CR), and Public Use & Recreation (PR) districts. However, there is no evidence of any attempts to reconcile the use-based regulations or procedural requirements of the

existing SMP and zoning code. The SMP update process and annexation of property will provide opportunities to better align shorelines policies and procedures with those of the zoning code.⁵

200 **Critical Areas Code** – Like the SMP, the state mandates that the City adopt regulations to protect what it has
deemed “critical areas,” including aquifer recharge areas, frequently flooded areas, geologically hazardous
areas, habitat areas, and wetlands. This mandate came as part of the GMA, and the overlapping regulatory
requirements of critical areas protection and the SMA have been troublesome for many municipalities and
205 state agencies. These tensions have required guidance from the state courts, and the City’s SMP update will
need to follow that guidance, which means that the City may either refer to the existing critical areas code in
the SMP or adopt specific critical areas provisions to apply when they exist in shoreline areas, or a
combination thereof.⁶

State Environmental Policy Act (SEPA) – The State Environmental Policy Act has been adopted locally as
SMC 18.04 – Environmental Policy. This program reviews all actions taken by the City to determine whether
210 the action is likely to have a significant adverse environmental impact. Action is very broadly defined to
include, among others, city-funded construction projects, policy adoption, and permitting of private projects.
The City’s decision to take such actions must be mindful of whether projects will have a significant impact,
whether their impacts can be mitigated, and the full scope of the impact if unavoidable. Checklists associated
with SEPA are required in all areas of the city, including those within shoreline jurisdiction.⁷

215 **1.3.2 State and Federal Plans and Programs**

The City’s SMP must also be compatible with state and federal regulations and programs that relate to
shoreline management. State and federal regulations and programs that intersect with Stevenson’s SMP
update are listed alphabetically below.

Bonneville Dam – The Bonneville Lock and Dam Project and the Bonneville Power Administration (BPA) are
220 components of a federal water resource management program designed to manage flood risk, generate
power, improve water quality, provide irrigation, and preserve and enhance fish and wildlife habitat,
recreation, and navigation on the Columbia River and some of its tributaries. Bonneville Dam, located 6 miles
downstream from Stevenson, is the earliest in a system of 31 hydropower dams generating power which the
BPA distributes throughout the Pacific Northwest. To balance the diverse needs of this water resource
225 management program, the U.S. Army Corps of Engineers (USACE) operates Bonneville Dam and the
Columbia River as a system, raising and lowering water levels in the Bonneville Pool based on complex
projections of the system’s water availability and power generation demands. This artificial control has a
great effect on the water and sediment regime of the City’s shoreline areas as will be discussed in section 2.4.

Clean Water Act (CWA) – Section 401 of the federal CWA requires projects obtain certification from the
230 state regarding compliance with water quality standards and other aquatic resource protections under
Ecology’s purview. Section 404 of the CWA regulates the discharge of dredged or fill material into waters of

⁵ *Recommendation #1-5 for SMP Update:* Evaluate and consider inclusion of the shoreline use, design, and procedural regulations adopted as part of the SMP Update as a component of a more unified development code along with those of the Zoning Code.

⁶ *Recommendation #1-6 for SMP Update:* Consider methods to integrate and reduce redundancy between Critical Areas and Shorelines permitting, especially regarding riparian habitat and wetland areas.

⁷ *Recommendation #1-7 for SMP Update:* Develop shoreline management policies that will help ensure projects avoid determinations of significant adverse environmental impacts under the SEPA.

the United States. Any project that proposes such impacts in waters of the United States, including special aquatic sites such as wetlands, must obtain a permit from USACE.

235 Under the authority of the CWA, the Environmental Protection Agency (EPA) authorizes Ecology to issue
permits under the National Pollutant Discharge Elimination System (NPDES). This system covers a wide range
of projects that discharge water. They are referred to as point source projects and include wastewater
treatment plants, industrial facilities, and large construction sites. The program also covers a graduated
system of municipal separate storm sewer systems (MS4s) to eliminate pollution from stormwater runoff. Two
240 phases of this program have been implemented to cover medium and large cities, but because of
Stevenson's size and location, its stormwater system is exempt from MS4 regulation. Ecology's Stormwater
Management Manual for Western Washington (2014) provides useful technical information and alternative
low impact development (LID) methods for managing runoff to help minimize pollution even in smaller
communities.⁸

Columbia River Gorge National Scenic Area Act – Congress passed the Columbia River Gorge National
245 Scenic Area Act in 1986 to protect and enhance the scenic, cultural, recreational, and natural resources of the
Columbia River Gorge – the National Scenic Area, or NSA. The Act also seeks to protect and support the
economy of the Gorge by encouraging growth within existing urban areas like Stevenson. Unlike
Washington's GMA, the Act is focused far more on *resource management* than *growth management*.
Whereas the statewide GMA establishes urban growth areas that are expected to continually expand to meet
250 the population management demands of projected 20-year growth, the NSA Act established urban areas
within which all industrial development and most commercial and residential development are expected to
occur. Minor revisions to the NSA boundaries are permissible, but not at the expense of the scenic resources
the Act was established to protect. While the Act severely limits the types of development that can occur
outside the urban areas, it places no planning requirements or development restrictions on the City. Instead,
255 it increases the pressure for Stevenson to accommodate the growth and uses prohibited elsewhere in the
NSA. Stevenson's SMP will be a key ingredient of the place-based solution required to absorb the added
development pressures created by the Act.

Endangered Species Act (ESA) – The federal ESA was adopted in 1973 as a regulatory measure to prevent
the extinction of plant and animal species. By establishing a "consultation" process, the Act provides for the
260 conservation of species that are endangered or threatened throughout all or a significant portion of their
range. During consultation, the National Marine Fisheries Service (NOAA Fisheries) (NMFS) and/or US Fish
and Wildlife Service (USFWS) review project proposals to ensure they do not result in the "take" of a listed
species. Take is broadly defined as any action that would "harass, harm, pursue, hunt, shoot, wound, kill, trap,
capture, or collect, or to attempt to engage in any such action." Agency feedback must then be
265 accommodated by the project.

Hydraulic Project Approval (HPA) – The state HPA program applies to any construction activity that would
alter the bed or bank of a water of the state. The program is administered by the Washington Department of
Fish and Wildlife (WDFW). All projects covered by the requirements must submit permit applications to show
that construction is done in a manner that prevents damage to the state's fish, shellfish, and their habitats.

⁸ *Recommendation #1-8 for SMP Update:* Evaluate and consider LID methods identified in the 2014 stormwater manual as appropriate to limit net loss of shoreline ecological functions.

270 **Magnuson-Stevens Fishery Conservation and Management Act** – This national act protects fish and
fisheries in the high seas and the anadromous species spawning in the rivers of the United States. The act
was originally adopted in 1976, and its focus on the nutritional, economic, and recreational value of fish
species differentiates it from the ESA. Whereas the latter seeks to prevent the extinction of the species it
protects, the Magnuson-Stevens Act seeks to maintain stocks of the species it protects to ensure optimum
275 ongoing yields for human consumption.

Migratory Bird Treaty Act – Originally adopted in 1918 as a treaty with Canada, this federal law has been
updated based on additional treaties with Mexico, Japan, and Russia. The Act seeks to prevent the unlicensed
killing, capturing, and commodification of migratory birds and their products (feathers, eggs, nests, etc.). The
Act also authorizes the Secretary of the Interior and the President to adopt suitable regulations regarding the
280 methods by which certain species of migratory birds may be hunted, captured, or commodified. The
Migratory Bird Treaty Act does not deal specifically with bird habitats and is primarily implemented through
state game wardens and hunting license provisions.

Rivers and Harbors Act of 1899 – The USACE reviews projects for compliance with Section 10 of the federal
Rivers and Harbors Act of 1899, which seeks to prohibit the unauthorized obstruction or alteration of
285 navigable waters of the United States (waters subject to the ebb and flow of the tide and/or are presently
used, previously used, or subject to future use to transport interstate commerce) without a USACE permit.

Washington Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan – An integrated plan
satisfying the requirements of several state, regional, and federal programs. This plan is adopted by NMFS as
a non-regulatory guidance document. The purpose of the plan is to restore the region’s threatened fish
290 species to healthy, harvestable levels and to protect and enhance other species adversely affected by human
actions. The plan provides site-specific management actions necessary for the conservation and survival of
threatened species, measurable criteria that be used to delist recovered species, and the project inventories,
priorities, and cost estimates necessary accomplish recovery goals.

Water Pollution Control Act – All projects affecting surface and ground waters in the state, including those
295 that are not subject to the CWA sections 401 and 404, must still comply with the provisions of the state’s
Water Pollution Control Act. It authorizes Ecology to operate a state waste disposal permitting system for
industrial, commercial, and municipal discharges of pollutants.

Other relevant federal laws include the National Environmental Policy Act, Anadromous Fish Conservation
Act, and the Clean Air Act. State laws that address shoreline issues include the Forest Practices Act, tribal
300 agreements and case law, the Watershed Planning Act, the Water Resources Act, and the Salmon Recovery
Act.

2.0 Ecosystem-Wide Processes

Ecosystem-wide processes are the dynamic physical and chemical interactions that form and maintain natural landscapes. These processes occur over large landscapes that include both shoreline areas and the wider watershed draining to the shoreline. The SMA requires local jurisdictions to consider the ecosystem-wide processes that are at play in shaping the structure of shorelines.

This section of the shoreline inventory and characterization report describes ecosystem-wide processes and the structures they have created. It focuses on the swift and cataclysmic nature of the ecosystem-wide processes at work in Stevenson and the Columbia River Gorge. The natural forces of geology, climate, and hydrology are especially visible in Stevenson. They are characterized below because of the massive scale of their impacts on Stevenson’s shorelines and because they demonstrate the complexity of developing place-based solutions to problems that can change overnight because of causes that are beyond Stevenson’s ability to influence.

2.1 Geologic Processes

In a place known for its jaw-dropping waterfalls and picturesque cliff faces, geology is *the* story of the Columbia River Gorge. The characters in this story include the joints between layers of sedimentary and igneous rock units, the lifting and folding of the ground caused by the shifting of the Earth’s plates, and the persistent forces of gravity, water, and their conflicting relationship with beauty and destruction. The descriptions in this section quite literally set the stage upon which Stevenson and the ecosystem-wide processes play out.

2.1.1 Rock Units

The oldest and deepest geologic formation in the Stevenson area is called **the Ohanapecosh Formation**. This sedimentary layer is rarely visible from the surface, but some layers of its tuffs (igneous rock that forms from the debris ejected by explosive volcanic events), breccias, conglomerates, sandstones, and claystones (various types of sedimentary rocks composed of rock fragments cemented within a matrix of smaller particles) are exposed in the Wind River canyon beneath and upstream of Carson’s Conrad Lundy (“High”) Bridge to the east of Stevenson.

The Stevenson Ridge Volcanics (sometimes referred to as Stevens Ridge Volcanics) is an igneous layer of basaltic-andesite lava and breccias flows visible in several places near Stevenson, especially along the shorelines of the Columbia River and in cuts for BNSF railroad tracks. This layer is highly permeable along its fractures and columnar joints and water percolates relatively freely through the Stevenson Ridge Volcanics, where it is then impeded by the relatively impermeable layer of thick clay-rich paleo-soil horizon that separates the Stevenson Ridge Volcanics from the underlying Ohanapecosh Formation.

The Eagle Creek Formation is the thickest rock unit in the Stevenson area and overlies the Stevenson Ridge Volcanics. This sedimentary formation consists of volcanic conglomerates, sandstones, and mudstones

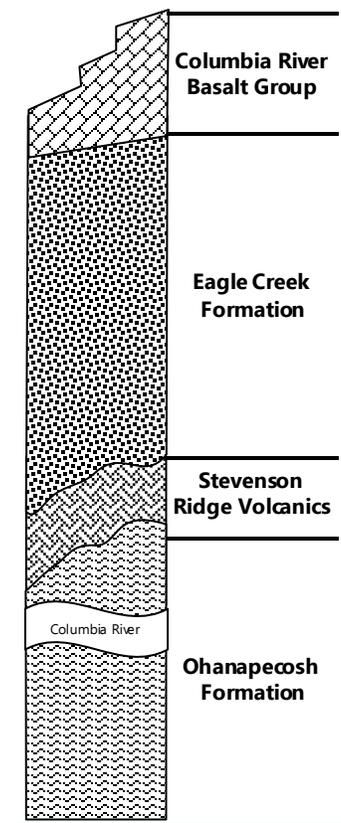


Figure 2.1-1 Generalized Stratigraphic Column

Figure Credit: Ben Shumaker, based on Berri & Korosec (1983) & Yinger (2007)

40 deposited as fluvial sediment drained from a volcanic terrain. This layer is visible in the stratified cliff faces of Red Bluffs and Table Mountain to the west of Stevenson. A thick clayey soil horizon separates the Eagle Creek Formation from the underlying Stevenson Ridge Volcanics and impedes the movement of water from one layer to the next.

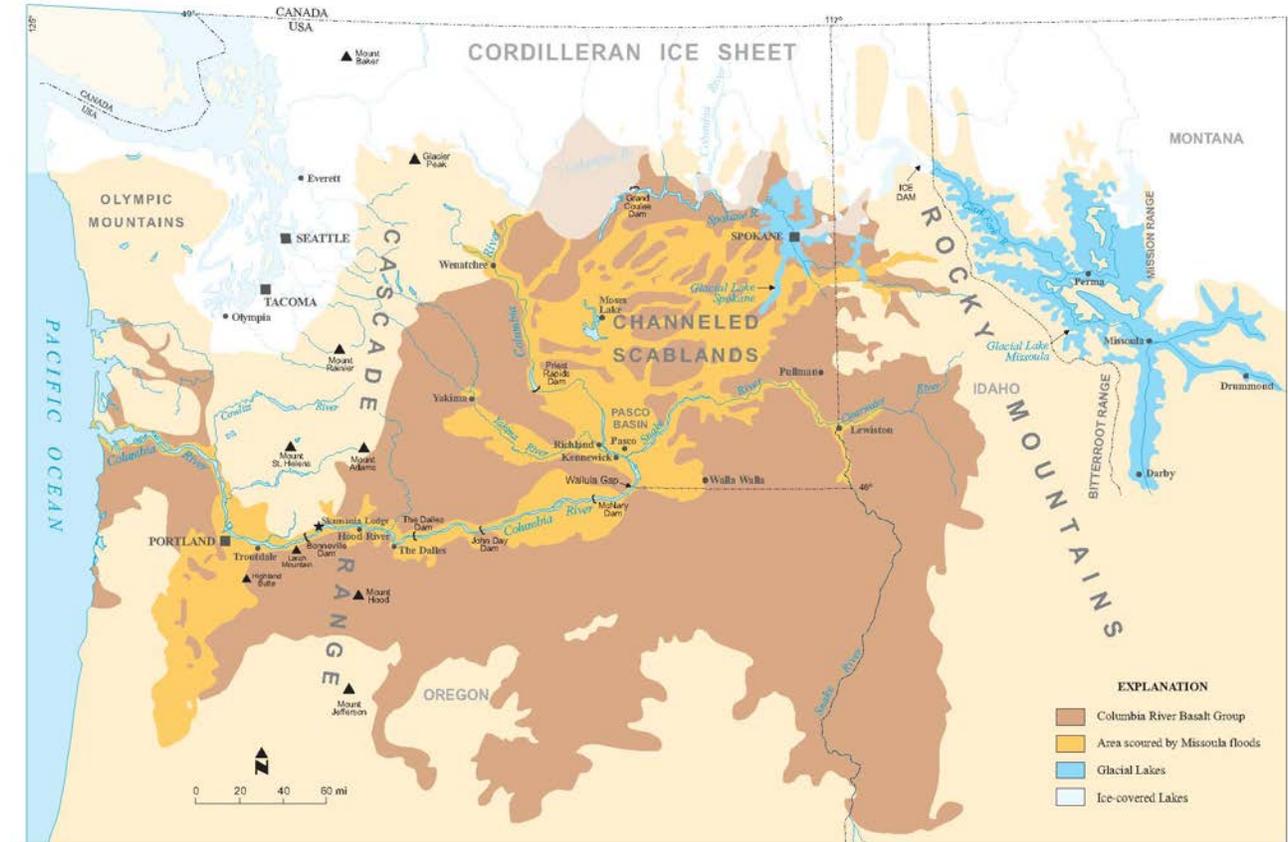


Figure 2.1-2 Columbia River Basalt Group & Missoula Floods

Figure Credit: Norman & Roloff (2004)

45 **The Columbia River Basalt Group**, typically the darling of the Columbia River Gorge’s geologic story, provides the uppermost and—at nearly 17 million years old—the youngest rock unit found in the Stevenson area. This series of basalt flows flooded out of eastern Washington and Oregon at an average rate of 3 miles per hour covering more than 100,000 square miles of territory with molten rock. Filling in the ancestral Columbia River valley on their way to the Pacific Ocean, these flows of rock pushed the river itself to the northern margin of the trough. Nowhere is this more visible than in the stretch of river valley near Stevenson where one can see what happens when a river is caught between a rock and a not-so-hard place. Here on the south side of the Gorge, the layers of the Columbia River Basalt Group form cliffs approximately 2,000 feet thick. Just over on the north side of the river, however, these massive flows are limited to small areas and generally cap only the highest ridges. Instead, the river cuts through the older and more erosive formations described above. The beautiful and destructive results of this anomaly are described more fully in section 2.1.3.

2.1.2 Plates, Faults, and Folds

The process of plate tectonics has been well documented as the force behind dramatic events like volcanic eruptions and earthquakes, but it also results in more subtle shifts to landscapes that drive ecological

60 processes at the local level. In places like Stevenson where multiple geologic processes converge, the shifts are often less subtle, with discrete change-inducing events occurring relatively frequently.

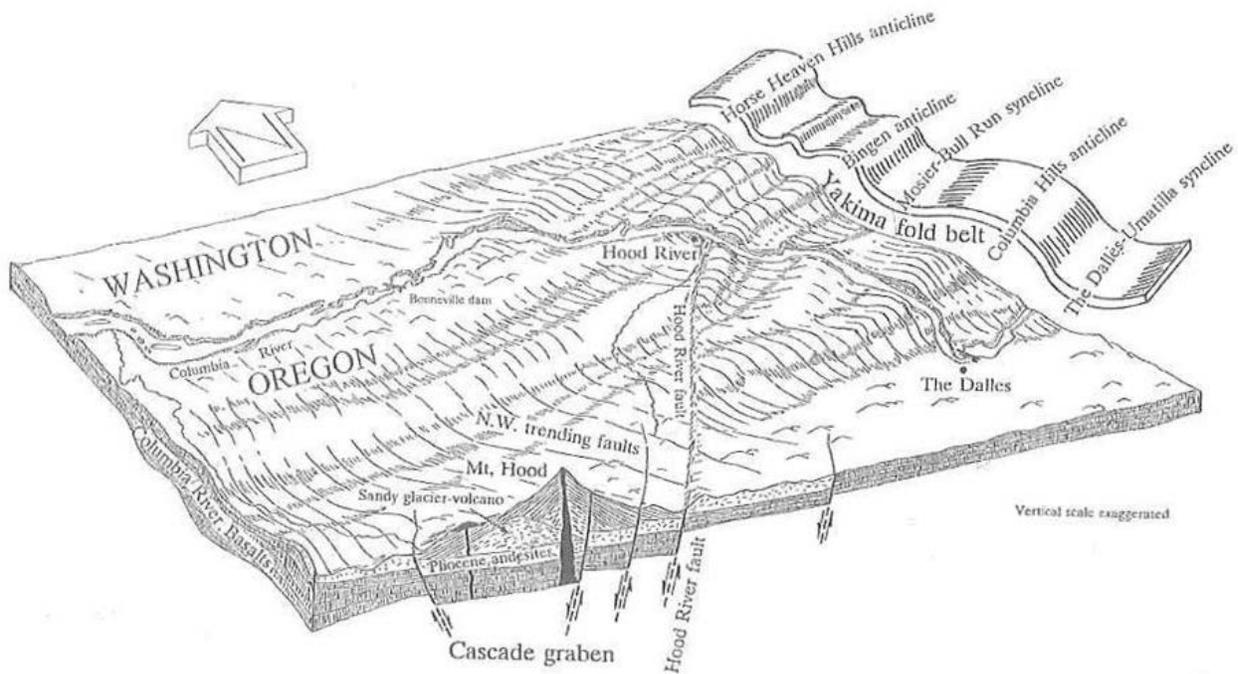


Figure 2.1-3 Yakima Fold Belt

Figure Credit: Orr & Orr (2012)

The constant shifting, convergence, and compression of the Earth’s plates upon one another in the 17 million years since the Columbia River Basalt Group flooded the ancestral Columbia River Valley have created a regional feature known as the **Yakima Fold Belt**. Northwest-southeast compression in this area has resulted in broad northeast trending folds of anticlines (convex upward folds of the geologic strata—hills) and synclines (concave downward folds of the geologic strata—holes) and northwest trending strike-slip faults (intra-plate faults separating individual sides of a rock unit that move laterally along a near-vertical crack). The south-facing slope of one of these folds underlies Stevenson, the Columbia River, and the surrounding landscape. Dipping southeasterly at an angle between 2 and 10 degrees, the orientation of this fold conspires with other ecosystem-wide processes and is another key contributor to shoreline structure and ecosystem functions, especially the persistent admission of new sediments into the water columns of Rock Creek and the Columbia River.

2.1.3 Landslides and Waterfalls

75 The combination of alternating rock units separated by thick clays, the deep percolation of surface waters through faults and fractures in the rock units, and the steep angle at which these units have been folded has been referred to by geologists as a “well-greased skidboard” (Waters, 1973, as quoted in O’Connor and Burns, 2009). Thousands of years’ worth of Columbia River erosive power has ensured the freedom of movement on this skidboard as gravity exerts its force. Two sets of cataclysmic experiences demonstrate the power of these lateral and vertical forces and their effects on Stevenson’s shorelines.

85 The **Missoula Floods** (also referred to as the Bretz Floods) produced some of the earliest recognizable landslides in the Stevenson area. This series of floods resulted from the repeated formation and breaching of Lake Missoula, a glacially dammed lake that covered much of western Montana. The ice dam broke approximately 80 times during a 6,000-year period between 18,000 and 12,000 years ago and sent torrents of floodwater racing across eastern Washington and down through the Gorge on their way to the Pacific Ocean.

As depicted on Figure 2.1-2, the waters of Lake Missoula spread out over the relatively homogenous flood basalt bedrock of eastern Washington to form the Channeled Scablands, but as they funneled into the Gorge, the floods' destructive cocktail of ice, rock, water, and biological debris reached depths of more than 1,000 feet and scoured the hill slopes, leaving behind cliff faces free of vegetation and soil.

90 These exposed faces are still visible today at the approximately 800-foot elevation line and contribute to the dramatic scenery of the eastern Columbia River Gorge. The waters had a far different effect near Stevenson as they were pushed to the margin between the Columbia River Flood Basalts and the softer Eagle Creek Formation. These floods exposed the thicker basalt layers on the Gorge's south side, leaving near vertical walls supported by the intact bedrock farther down-gradient of the underlying fold terrain. It is over these
95 walls of rock that many of the Gorge's spectacular waterfalls tumble. On the north side of the Gorge, however, the water's power stripped away the basalt and underlying sedimentary rock, leaving nothing down-gradient on the fold terrain to stabilize the rock units above. It is for this reason that the northern side of the Gorge is home to fewer waterfalls and more landslides.⁹

100 The **Cascade Landslide Complex** is one such set of landslides. Beginning approximately 1,000 years ago, the southern slopes of Table Mountain and Greenleaf Peak began mass wasting into the Columbia River through a series of landslides covering nearly 15 square miles, temporarily damming, and subsequently diverting, the Columbia River channel 1.5 miles south of its pre-slide location. The Bonneville Landslide is the most recent and, as the progenitor of several Bridge of the Gods legends, the most well-known landslide of this complex. A landscape-based allegory about love, loss, and familial relations, one Native American legend tells of two
105 brothers, Wy'East (Mount Hood) and Pahto (Mount Adams), battling over the love of Loowit (Mount St. Helens). When Old Coyote grew tired of his sons using the land bridge across the Columbia to fight with each other, he settled their quarrels by collapsing the bridge and forever separating the land on each side of the river.

110 Empirical evidence confirms that this area would have been dammed by the slide, and even if the allegorical bridge did not represent the type of free-spanning bridge of the European Americans' imaginations, it still provided some type of ford or dike over which people could "cross the river without getting their feet wet" (Lawrence and Lawrence, 1958, as quoted in O'Connor and Burns, 2009). Today's evidence also indicates that the impounded waters behind this dam rose more than 60 feet and stretched more than 70 miles upstream and, when they overtopped and breached the land bridge, they left observable marks of floodwaters nearly
115 100 feet deep at Troutdale, Oregon.

Though the exact date of the Bonneville Landslide is being debated, radio carbon dating indicates it occurred only 600 years ago. This timeline is generally borne out by modern historical Native American accounts,

⁹ *Recommendation #2-XX for SMP Update*: Evaluate geologically hazardous areas along shorelines for inclusion within Shoreline Jurisdiction and consider voluntary protective measure and/or special standards for site development in such areas.

130 Not to be outdone by the environmental obstacles, accounts of the human presence at this funneling of the
Columbia soon began to reveal the strategic importance of the area for travel and trade. Native Americans
recognized this long before Lewis and Clark's paddles plied these waters and were there to witness, aid, and
exploit these and later explorers as they attempted to avoid this dangerous stretch of water by using the
already well-worn portage trail.

135 The earliest accounts of European Americans focused on the perceived "otherness" of these peoples' dress,
physical features, and social hierarchies, but soon the otherness of their trading and tolling customs
increased in importance. Commonly accepted customs and cultural expectations of the Native Americans
were unknown to the European Americans, whose trading practices and land settlement patterns were
foreign to the Native American populations. Disagreements soon led to violence. The number of incidents
initiated by one group or another waxed and waned. The Hudson's Bay Company opened Fort Vancouver in
1825, but by the 1850s, the military and organizational force of the U.S. Army was deployed to the Cascades
140 where three forts (including Fort Vancouver) were set up along the Columbia's north shore, and the control
of this strategic stretch of river was ceded to the hands of European Americans.

The strategic value of Stevenson's location at the head of the Cascade Rapids materialized in the decades
after European Americans solidified control of the Columbia River and as steam-powered sternwheelers
replaced rafts as the primary mode of transportation. In the 1890s, brothers George and Momen Stevenson
145 of the Stevenson Land Company saw opportunity in a landing dock owned by Henry Shepard and his family
on a river terrace pinched between the outlets of two wood-filled watersheds. Here, they purchased land and
laid out the "Plat of Stevenson," an irregularly shaped, eight-block grid focused on its Columbia River wharf.
The site became a strategic stopping point for refueling and relaxation as boats and passengers prepared for
or recuperated from the passage through the Cascade Rapids. To serve the needs of the boats, cordwood
150 from the surrounding hillslopes crowded the pier, ready to stoke the boilers of sternwheelers like the famous
Bailey Gatzert on the route between Portland and The Dalles. Likewise, hotels and saloons crowded
Stevenson's "Whisky Row," ready to quell the needs of weary and thirsty travelers.¹⁰

2.2 Climate

155 Stevenson's peculiar geologic setting magnifies the effects of ecosystem-wide processes related to climate
and the atmosphere. Marine air masses from the Pacific Ocean largely determine the climate regime on the
western side of the Cascade Range, while continental air masses from northern latitudes in British Columbia
hold sway over the climate on the eastern side of the range. Stevenson is sited squarely in the transition zone
between these two climate regions, and its average temperatures show a predictable gradient between the
two. Local precipitation and wind patterns in Stevenson, however, demonstrate entirely different gradients
160 that are unlike any other areas in the state.

2.2.1 Temperature

To the west of the Cascade crest, air masses move in from the Pacific Ocean and maintain fairly moderate air
temperatures throughout the year, with average monthly temperatures ranging from 37° to 67° F. This
variability is seasonal and primarily because of the sun's effect on the region's high latitude. The high

¹⁰ *Recommendation #2-XX for SMP Update:* Consider how the Stevenson shoreline areas can accommodate modern-day
uses equivalent to the nineteenth-century amenities that led to the town's early success as a refueling and relaxation hub
while still following the priority order of shoreline use preference established by WAC 173-26-201(2d).

165 altitudes of the Cascade Range mitigate the influence of this warm air, and to the east, the air masses from
the Canadian interior have greater influence. Average monthly temperatures there range from 33° to 76° F.
While the lower lows are a direct result of air stream patterns, the higher highs arise from the thermal gains
imparted on the land by the high summer sun. Stevenson’s average monthly temperatures tuck neatly
170 between the averages on either side of the Cascade Range, with December being the coldest month with a
temperature of 34.5° F and August being the warmest month at 69° F.

Figure 2.2-1 Temperatures & Precipitation Rates for Stevenson & Two Neighboring Climate Regimes (30-Year Average)

	St. Helens, OR	Battle Ground, WA	Stevenson, WA*	Prosser, WA	Kennewick, WA
Highest Temperature Month	67.2° F (Aug)	65.0° F (Aug)	68.9° F (Aug)	74.2° F (July)	76.0° F (July)
Lowest Temperature Month	37.1° F (Dec)	38.5° F (Dec)	34.5° F (Dec)	32.9° F (Dec)	34.3° F (Dec)
Annual Precipitation	46.64 in.	52.60 in.	77.52 in.	8.94 in.	7.73 in.
Highest Precipitation Month	7.22 in. (Dec)	8.14 in. (Nov)	12.64 in. (Nov)	1.36 in. (Dec)	1.13 in. (Dec)
Lowest Precipitation Month	0.72 in. (July)	0.87 in. (July)	0.92 in. (July)	0.20 in. (July)	0.18 in. (Aug)

Data Credit: NOAA (2010)

*Stevenson Data is taken from Bonneville Dam, located ~5 miles to the west

2.2.2 Wind

175 Associated with the different temperature regimes, the Cascade Range also separates different atmospheric
pressure regimes. Wind is created as high pressure air moves toward lower pressure air. Often, the pressure
differential is a result of surface air temperatures: as surface air heats up, it rises, leaving behind a vacuum
into which cooler surface air is pulled. Lower elevations in such systems experience this effect to a greater
degree than higher elevations, and as the only near sea-level pass through the Cascades, the Columbia Gorge
provides the primary conduit through which the pressure regimes interact—and through which winds are
funneled.

180 Because of the seasonal differences in temperatures on each side of the Cascades, there are also seasonal
differences in the direction of prevailing winds. In the summer months, the hot continental air to the east of
the Cascades rises, pulling west winds through the Gorge that increase in intensity as daytime heating
increases the pressure differential. These summertime thermals produce the dependable and strong winds
lauded as world class by sailors, windsurfers, and kiteboarders. The exhilarating rush of being pulled by 30-
185 mph winds draws daytrippers from the Portland/Vancouver area and seasonal recreationalists from across
the world.¹¹ In the winter, winds move in the opposite direction as the warmer maritime air to the west of the
Cascades draws the cold continental air from the east. Anomalies to these norms do occur, but east winds
during the summer and west winds during the winter are comparatively infrequent and short in duration.

190 A phenomenon known as “gap flow” also occurs through the Gorge, which affects wind intensity based on
the direction of flow. As air moves down the pressure gradient—from high to low/cool to warm—it
accelerates and the strongest winds are observed at the gap’s exit. This flow is well known to wind-based
recreationalists whose preferred launch spot could be anywhere along the length of the Gorge depending on
the wind direction. On west-wind days, thrill seekers will travel east towards Hood River and The Dalles to

¹¹ *Recommendation #2-XX for SMP Update:* Develop tools to accommodate the unique uses related to wind-based recreation and position Stevenson to corner the emerging markets associated with these forms of water-dependent shoreline recreation.

195 capture the intense wind near the gap's exit. East winds will draw them to Stevenson and other launches on the west end of the Gorge.



Figure 2.2-2 Wind Recreation on the Columbia River
Left Photo: Windsurfers rig their sails at Bob's Beach.
Right Photo: Kiteboarders carve into the wind, sharing tight spaces on the water.

Photo Credits: Left, Dawn Nielson (2008) Right, Carol Bolstad (2009)

2.2.3 Precipitation

200 Seasonal variations in temperature also interact with the air's moisture content to produce differing patterns of precipitation on each side of the Cascades. To the west, the consistently moist maritime air is most noticeable in the wintertime when temperatures are far below the point when water vapor saturates the air to coalesce as precipitation. The result involves persistent stretches of clouds and more than 65 percent of the approximately 50 inches of annual precipitation falling between November and March. The opposite is

largely true during the warm summer months, when higher temperatures rarely fall below the point when the water vapor in the air coalesces, and rain is infrequent.

The higher altitudes of the Cascade Range also affect the air's moisture content, causing most of it to fall out before it reaches the Columbia Basin to the east. The limited precipitation that does fall on the eastside amounts to only approximately 8 inches, and, with only 60 percent of the annual rain falling between November and March, it is spread more evenly over the year than on the west side.

Due in part to Stevenson's location along the Cascade crest and in part to the air mass interactions facilitated by the Columbia River Gorge, Stevenson's annual precipitation, measured at the Bonneville Dam, is greater than the precipitation falling on the surrounding regions. At the Bonneville Dam, 5 miles downstream of Stevenson, the 30-year average annual precipitation is approximately 78 inches, 70 percent of which falls in the five months between November and March.¹²



Figure 2.2-3 Freezing Rain: Beautiful, Dangerous

Photo Credit Dawn Nielson (2005).

¹² Recommendation #2-XX for SMP Update: Consider how this amount and timing of precipitation impacts the City's stormwater system as it outlets to shoreline areas and whether this impact can be lessened.

220 Wintertime interactions between the neighboring climatic regimes are of special note for the Stevenson area
because of the potential dangers involved. High-level atmospheric snows falling through a layer of moist,
warm Pacific air often melt into rain before falling through the cold air mass from the Columbia Basin. If the
Columbia Basin air mass is thick, this mixture will refreeze as sleet before it reaches ground level, but often it
will fall as super-cooled water and refreeze when it reaches a cold surface or solid object. The glaze of ice
225 that results from these “silver thaws” threatens to down habitat-friendly trees, results in shoreline
modifications to replace overhead utility lines, and makes pedestrian and vehicular travel dangerous.¹³

2.3 Hydrology

230 As the regional climatic patterns deposit rain and snow from above, Stevenson’s geologic setting transmits
them downstream to form the structures of Stevenson’s shorelines. Ashes Lake, Rock Cove, Rock Creek, and
the Columbia River are formed through the various groundwater and surface water hydrological processes
described here.

2.3.1 Groundwater

235 Specific studies on aquifers and groundwater movement have not been conducted in the Stevenson area, but
previous studies made several general observations based on the geology of the basin.¹⁴ These studies
describe three general types of groundwater, including perched water tables (small aquifers trapped by clay-
rich layers between rock units), artesian wells (including warm or hot springs), and the Bonneville Landslide
aquifer.

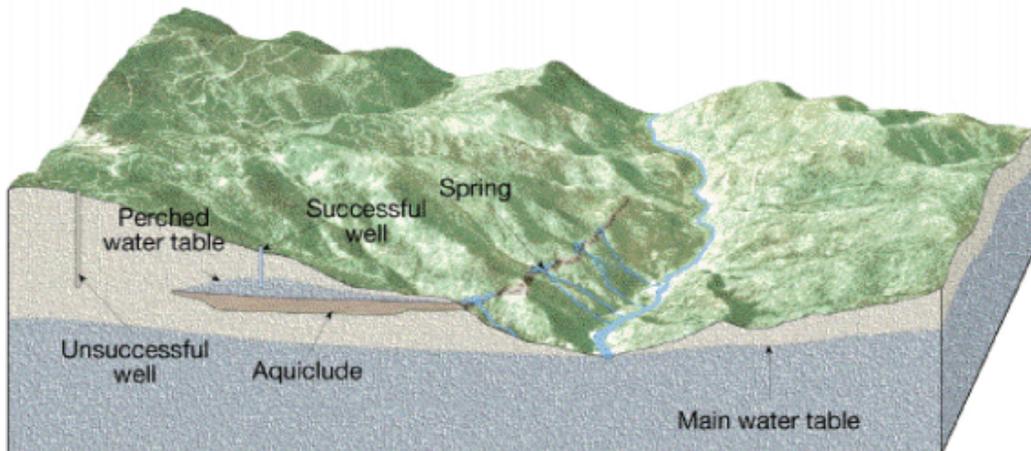


Figure 2.3-1 Perched Water Tables, Springs, and Unsuccessful Wells

If deep, wells in the Stevenson area are likely hydrologically connected to the Columbia River. Springs and shallow wells are likely connected to perched water tables in the Rock Creek basin.

Figure Credits: Tarbuck, et. al. (2005)

¹³ *Recommendation #2-XX for SMP Update:* Consider methods to increase resiliency during winter storm events, including burying overhead utility lines in shoreline areas and the voluntary or assisted replacement of downed vegetation.

¹⁴ *Recommendation #2-XX for SMP Update:* Consider future studies of aquifers and groundwater in the Rock Creek basin similar to those conducted by the U.S. Geological Survey for the basins in Hood River and Wasco counties.

240 The Bonneville Landslide aquifer is one of the more important groundwater features because of its
relationship to Stevenson’s municipal water supply and influence on Rock Creek. The high permeability of
ground above this aquifer allows the ready percolation of precipitation through the landslide’s jumbled
deposits. Through the not-always-intuitive connectedness of ground and surface waters, these waters travel
along the margin of the landslide and its underlying rock units to emerge as springs and supply the base flow
for a Rock Creek tributary. Surface waters are drawn from this tributary—and also from Rock Creek during
certain flows—for treatment and delivery to the taps of the homes and businesses connected to the City’s
245 municipal system. Those not served by this system draw their water from wells drilled into or springs
originating from perched water tables—with varying degrees of reliability. To overcome unreliable sources,
surface and ground water withdrawals are expected to continue along Stevenson’s shoreline areas, especially
within the Rock Creek watershed.¹⁵

250 Groundwaters in the Stevenson area also engage in a complex interrelationship with the local climate and
geology. By building up a thick deposit of ice glaze on all exposed surfaces, wintertime icing affects the
infiltration of water into the ground. By freezing the outlet of springs, winter temperatures reduce the
discharge of groundwater into streams and cause temporary rises in the groundwater table and increased
hydrostatic pressure within the soils. The reduced stability of slopes during states of high hydrostatic pressure
increases the likelihood of landslides.¹⁶ Ground movement creates new or expanded fractures affecting the
255 location, recharge, and/or presence of perched water tables and springs.

2.3.2 Ashes Lake

Ashes Lake is an approximately 57-acre backwater of the Columbia River created behind a railroad berm
when the Bonneville Pool inundated a lowland. While the waters of the lake lie outside the Stevenson urban
area, a portion of its shorelands are included within the area the City may annex in the future. It is included
260 here to allow the City to predesignate shoreline environments within the Stevenson urban area.

2.3.3 Rock Cove

Previously known as Stevenson Lake and the Hegewald Mill Pond, Rock Cove is an approximately 75-acre
backwater of the Columbia River which, like Ashes Lake, was created behind a railroad berm when the
Bonneville Pool inundated a lowland (approximately 75 feet above sea level). Prior to completion of the
265 Bonneville Dam, the area that is now Rock Cove was pasture and agricultural bottomland composed of the
deltaic deposits from Foster and Rock creeks (See Section 4.6.). Today, this same area is fed by Foster Creek
on its western side, but the small stream does little to affect hydrology or water levels in the cove. Instead,
water levels can fluctuate daily by several feet based on decisions made by the USACE and BPA at the
Bonneville Dam.¹⁷ Deep-water areas of the cove are typically between 10 and 15 feet below the water’s
270 surface.

¹⁵ *Recommendation #2-XX for SMP Update:* Consider private and municipal water supply needs when developing allowed uses in shoreline areas.

¹⁶ *Recommendation #2-XX for SMP Update:* Consider developing voluntary restoration activities and regulatory standards that decrease or avoid increased hydrostatic pressures within shoreline soils, potentially including the impacts of stormwater control facilities, on-site septic systems, and other land uses and developments.

¹⁷ *Recommendation #2-XX for SMP Update:* Acknowledge the City’s lack of control over water levels and flow regimes in the SMP’s goals and regulations for Rock Cove shorelines.

2.3.4 Rock Creek

275 The Rock Creek watershed is more than 43 square miles in area with a dendritic drainage pattern. The stream runs generally from the northwest to the southeast over its 15-mile course. Elevations in the watershed range from nearly 4,000 feet above sea level at the headwaters of the creek on Lookout Mountain to near 80 feet at its outlet into the Columbia River in Stevenson. Approximately 90 percent of the watershed lies in the rain-dominated and rain-on-snow precipitation zones described by the Washington Department of Natural Resources (DNR). Less than 1.5 miles of this course lies within the Stevenson urban area, and all of the watershed within the urban area is in the rain-dominated category.

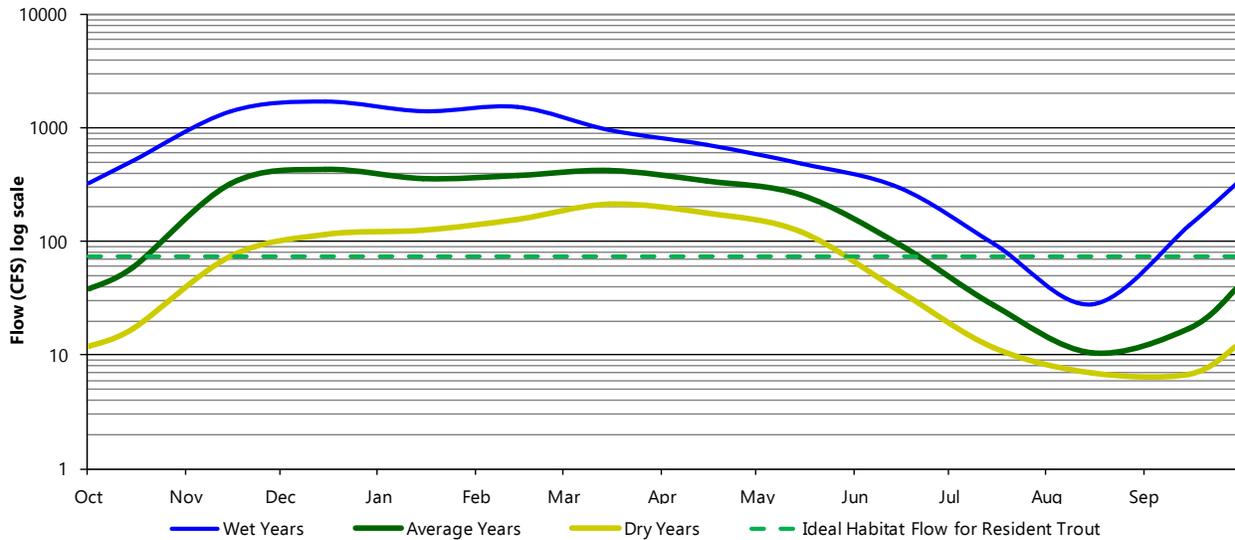


Figure 2.3-2 Rock Creek Hydrograph
Water years synthesized via monthly regression with Wind River daily flows.
Figure Credits: Ben Shumaker (2015) after Jim Pacheco (2014)

280 Figure 2.3-2 shows the extreme variation in flows expected in this stream, which can range from approximately 1,700 cfs in the wettest months of the wettest years (blue line) to only 7 cfs in the driest months of the driest years (yellow line). Even in average years (solid green line), Rock Creek’s flow can vary between 430 cfs and 10 cfs depending on the time of year.

285 The lack of snow-dominated areas in the watershed is also apparent in this hydrograph, which does not display the delayed increase in flows typically expected of such watersheds in the early summer when snowmelt supplements precipitation. This situation will insulate Rock Creek from many predictable effects associated with the current warming trends, though the hydrograph may show decreased runoff in May and June if less snow occurs in the higher portions of the watershed. Even if such decreases become notable in the future, the City does not anticipate the mean annual flow dropping below the 20 cfs threshold for consideration as a shoreline of the state.¹⁸

2.3.5 Columbia River

The Columbia River watershed is a behemoth by comparison. Draining an area nearly the size of Texas (approximately 260,000 square miles), the stream travels more than 1,200 miles between its headwaters in

¹⁸ Recommendation #2-XX for SMP Update: Evaluate ongoing monitoring efforts and activities to ensure Rock Creek remains a shoreline of the state.

the Rocky Mountains of British Columbia and its mouth at the Pacific Ocean. The fourth-largest river by
 295 volume in North America, flows at the river’s mouth range between approximately 100,000 cfs in the low flow
 months of September and October (when rainfall and snowmelt runoff are low) to approximately 500,000 cfs
 during the high flow months between April and June (when snowmelt runoff is at its greatest), averaging
 approximately 260,000 cfs over the course of a full year. Prior to regulation of flows by dams, flows at the
 mouth experienced greater extremes, with low flows of 79,000 cfs, high flows of over 1,000,000 cfs, and
 300 average flows of approximately 273,000 cfs. Figure 2.3-3 puts these giant numbers into perspective, showing
 how dams and urbanization have moderated high and low flows over the course of the year.

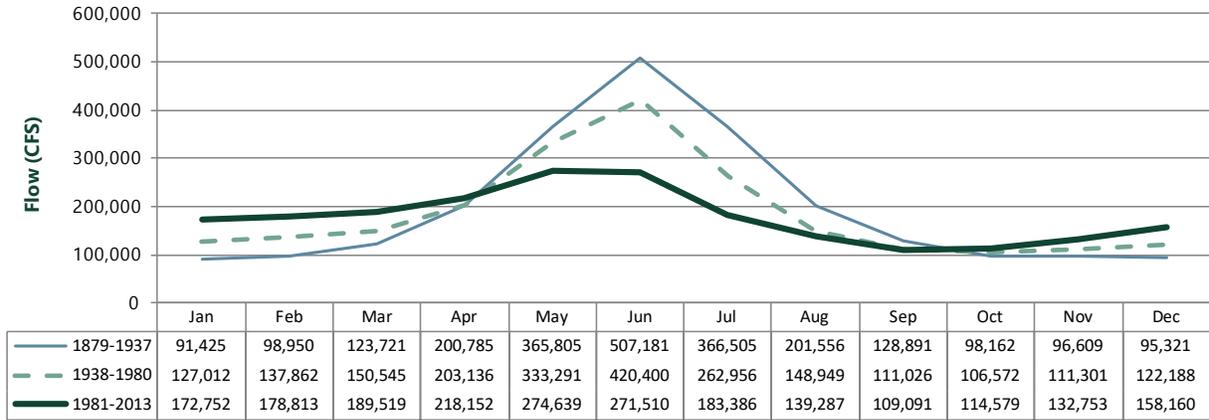


Figure 2.3-3 Columbia River Hydrograph through Time

Three representative hydrographs as measured below The Dalles Dam. Time periods reflect hydrograph before completion of the Bonneville Dam, between completion and expansion of the Bonneville Dam, and since expansion.

Figure Credits: Ben Shumaker (2015) with data from USGS National Water Information System.

More locally, the Columbia Gorge subbasin (the watersheds between the Bonneville and The Dalles dams) is a
 drainage area of 3,300 square miles and contributes approximately 3.9 percent of the river’s powerful
 305 discharge through Bonneville Dam. Elevations within this subbasin range from more than 150 feet below
 mean sea level (the deepest riverbed elevation in the Bonneville Reservoir) to over 4,000 feet in the
 mountainous headwaters bordering the river. The Stevenson urban area contains approximately 3.5 miles of
 Columbia River shoreline. Water depths adjacent to this area follow a shallow gradient over the dam-
 inundated historic floodplain before a rapid drop-off into the approximately 80-foot-deep navigation
 310 channel.

2.4 Bonneville Dam

*Roll on, Columbia, roll on. Your power is turning our darkness to dawn... At Bonneville
 now there are ships in the locks, the waters have risen and cleared all the
 rocks, shiploads of plenty will steam past the docks, roll on, Columbia, roll on.*

315 --Woody Guthrie, 1941

Penned while the famous folksinger was employed by the Bonneville Power Administration, Washington’s
 official folk song speaks for the chorus of boosters who engineered opportunity from a narrow bottleneck of
 the Columbia River. With a few lines of lyrics, Woody Guthrie’s “Roll On Columbia” captures the mid-
 twentieth century’s belief in its ability to create improvements that benefit many and harm no one through
 320 massive alterations of the environment. The river’s power could be harnessed and transported to provide
 electricity to industries and homes, unproductive lands could be watered to grow crops, barriers to

navigation could be cleared to allow goods to flow to and from new ports of call, a new empire could arise, and the river that created it would just roll on as if nothing had changed. History, however, has sung a different song. In this new song, the benefits of the Bonneville Dam are in disharmony with its drawbacks, and the dam has become an ecosystem-wide process unto itself. This section discusses the physical and legal influences of this massive structure on Stevenson’s shoreline areas.

2.4.1 Physical Influences: Not a River/Not a Lake

Built at the same location as the Cascades Landslide Complex, the Bonneville Dam’s influence on the Columbia River has mimicked the influence of the legendary Bridge of the Gods. Its relative permanence in comparison to that earlier river blockage sets this structure apart and requires constant human management to ensure the river’s force passes through the dam’s turbines without overtopping or breaching its concrete walls. The ecosystem-wide processes associated with this management result in water levels and flows having characteristics of a lake, a reservoir, an inland river, and a tidally influenced river.

The Bonneville Dam is the last of 18 on the mainstem of the Columbia and Snake rivers, and the decisions about water levels and flow rates behind each dam are made well in advance of a wide variety of anticipated events within the Columbia River’s highly interconnected and rationalized system. Anticipation of a large rain-on-snow event in the Idaho Rockies will trigger a drawdown of the Grand Coulee Dam, whose waters are then distributed behind the dams lower in the system; forecasts of extended heavy rains in the Willamette Valley will trigger the storage of waters behind upstream dams to eliminate any flood threat to the Portland-Vancouver area; predictions of unusually dry summers will result in longer-term storage of irrigation waters behind the dams of the Columbia Basin; scheduled maintenance of The Dalles Dam will result in the drawdown of both The Dalles and the Bonneville pools for worker safety.

The list of interconnections goes on, but human decisions have rationalized the Columbia’s ecosystem processes to ensure that management decisions balance regional needs of power generation, navigation, flood control, irrigation, and fisheries management. Managing the system at a regional level, however, can often appear irrational in relation to processes experienced at the local level. Water levels in the Bonneville Pool may hold steady for weeks at a time; then, within the course of a few days, may rise or fall by up to 12.5 feet. Balancing other needs, operational decisions made at the dam do not consider the impact of fluctuating



Figure 2.4-1 The Bonneville Dam
Turbulent waters emerge from the river-altering Bonneville Dam.

Figure Credits: David Hamilton (2014), Washington State Department of Ecology (2007)

water levels to the erosion or protection of riparian shorelines.¹⁹ Decisions establishing the normal pool elevation have been made without consideration for its impact on tributary streams, whose pre-dam sediment fallout curves have been drastically altered.²⁰ Changes to the rate of the river's flow alter water currents at local shoreline eddies.

2.4.2 Legal Influences: Flowage Easements

To facilitate the maintenance of artificial water levels, the federal government initiated a phase of land acquisition associated with the original construction of the Bonneville Dam and navigation lock in 1938 and the addition of a second powerhouse in 1981. Beginning in 1936 and concluding in 1980, this land acquisition was accomplished largely through the voluntary purchase of "flowage easements," though the federal government had, and used, the authority to force the matter through court-sanctioned "declarations of taking." The specific provisions of these easements changed over the course of time and varied slightly according to the demands of the individual property owners selling the easements. Early granters of the easement only sold:

... the full and perpetual right, power, privilege and easement to overflow...all that portion of [the owner's] land lying below [a specific elevation's] contour line...together with the right to go upon the land...from time to time to remove therefrom the timber and other natural growth, and any accumulations of brush, trash or driftwood...

More typically, however, these easements granted to the United States of America contained a longer list of encumbrances on the underlying properties. The key provisions regarding the control of water levels and the maintenance of vegetative growth and/or accumulation were included when these owners granted:

The perpetual right, power, privilege and easement permanently to overflow, flood and submerge the land...and the continuing right to clear and remove any brush, debris and natural obstructions which...may be detrimental to the [Bonneville Lock and Dam] project, together with all right, title and interest in and to the timber, structures and improvements situate on the land...

But these later granters also sold their rights to construct buildings or conduct land-filling activities within these easements,^{21 22} providing:

... that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, and that no

¹⁹ Recommendation #2-XX for SMP Update: Consider shoreline use and modification policies that incorporate solutions for shoreline protective works similar to those being developed for coastal areas expecting sea level rises.

²⁰ Recommendation #2-XX for SMP Update: Consider costs and benefits of ongoing sediment management efforts, such as dredging, when developing Environment designations and shoreline use and modification policies.

²¹ Recommendation #2-XX for SMP Update: Consider how these easements interact with the vegetation conservation and removal standards of the SMP and how what level education and outreach is necessary for the Corps and the property owners.

²² Recommendation #2-XX for SMP Update: Consider the reduced likelihood of development within areas covered by flowage easements when crafting allowed uses and development standards in shoreline environments.

excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill...²³

395 Beyond the monetary compensation the owners received for these easements—which could range into the thousands of dollars—the easement declarations concluded with the palliative statement that the landowners, their heirs, and assigns reserved:

400 *... all such rights and privileges as may be used and enjoyed without interfering with the use of the [Bonneville Lock and Dam] project...or abridging the rights and easement...acquired; provided further that any use of the land shall be subject to Federal and state laws with respect to pollution.*

405 While the rights granted to facilitate the massive Bonneville Dam project have had sweeping effects on the property owners' ability to use and develop portions of their properties, the easements have been largely effective in preventing damages from flooding. Repetitive flood losses for properties along Stevenson's shorelines are minimal, largely because of the consistent overlap of these areas.^{24, 25}

²³ *Recommendation #2-XX for SMP Update:* Evaluate administrative mechanisms related to coordination with the USACE and other governmental regulators during the review and issuance of permits under the SMP.

²⁴ *Recommendation #2-XX for SMP Update:* Consider shoreline use and modification policies that continue to minimize flood losses for shoreline property owners.

²⁵ *Recommendation #2-XX for SMP Update:* Consider incorporating a floodplain management plan into the restoration plan to better reflect the actual risk to floodplain property, thereby reducing owners' insurance costs.

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3.0 Shoreline Ecological Functions

Ecological functions are the services performed when physical, chemical, and biological ecosystem-wide processes interact. Ecological functions occur at discrete locations along shoreline areas. Because the SMA and the SMP guidelines attribute value to the services performed through ecological functions, local jurisdictions are required to evaluate the baseline level of service these functions provide to their shoreline areas. These functions are typically grouped into categories related to water quality, water quantity, and habitat.

This section of the shoreline inventory and characterization report describes water quality, water quantity, and habitat functions occurring along Stevenson’s shorelines. The characterizations below provide a necessary link between the ecosystem-wide processes of Section 2.0 and the indicators that will be used to more fully characterize specific shoreline reaches in Section 4.0.

3.1 Water Quality Functions

The water making its way past Stevenson’s shorelines includes a complex mixture of sediments, nutrients and toxics, and temperatures that interact with local shoreline morphology. During these interactions, the water’s overall quality is either improved or diminished when the ecological functions of sediment transport, nutrients and toxics filtration, and temperature regulation are performed. For most water quality functions, the City can rely on characterizations performed by Ecology and the EPA through the CWA 303(d) list and its 5-point scale for water quality concerns, including water temperature and pollutants. Under this scale, Categories 4 and 5 indicate serious impairments that require some degree of action.

3.1.1 Sediment Transport

Sediment transport is an important ecological function because of its ability to influence shoreline morphology and because of its interaction with ecological functions related to habitat. Commonly described in terms of “sources and sinks,” sediment transport occurs differently over the course of a waterway. In a large stream system like the Columbia, common sources of sediments are soil erosion from overland flow, streambank erosion, wind deposition, and tree fall. In a forested mountainous stream system like Rock Creek, these sediment sources are dwarfed by in-channel erosion and the landslides and mass wasting events discussed above. In an urbanized watershed like Rock Cove, runoff from buildings and transportation corridors plays a bigger role in the supply of sediment.

PROCESS	Geologic Processes, Climate Processes, Hydrologic Processes, Bonneville Dam Processes
FUNCTION	—Sediment Transport—
INDICATORS	Riparian Vegetation, Shoreline Stabilization, Impervious Surface Area, Urban Runoff, Permanently Protected Areas, 303(d) List, Floodplain Area, Wetland Acreage

Regardless of the source, a waterbody uses any of several methods to transport the sediments downstream. Larger sediments roll, slide, or skip along the stream bed pushed by higher flows. Smaller sediments are either dissolved or suspended in the water itself. All sediments will continue migrating downstream until flow velocities (largely a function of flow rates, channel widths, and channel gradients) decrease to the point where sediments settle out and deposit or sink to form new and ever-changing shoreline morphological features.

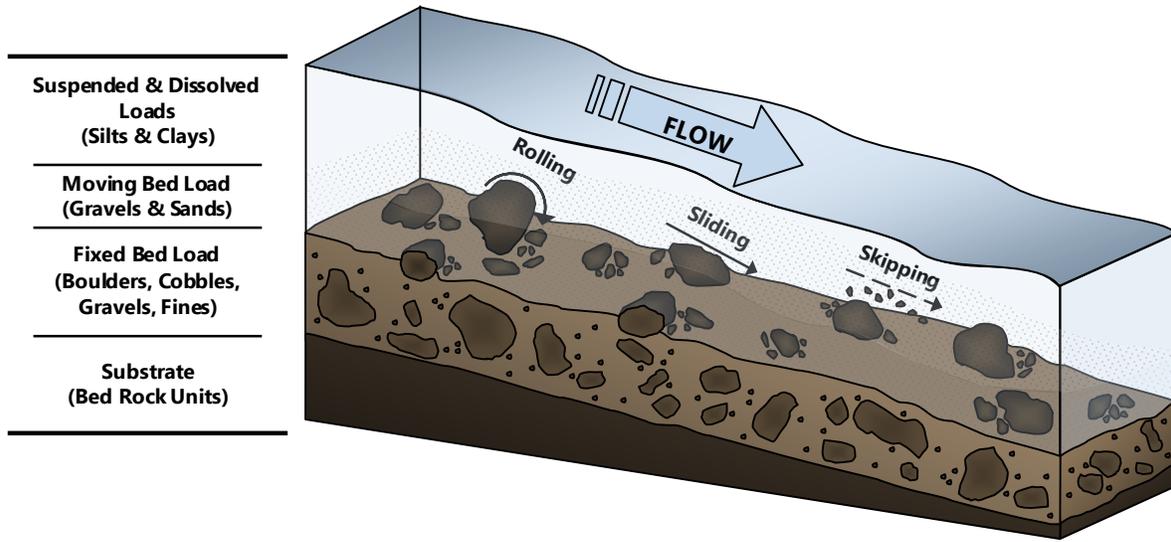


Figure 3.1-1 Sediment Transport Processes

Figure Credit: Ben Shumaker

The factors controlling sediment inputs and flow velocity are variable along a stream’s course and over the course of time, seasonally and long-term. Though no stream system has a continually balanced management of sediment sources and sinks, unimpaired shorelines generally manage the input and throughput of sediments on an annual basis. Impaired sediment transport occurs when sources of sediment are cutoff from a stream or when sources of sediment overwhelm a stream’s ability to move it through the system. Stevenson’s shorelines areas—especially Lower Rock Creek and Rock Cove—mostly serve as sediment sinks and areas of the Columbia River, Rock Cove and Rock Creek are particularly impaired through rapid accretion.

45 **3.1.2 Nutrient and Toxic Filtration**

Nutrient and toxic filtration is an ecological function closely related to sediment transport, habitat functions and can also affect public health. Specific nutrients and toxins include heavy metals (lead, zinc, mercury), nitrogen, pathogens (disease causing bacteria, virus, or microorganisms), pesticides and herbicides, and phosphorous. Nutrients & toxics are contributed to waterways by naturally occurring metals in the soil and biotic sources, “point sources” (factories and wastewater treatment plants), and “nonpoint sources” (acid rain, agriculture, contaminated groundwater, and urban runoff). Filtration of nutrients and toxins is performed through biotic uptake, adsorption to other elements or particles, chemical interactions and changes, and—in the case of pathogens like bacteria and protozoa—death of the organism.

<p>PROCESS FUNCTION INDICATORS</p>	<p>Hydrologic Processes, Bonneville Dam Processes —Nutrient & Toxic Filtration— Riparian Vegetation, Shoreline Stabilization, Impervious Surface Area, Urban Runoff, Permanently Protected Areas, 303(d) List, Floodplain Area, Wetland Acreage</p>
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55 Impaired nutrient and toxic filtration occurs when sources of nutrients and toxins overwhelm the capacity of a shoreline system, when shoreline waterbodies are cutoff from floodplains or associated wetlands, and when sedimentation of adsorbed nutrients and toxics pollutes a river bottom. These functions along Stevenson’s shoreline areas are at risk of impairment but largely operating within the expectations of the CWA water quality standards.

60 **3.1.3 Temperature Regulation**

Important to the lifecycle needs of fish and wildlife and the maintenance of other water quality functions, temperature regulation varies according to climate processes based on diurnal (daily) and annual cycles, but can also be heavily influenced by geologic processes (hot springs), shoreline morphology, and vegetative cover.

<p>PROCESS FUNCTION INDICATORS</p>	<p>Geologic Processes, Climate Processes, Bonneville Dam Processes —Temperature Regulation— Riparian Vegetation, Impervious Surface Area, Urban Runoff, Permanently Protected Areas, 303(d) List, Floodplain Area</p>
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65 The temperature regulation function is often considered impaired when shade-producing vegetative cover is removed from a shoreline or when point sources, hot springs, and/or urban runoff increase ambient stream temperatures. The Columbia River, Rock Cove, and Rock Creek systems demonstrate higher than normal temperatures for shorelines of their type as indicated in section 4.

70 **3.2 Water Quantity Functions**

Water quantity functions deal with the supply of water provided by climate and hydrological processes. Water quantity functions are valued because they moderate the distribution of the water supply over time. Reducing peak flood levels during high flows and maintaining streamflow and water availability during low flows.

75 Water storage occurs in depressional wetlands, lakes, floodplains, and in subsurface aquifers along or under shoreline systems. Water storage is valued as a shoreline ecological function because of its ability to regulate flows, maintain lifecycle needs for habitat, moderate flood risks to human life, and provide water for consumptive purposes.

<p>PROCESS FUNCTION INDICATORS</p>	<p>Geologic Processes, Climate Processes, Hydrologic Processes, Bonneville Dam Processes —Water Storage & Flow Regulation— Riparian Vegetation, Impervious Surface Area, Urban Runoff, Permanently Protected Areas, Floodplain Area, Wetland Acreage</p>
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80 Water storage and flow regulation functions vary greatly depending on the underlying geologic, and hydrologic processes and some areas are naturally unsuited for the storage of water. Areas with naturally permeable soils, connected floodplains and associated wetlands, and few impervious surfaces are considered well suited to water storage and flow regulation functions. Impairment occurs when these types of natural conditions are not present or are diminished. The Stevenson’s Rock Creek shoreline areas contains some
85 complex stream bottom, plunge pit, and snags of large woody material (LWM), these shoreline reaches are largely ill-suited for water storage and flow regulation functions. The Bonneville Dam places a daily demand on the water storage functions of the Columbia River and Rock Cove shorelines. This process creates a well-functioning flow regulation, but partially impairs the interrelated water storage function of these shorelines as a result.

90 **3.3 Habitat Functions**

The rocks, soils, sediments, and waters of Stevenson’s shorelines host a number of terrestrial, aquatic, and amphibious plant and animal species. Some of these species attract flocks of visiting bird watchers, some are a boon for backyard naturalists, some spark the imagination of the city’s children, some are a veritable nuisance to area vegetable gardens, and some are afforded special protection by the state and federal
95 governments.

Habitats are occupied by species demonstrating varying degrees of responsiveness and/or sentience in the selection of preferred sites. Because of this selectivity, the characterization of habitat functions goes into greater detail than the characterizations above. Descriptions of sensitive species are provided and followed by the ecological functions related to the input of organics and LWM and the connectivity and structures suitable for lifecycle needs.

3.3.1 In-water Habitat and Anadromous Fish

Anadromous fish are fish that are born and reproduce in freshwater habitats and then migrate to saltwater for a portion of their lifecycle. These species include salmon, trout, and lamprey. Anadromous species are among the most important species to consider when planning for the future of Stevenson's shorelines



Figure 3.3-1 Chinook Salmon

A female Chinook spawns in clean gravels free of fine sediments.

Photo Credit: City of Seattle (2013).

because of the decline in their numbers that has been observed over time.

Chinook Salmon (*Oncorhynchus tshawytscha*) is the largest of the Pacific salmon with the most diverse and complex lifecycle strategies, including distinct fall and spring migratory runs that evolved over thousands of years. Lower Columbia Chinook were listed as a threatened species under the ESA on March 24, 1999 and the designation was reaffirmed on June 28, 2005. Critical habitat for Lower Columbia Chinook was designated on September 2, 2005, and includes the Columbia River and Rock Creek.

Chum Salmon (*Oncorhynchus keta*) is the most widespread species of Pacific salmon,

with production extending along the Pacific Rim from southern California to Korea as well as many tributaries to the Arctic Ocean. Prior to the species' decline, chum salmon are believed to have been the most abundant of the salmonids in the Pacific Ocean. Lower Columbia chum were listed as a threatened species under the ESA on March 25, 1999 and the designation was reaffirmed on June 28, 2005. Critical habitat for Columbia River chum was designated on September 2, 2005, and includes the Columbia River.

Coho Salmon (*Oncorhynchus kisutch*) is a widespread species of Pacific salmon, with production in most river basins around the Pacific Rim from central California to Korea and Japan. The decline of Columbia River Coho abundance began in the mid-1800s due to the impacts of Euro-American activities in the region. Lower Columbia Coho were listed as a threatened species under the ESA on June 28, 2005, and critical habitat documentation for the Stevenson area is still being developed.

Eulachon or Smelt (*Thaleichthys pacificus*) is a small anadromous fish inhabiting rivers and streams from central California to the Bering Sea. Eulachon is a forage fish occupying an important link in the food chain between zooplankton and larger organisms. Eulachon were listed as a threatened species under the ESA on March 18, 2010 and critical habitat was designated on October 20, 2011. This critical habitat includes the Columbia River and its tributaries downstream of Bonneville Dam, but does not extend to Stevenson's shoreline areas.

Pacific Lamprey (*Lampetra tridentate*) is an anadromous species of eel-like fish with great cultural importance to the tribes of the Columbia River Basin. Information on lamprey abundance is limited and does not exist for the Columbia River or its tributaries above Bonneville Dam. However, based on declining trends measured at the dam, the decline of Pacific lamprey has become a significant regional concern. A 2003 petition for ESA listing was determined insufficient to evaluate the species' status, but it is possible that Pacific lamprey will again be petitioned for ESA listing if their numbers continue to decline.



Figure 3.3-2 Pacific Lamprey
Pacific Lamprey cling to the fish window at Bonneville Dam during return-migration.
Photo Credit: Randy Rasmussen, *The Oregonian* (2013).

Steelhead Trout (*Oncorhynchus mykiss*) has the greatest diversity of lifecycle patterns of all Pacific salmonids, including individuals and populations that do not migrate to saltwater and survive multiple spawning and ocean migration cycles. Resident (non-anadromous) varieties are called rainbow trout, and anadromous varieties are called steelhead, which are further classified by their summer and winter migratory runs. Despite their flexible lifecycles and spawning patterns, Lower Columbia steelhead populations have declined. Originally listed as a threatened species under the ESA on March 19, 1998, Lower Columbia Steelhead's threatened status was reaffirmed on June 28, 2005 and critical habitat was designated on September 2, 2005. Along Stevenson's shorelines, this critical habitat includes the Columbia River. The primary avoidable human contributions to the natural population's declining abundance include reduction of tributary and estuary habitat, dam construction and operation, fishing, fish hatcheries, and predation by other animals. Because Stevenson's shorelines do not contain estuaries or fish hatcheries, and because the City exerts no control over the operations of the Bonneville Dam or enforcement of fish harvesting laws, the City's ability to contribute effectively to the recovery of anadromous fish is limited to the preservation and restoration of habitat areas suitable for spawning, rearing, and cold water refuge. Figure 2.4-1 displays the lifecycle characteristics of anadromous species, including substrate conditions necessary for spawning and their rearing and migration timelines. For species protected under the ESA, the federal government has designated habitat ranges important to each species and the primary constituent elements (PCE) of these ranges that are important to the survival of the species. For salmonids, these PCEs include rearing habitat in side sloughs, side channels, wetlands and other areas along stream margins. These preferred cold- and quiet-water areas often contain woody debris and overhead cover to aid in food and nutrient (allochthonous) inputs and provide protection from predators. Lamprey require a different substrate than salmonids, residing in muddy/silty areas and filtering microscopic plants and animals from passing water. Once more developed, the sucker-like mouth is used to attach to other host fish where they feed, parasitically, on body fluids. Mature anadromous species require habitat connectivity to return to suitable spawning areas.

Figure 3.3-3 Lifecycle Characteristics of Anadromous Fish

	Spawning Substrates	Incubation	Freshwater Rearing Duration	Saltwater Rearing Duration	Out-Migration	Return-Migration
Fall Chinook Salmon	Clean gravel w/ good subgravel flow (irrigation)	60-150 days	3-8 months	1-5 years	April to August	July to November
Spring Chinook Salmon	Clean gravel w/ good subgravel flow (irrigation)	30-60 days	2-6 months	1-5 years	March to June (Peak) ¹	January to May
Chum Salmon	Gravel w/subgravel flow (temperature)	30-120 days	1-5 months	3-6 years	January to May	October to December
Coho Salmon	Stable, clean gravel	30-180 days	8-12 months	1-2 years	August to March	August to January
Eulachon (Smelt)	Sandy gravel	21-40 days	1-7 months	3-5 years	January to July	January to June
Pacific Lamprey	Fine gravels & silts	14-21 days	4-7 years	2-3 years	February to July	March to October
Summer Steelhead Trout	Clean gravel w/ well aerated flow	30-180 days	2-3 years	1-3 years	March to June	May to October
Winter Steelhead Trout	Clean gravel w/ well aerated flow	30-210 days	2-3 years	2-3 years	March to June	November to April

Data Credit: Ben Shumaker (2014) after Lower Columbia Fish Recovery Board (2010)
¹Some spring Chinook begin out-migration immediately upon emergence from the egg. Year-round out-migration has been observed.

180 **3.3.2 Additional Protected Habitats and Species**

The shoreline functions important to anadromous fish are also important to other species and the maintenance of those functions will increase the habitat available for them. The species listed below are of particular concern, and other species such as the Ring-necked Snake (*Diadophis punctatus*) and Sand Roller (*Percopsis transmontana*) are monitored by WDFW and concern may grow if monitoring reveals a decline in species health.

185 **Migratory Birds** visit Stevenson’s shorelines at various times throughout the year, including birds of prey (hawks, osprey, owls, etc.), ducks (bufflehead, mallard, scaup, widgeon, etc.), geese (Canada, greater white-fronted, snow, etc.), seabirds (cormorants, gulls, mergansers, etc.), and smaller birds. While many of these bird species are not at significant risk of extinction, they are still protected under the Migratory Bird Treaty Act and various state and federal population management efforts. Notably, the WDFW protections for Canada geese do not apply in urban areas like Stevenson, though conflicts between these and other migratory birds are reduced through protections related to in-water habitat and anadromous fish.

190 **Bald Eagle** (*Haliaeetus leucocephalus*), one of America’s symbols of freedom, is also a symbol of the success of the ESA. Beginning in the late 1940s, bald eagle populations began a precipitous decline based on the accelerated use of organochloride pesticides like DDT, and by the 1960s, less than 700 breeding pairs were estimated to exist in the lower 48 states. This decline led to the eagle’s listing as endangered under the ESA in 1978. The protections associated with this listing and the ban of DDT have allowed bald eagle populations to double every 7 to 8 years. In 1995, the species’ designation was changed from endangered to threatened, and by 2007, its recovery was deemed so successful that it was delisted throughout its range. Despite this



Figure 3.3-4 Bald Eagle

A Bald Eagle perches on an abandoned pilings in the Columbia River near Stevenson

Photo Credit: John McSherry (2012).

delisting, bald eagles are still protected under the Bald and Golden Eagle Protection and the Migratory Bird Treaty acts, which prevent the killing, capturing, and commodification of eagles or their products (feathers, eggs, nests, etc.), including any nests along Stevenson’s shorelines.

Bull Trout (*Salvelinus confluentus*) was fairly recently differentiated as an independent species of trout. Previously confused with the Dolly Varden, genetic studies of these fish have shown bull trout to be more closely associated with char than with the Dolly Varden it resembles. Bull trout in the Lower Columbia are a freshwater migratory species, although Puget Sound populations are known to be anadromous. Bull trout were listed as a threatened species under the ESA on November 1, 1999, a designation that was reaffirmed on April 25, 2008. Current critical habitat for the Lower Columbia was designated on October 18, 2010 and includes the Columbia River mainstem.

Oregon Spotted Frog (*Rana pretiosa*) is an almost entirely aquatic frog and leaves wetlands only occasionally and for a short time. This species was recently differentiated as independent from the Columbia spotted frog, a common, thriving species. The Oregon spotted frog was designated as threatened on August 29, 2014 and critical habitat is still being developed. The current draft of the proposed critical habitat does not include any units along or near Stevenson or its shorelines.

- 230 **Oregon White Oak Woodlands** are priority habitats in Washington because of the abundance of mammals, birds, reptiles, amphibians, and invertebrates inhabiting their stands. The Oregon white oak (*Quercus garryana*) is Washington’s only native oak, and the already limited distribution of this habitat type has been declining based on the removal of oaks for urban development and the encroachment of conifers in remaining stands. Along Stevenson’s shorelines, the Washington Department of Fish & Wildlife considers
- 235 Oregon white oak woodlands a priority habitat if the stand is at least 1 acre in size and oaks make up at least 25 percent of the canopy cover. Though none have yet been officially designated, stands, or even single oaks, found to be particularly valuable to fish and wildlife (i.e., they contain many cavities, have a large diameter at breast height, are used by priority species, or have a large canopy) may also be considered priority habitats along Stevenson’s shorelines.

240 Management recommendations for priority Oregon white oak woodlands include reducing/eliminating the removal of oaks unless necessary for habitat enhancement purposes, thinning encroaching conifers, planting oak seedlings, and maintaining aerial pathways for sensitive species like the western gray squirrel.²⁶

245 **Pacific Northwest Sasquatch** (*Gigantanthropus crypticus*) is a humanoid species of great cultural importance to local, regional, national, and international interests. Responding to this perceived importance, Skamania County (through ordinances 1969-1 and 1984-2) has formally declared a Sasquatch Refuge which is “coextensive with the boundaries of Skamania County” and adopted felony and misdemeanor punishments for “the premeditated, willful, or wanton slaying of Sasquatch.”

250 Information on Sasquatch, its lifecycle, range, and abundance, is limited and cannot be quantified for Stevenson’s shoreline areas, but because of the significance of the species, the protections that have been put in place are necessary. The City concurs with Skamania County’s designation of a Sasquatch Refuge and has determined these conservation measures to be adequate for the future protection of Sasquatch populations in the vicinity.

255 **Western Pond Turtle** (*Clemmys marmorata*) is a species of highly aquatic turtle residing in streams, ponds, lakes, and wetlands. The historic range of the Western pond turtle extended from the Puget Sound to Baja California, but by the early 1990s, populations in Washington were reduced to two sites in Skamania and Klickitat counties. The species received protection in 1992 as an endangered species under the Washington ESA, but populations in other parts of its range remained healthy, and a petition for federal listing was denied in 1993. Washington’s recovery plan calls for the establishment of healthy populations at seven sites statewide, four of which are in the Columbia Gorge. Surveys conducted between 1990 and 1994 found 39
260 turtles at 14 different sites, but none of the sites are along or near Stevenson’s shorelines.

3.3.3 Inputs of Organics and Large Woody Material

265 The inputs of organics and LWM are important ecological functions contributing to the food supply and complexity of shoreline systems. Organics include insects and vegetative deposits, which are important sources of nutrients for shoreline species. Standing LWM creates nesting sites for migratory birds and overhead cover to protect anadromous species from airborne predators. Fallen LWM creates channel complexity to moderate flow rates and provide refuge from water- and land-based predators. The shoreline functions important to anadromous fish are also important to other species, and the maintenance of those functions will increase the available habitat for other protected species.

PROCESS	Geologic Processes, Climate Processes, Hydrologic Processes, Bonneville Dam Processes
FUNCTION	—Input of Organics & LWM—
INDICATORS	Riparian Vegetation, Shoreline Stabilization, Impervious Surface Area, Permanently Protected Areas, Floodplain Area, Wetland Acreage

270 Impaired input of organics and LWM functions occurs when LWM cannot reach streams from adjacent riparian areas or when mass wasting events contribute LWM at a rate that exceeds the stream’s capacity to move the materials through the system. These impairments then impact the suitability of streams as habitat areas or can lead to further impairments of other shoreline ecological functions, such as reduced water storage and flow regulation. This function varies from impaired to well-functioning depending on the
275 shoreline considered in the Stevenson area.

²⁶ Recommendation #3-XX for SMP Update: Evaluate greater prioritization of Oregon White Oak trees when considering vegetation retention/removal/replanting policies.

3.3.4 Connectivity to Habitat Structures Suitable for Lifecycle Needs

280 Habitats along Stevenson’s shorelines depend on the ecological functions of connectivity to preferred and/or critical habitat structures. Connectivity includes stream passage for anadromous fishes, flight corridors for migratory birds, and riparian areas for land animals and amphibians. Habitat structure suitable for lifecycle needs include the LWM and sediment transport described above, but also rely on other structural features like undercut banks, (protection from predators), cliff faces (nesting), and wetlands (rearing and refuge).

PROCESS	Geologic Processes, Climate Processes, Bonneville Dam Processes
FUNCTION	—Connectivity to Structure Suitable for Lifecycle Needs—
INDICATORS	Riparian Vegetation, Shoreline Stabilization, Piers/Docks/Floats, Road Crossings, Impervious Surface Area, Permanently Protected Areas, Priority Habitats & Species List, Floodplain Area

285 When impaired, connectivity between structures suitable for lifecycle needs prevents fish and wildlife from reaching suitable structures or reduces the quantity or quality of suitable structures. Specific impairments to these functions are considered in more detail in section 4 and include culvert passage²⁷, Rock Creek’s waterfalls, and inundated floodplains within the Columbia River and Rock Cove systems.

²⁷ Recommendation #3-XX for SMP Update: Evaluate methods to remove/rehabilitate/replace existing culverts within shoreline areas that decrease habitat connectivity.

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4.0 Reach Level Characterization

This chapter builds on the information in chapters 2 and 3 and describes conditions adjacent to individual shoreline reaches. According to the state shoreline guidelines (WAC 173-26-201(3)(c)), local governments are required to inventory and report available information at the shoreline reach scale as follows:

- 5 • Shoreline and adjacent land use patterns and transportation and utility facilities, including the extent of existing structures, impervious surfaces, vegetation, and shoreline modifications within shoreline jurisdiction;
- Critical areas, including wetlands, aquifer recharge areas, fish and wildlife habitat conservation areas, geologically hazardous areas, and frequently flooded areas;
- 10 • Degraded areas and sites with potential for ecological restoration;
- Areas of special interest, such as priority habitats, developing or redeveloping harbors and waterfronts, previously identified toxic or hazardous material clean-up sites, dredged material disposal sites, or eroding shorelines;
- Conditions and regulations in shoreland and adjacent areas that affect shorelines, such as surface
- 15 water management and land use regulations;
- Existing and potential shoreline public access sites, including public rights-of-way and utility corridors;
- General location of channel migration zones (CMZs) and floodplains; and
- Known cultural, historical, and archaeological resources
- 20 In addition, this report includes data and characterization of other aspects related to shoreline condition:
 - Description of physical features, landmarks, and land use trends based on existing and future land use, zoning and ownership;
 - Description of known archeological, cultural, and historic resources;
 - Summary table of the ecological indicators;
 - 25 • Description of public access features; and
 - Summary of the degraded conditions and restoration opportunities.

The combination of the ecological indicator ratings and these additional assessments help describe both the natural and built character of each reach, thereby setting the baseline condition from which Ecology's 'no net loss' standard is considered.

30 ***4.0.1 Methodology***

Building on the assessment of broad, landscape-scale processes and shoreline functions in previous sections (see also Table 1.2-1, this section describes current shoreline conditions based on their performance on 12 indicators of ecological functions for 7 reaches along Ashes Lake, Columbia River, Rock Cove, and Rock Creek. The Physical Environment of each reach is characterized based on Available Floodplain Areas

35 (including Channel Migration Zones), Riparian Vegetation, Shoreline Stability, and Wetland Acreage. Fish-Blocking Culverts, Priority Habitat & Species (PHS) Listings, and Permanently Protected Areas are used to characterize the Biological Resources of each shoreline reach. Altered Conditions within each reach are characterized based on Ecology's determination of water quality through their 303(d) Listings, Impervious

40 Surface Area, Overwater Roads & Structures, Setbacks to OHWM, and Urban Runoff. Performance is rated qualitatively by a 5-point scale as shown in Figure 4.0-1.



Figure 4.0-1 Qualitative Scale for Indicators of Ecological Function
 A 5-point, Harvey Ball scale.

Figure Credit Ben Shumaker (2017) after Consumer Reports.

The qualitative scale rating each reach’s performance by ecological indicator ranges from Excellent to Very Poor. These terms are intended to make relative comparisons between Stevenson’s various reaches and may not be comparable to other assessments of similar or related factors in the same or separate locations.

45 Further, the ratings are assigned depending on whether the indicator describes a sign of health or degradation. Examples of the range of conditions and rationale for each indicator include:

Physical Environment:

- Available Floodplain Areas – Provide storage capacity and attenuate fluctuations in flow, filter pollution, and provide habitat. Highest rating for areas with intact, functioning floodplains, lowest rating for areas with heavily degraded, disconnected, or eliminated floodplains.
- Riparian Vegetation – Support healthy water quality, quantity, and habitat. Highest rating for intact, functioning native plant assemblages, lowest rating for areas with heavily degraded or eliminated native vegetation.
- Shoreline Stability – Soil type affects susceptibility to erosion, landslide, liquefaction and other geological hazards. Stabilization structures intended to protect development often degrade natural sediment transport processes. Hard armoring is sometimes applied as an ineffective solution to slope stability issues other than erosion. Highest rating for areas with minimal hazards and lack of stabilization structures, lowest rating for areas with severe risk and extensive armoring.

Biological Environment:

- Fish Blocking Culverts – Culverts that allow waterbodies to flow under roads and other developed areas are sometimes too small or disconnected from the stream channel making them unpassable for fish.
- Permanently Protected Areas – Community designated parks, preserves, and open space, and public/private land with legally established conservation easements help limit development that can degrade natural conditions. Highest rating for areas with permanent protection from future development/alterations, lowest rating for areas with no such protections.
- Priority Habitats & Species – Certain plants and animals are listed as threatened or endangered, at risk for decreased populations or extinction. Highest rating for areas with such habitats or species present, lowest rating for areas where they are not.
- Wetland Acreage – Wetlands filter pollutants, provide habitat, and moderate hydrologic cycles. Highest rating for reaches with high functioning wetlands, lowest when wetlands are not present.

Altered Conditions:

- 75 • 303(d) Listings – Water pollution including toxics, excess nutrients, and elevated temperatures affect aquatic and human health. Highest rating for areas with clean, cool water, lowest rating for areas with contaminated and warmer water.
- Impervious Surface Area – Impervious surfaces prevent water filtration, increase erosion, and provide preclude on riparian habitat functions. Highest rating for areas without impervious surfaces, lowest for areas with high proportions of impervious surface area.
- 80 • Overwater Roads & Structures – When structures, including bridges, are built overwater, their foundations alter water courses and they provide refuge for predators of anadromous fish. Areas without such structures receive the highest rating, areas with numerous structures receive the lowest rating.
- 85 • Setbacks to OHWM – The location of buildings with roofs and other structures such as roads, parking, and railroad landward of OHWM. The replacement of riparian vegetation with impervious surfaces and other impacts of development close to the water’s edge (such as light and noise) impacts shoreline ecological functions. Highest rating for areas with greater setback distance, lowest rating for smallest setbacks.
- 90 • Urban Runoff – The amount and quality of runoff water entering a stream impact water quality levels, including pollutants and temperature. Highest rating for areas with minimal smallest catchment areas and most robust levels of treatment, lowest rating for reaches with disproportionately large catchment areas with a lack of treatment.

To create the Overall rating in the indicator summary tables, value scoring was assigned (Excellent=2, Good=1, Fair=0, Poor=-1 and Very Poor=-2) and an average of relevant indicators was calculated. A Jenks Breaks method was then applied to separate the division between the 5 ratings within the overall score with 95 breaks occurring at plus or minus 0.1 and 0.5. In cases where a reach with several Good or several Poor ratings would mathematically result in a Very Good or Very Poor rating, the Overall rating was held as Good or Poor. While this approach allowed an average to be calculated *quantitatively*, the assessment remains fundamentally *qualitative*. The scoring points do not have actual or precise data value, they are not intended to provide any quantitative analysis of the indicator conditions, and were only used to help roll-up the 100 information into a composite rating.

4.0.2 Connection between Indicators & Characterization Maps

A variety of data and technical information was considered in preparing this report. Attributes with geo-referenced data can be displayed as maps, connecting data values to geographic location. These maps are used to help visually describe existing conditions and are shown in the Appendix C Map Portfolio and include 105 a study of optional shoreline jurisdiction for landslide hazard areas. Also, some map pages include related tabular data (e.g. tallies and basic statistics) that are reflected in the reach description text. Building on the relationships between ecosystem-wide processes, shoreline ecological functions, and reach-scale indicators described in Table 1.2-1, Table 4.0-1 below is organized by attribute categories in the order they are presented in each reach description, and provides a cross-reference to the maps by number. This allows the 110 description of current shoreline conditions both by narrative text and visual display of the data and technical information. Only a few indicators described by text are not depicted visually, including Fish Blocking Culverts, Protected Areas, Priority Habitat & Species, and 303(d) water quality data.

Table 4.0-1 – Characterization Maps & Attributes

Reach-scale Attribute	Description	Map Number
Preliminary Shoreline Jurisdiction	Approximate extent of SMP jurisdiction (current), approximate extent of SMP jurisdiction (predesignation), approximate extent of landslide hazard areas considered for optional jurisdiction.	1
Physical Environment		
Land Cover	USGS gap analysis program (GAP) data showing forested, shrub-covered, grass-covered, non-vegetated, and water areas. Includes tabular summary of vegetation/land cover.	2
Soil	USGS Soil Survey Geographic Database (SSURGO) and US Forest Service data.	3
Contours	LiDAR-derived 10- and 100-foot contours provided by Skamania County GIS.	4
Liquefaction Hazards	Displays hazard categories for land movement during earthquakes.	5
Geologic Hazards	Stevenson Critical Areas Hazard Map showing potentially unstable slopes, landslide hazard areas, scarps, and unstable soils. Includes memo from PBS Engineering, 2007.	5A
Floodplains	FEMA FIRM, Zone A on Map 530161 A, Panels 01-02 (Red) and Map 530160, Panel 425 (Yellow).	6
Channel Migration Zones	Department of Ecology Map and coarse-scale analysis of likely Channel Migration Zones (CMZs) in Skamania County. Includes memo.	6A
Flowage Easements	Based on County easements records and shows vertical elevation of all flowage easements maintained by the Corps of Engineers for the Bonneville Dam Project.	6B
Biological Resources		
PHS Data	WDFW Priority Habitat and Species (PHS) Wildlife GIS data. Includes species list by reach.	7
Wetlands	USFWS National Wetlands Inventory and Stevenson Critical Areas Wetland Map showing potential wetlands as identified by JD White and Associates in 2007. Includes acreage of wetlands.	8
Land Use & Altered Conditions		
Existing Land Use	County parcel data using Department of Revenue (DOR) codes (derived and categorized from Skamania County Assessor's database).	9
Future Land Use	Map from 2013 Stevenson Comprehensive Plan designating areas for different types of residential and trade uses.	9A
Zoning	Map developed by Skamania County GIS using County and City maps.	10
Archeology/Historic Resources	Washington State Department of Archaeology and Historic Preservation (DAHP), includes publicly available information, excludes sensitive information.	14
Public Access		
Public Ownership	Public land includes all land owned by federal, state, or local government agencies. "Rights-of-way" were not classified as "Public". Areas not covered by parcel dataset (i.e., large portion of the Columbia River) were classified as "Public". Data for length and area in public ownership included and specific recreation areas also noted.	11
Restoration Opportunities		
Impervious Surfaces	County data was used to calculate impervious area (square feet) and linear distance of impervious surface (feet). Includes tabular data for impervious surface types.	12
Rooftops	County data on rooftops within shoreline area and measuring rooftop distance to OHWM. Includes tabular data for building number and size.	13
Shoreline Modifications	Aerial photo-derived data by Skamania County GIS. Includes tabular data on armoring length, island dimensions, and size of docks/piers.	15
Fish Passage Barriers	WDFW Fish Passage and Diversion Screening Inventory Database. Includes reports for identified barriers..	16

115 **4.1 Columbia River Reach 1 – East Urban Area**



Figure 4.1-1 Columbia River Reach 1
Bedrock outcroppings and railroad berms characterize shoreline structure
Photo Credits: Department of Ecology (2007), Ben Shumaker (2013), Department of Ecology (2007).

120 The physical shoreline of Columbia River Reach 1 is located entirely within Skamania County and east of the City's downtown waterfront. However, some small areas of shorelands and 2 associated wetlands from this reach extend into inside city limits. The shorelands occur along the Kanaka Creek Underpass road, and the wetlands are located on the north side of SR 14, affecting 3 properties having commercial, stormwater utility, and residential uses. Beyond these areas, the City has elected to pre-designate the shorelines of this reach that are located outside existing City boundaries. In total, this comprises ~5,555 linear feet of Columbia River shoreline and 256 acres of shoreline jurisdiction area, 26.1 acres of which are shorelands above the OHWM. The reach starts at the eastern urban growth boundary line at Nelson Creek and ends downstream at the eastern city limits and Kanaka Creek. This reach is a shoreline of statewide significance.

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Table 4.1-1 – Columbia River Reach 1 Land Use Trends

Future Land Use							
	Low Density Residential	High Density Residential	Low Intensity Trade	High Intensity Trade	Total		
	5%	2%	92%	1%	100%		
Current Zoning							
	Residential	Public	Resource	Commercial	Industrial	Total	
	7%	0%	0%	93%	0%	100%	
Existing Land Use							
	Undeveloped	Residential	Public	Resource	Commercial	Industrial	Total
	3%	24%	62%	0%	10%	0%	100%
Shoreline Preferred Uses							
	Undeveloped	Single –Family Residential	Water-Oriented	Non-Water Oriented	Total		
	3%	17%	11%	69%	100%		
Land Ownership							
	Private	Local Government	State or Federal Government	Total			
	67%	20%	13%	100%			

The projected land uses of this reach primarily involve commercial uses, however almost 25% of the reach is currently used for residential purposes. While 62% is devoted to public uses, 69% of the reach's development

130 is non-water-oriented. Since only 3% of land in this reach is undeveloped, and 2/3rds of the land is privately owned, opportunities to expand commercial uses or shoreline preferred uses are minimal. Archaeological, cultural, or historical resources are known to exist within this reach, including—among others—one public cemetery.

4.1.1 Summary of Ecological Functions

Indicators of Ecological Functions—CR1

		Physical Environment			Biological Environment				Altered Conditions			Overall		
		Available Floodplain Area	Riparian Vegetation	Shoreline Stability	Fish-Blocking Culverts	Permanently Protected Areas	PHS Listings	Wetland Acreage	303(d) Listings	Impervious Surface Area	Overwater Roads & Structures		Setbacks to OHWM	Urban Runoff
Water Quality	Sediment Transport		↑	↓	↓	↓		↓	↓	↓		↓	↓	↓
	Nutrient & Toxic Filtration	↓	↑			↓		↓	↓	↓		↓	↓	↓
	Temperature Regulation		↑			↓	↓		↓			↓	↓	↓
Water Quantity	Water Storage & Flow Regulation	↓	↑		↓			↓		↓	↓		↓	↓
Habitat	Input of Organics & LWM	↓	↑	↓		↓	↓			↓				↓
	Connectivity to Suitable Habitat		↑	↓	↓	↓	↓	↓		↓	↓	↓		↓

135

4.1.2 Physical Environment

140  **Available Floodplain Areas-** The available floodplain for the Columbia River has been inundated by, and is fully controlled by operations at, the Bonneville Dam. The US Army Corps of Engineers maintains flowage easements for all properties in the reach. The Department of Ecology’s Preliminary Channel Migration Zone Map for this reach was developed at a very coarse-scale, and recommends reliance on the Flood Insurance Rate Maps and/or site-specific delineations to more precisely determine the locations of channel migration zones (CMZs). The “Very Poor” rating of this reach relates to the Corps’ current inundation of the floodplain and its authority to further inundate the properties of this reach.

145  **Riparian Vegetation-** Riparian vegetation covers 73% of the land in this reach, with forest cover accounting for 41% of all land areas. This vegetative cover is similar to the Rock Cove Reach and among the most vegetated of all reaches characterized. Vegetation on shorelands includes deciduous lowland riparian forest and westside lowland confiner-hardwood forest. The lowland riparian forest cover overhangs the shoreline edge and help transfer terrestrial nutrients and energy to the aquatic system by adding organic debris, leaf litter, and insects (allochthonous inputs). The forested areas are a source of large woody material (LWM) recruitment. However, degraded vegetative cover exists along the berms for the BNSF railroad track and SR 14 and provide the main reason why this indicator is deemed “Good” rather than “Excellent”.

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Table 4.1-2 – Columbia River Reach 1 Land & Water Areas

Land Cover						
Forested	Riparian Vegetation		Vegetated Subtotal	Non-Vegetated Land	LAND TOTAL	Water
	Shrub	Grass				
10.6 ac	2.6 ac	5.8 ac	19.0 ac	7.1 ac	26.1 ac	229.9 ac
40.6%	10.0%	22.2%	72.8%	27.2%	100%	-

155 **1 Shoreline Stability-** The “Fair” rating has been applied to this shoreline reach, which is characterized by a mix of rock outcroppings and fill slopes for the BNSF railroad. The reach’s soil types include differing slope categories of Skamania and Stevenson soils. Skamania soils offer a very fine sandy loam which is Well Drained and has a Moderate availability of water storage. Stevenson soils are loams which are also Well Drained, but offer a High availability of water storage. In most cases these soil types are not subject to high erosion hazards, however, when Stevenson loams exist on very steep slopes—as they do in limited areas in 160 the center of this reach—their erosion hazard is Severe.

Knowledge of Geologic Hazard Areas in this reach is less robust than in other reaches within city limits. However, the City’s Geologic Hazards Map includes coverage of some key hazard types. Known soils with severe erosion hazard are detailed above, debris flow hazards are identified at the outlet of Kanaka Creek, and potentially unstable slopes (slopes greater than 25%) can be found along the shoreline (Maps 4 and 5A). 165 Despite the presence of railroad berms similar to Columbia River Reach 3, liquefaction potential is considered Bedrock and subject to minimal concern.

4.1.3 Biological Environment

170 **1 Fish-Blocking Culverts-** Culverts flank this reach on the east and west. Both the culvert/fish passage on the western edge and the culvert on the eastern edge are considered 100% passable by WDFW. A 100% passable culvert is also identified at the outlet of Vallett Creek. Local reconnaissance also identifies culverts at Vallett Creek and Lutheran Church Road and connecting the wetlands in the center of this reach with the Columbia River. Fish passage through these culverts is unknown. Though passability is a lesser concern, the sheer number of culverts in this reach justifies the “Fair” rating.

175 **1 Permanently Protected Areas-** No areas in this reach are subject to permanent protective covenants or environmentally protective deed restrictions, though the Port of Skamania is seeking to protect “Slaughterhouse Point” as mitigation for nearby development. Cemetery District ownership provides some informal protection of the shoreline based on operations at the Stevenson Cemetery. Of the privately owned properties in this reach, only a small portion is subject to the conservation covenant developed for the Chinidere Mountain Estates subdivision (2017). The remainder of the reach is privately owned and not subject 180 to permanent conservation covenants. While this reach is rated as “Fair” currently, this reach could be considered “Good” if the Port includes protections for Slaughterhouse Point.

185 **2 Priority Habitat & Species-** The PHS priority habitat types within the reach include one lacustrine littoral habitat at the outlet of Kanaka Creek and two palustrine wetlands as discussed above. The PHS species within the reach include salmonids (Chinook, Coho, Dolly Varden, Chum, Pink Salmon, Coastal Cutthroat, Sockeye, and Steelhead), white sturgeon (*Acipenser transmontanus*), and northern spotted owl (*Strix occidentalis caurina*). The monitored non-PHS species within the reach includes the sand roller (*Percopsis transmontana*). Some threat to aquatic habitat exists based on the spread of milfoil. The condition of these habitat and

species types has not been evaluated, but their presence is a positive ecological indicator and rate this reach as "Good".

190  **Wetland Acreage-** A total of five wetlands are mapped within the reach for a total of 1.72 acres of NWI and local inventory wetlands. All of these wetlands are palustrine forested wetlands. Three are located between SR 14 and the BNSF tracks and two are located north of SR 14. All of these wetlands drain to the Columbia River and are considered associated wetlands. While the condition of each wetland has not been evaluated their presence is positive and carries a "Good" rating.

195 **4.1.4 Altered Conditions**

200  **303(d) Listings-** The Columbia River within this reach has a Category 5 listing for temperature and through a 3-state memorandum of understanding the EPA is developing total maximum daily load (TMDL) protocols to address the water quality deficiency. This reach is also subject to pollution from Dioxin as a Category 4A pollutant subject to a TMDL from the EPA. The Columbia is also a Category 2 water of concern for pH, PCBs, Chlordane, and 4,4'-DDE. The "Very Poor" rating results from these multiple listings.

 **Impervious Surface Area-** The 1.6 ac total impervious surface coverage in this reach is comparatively low and makes up only 6.2% of its land area. The "Good" rating of the reach is based on its relative lack of impervious coverage and the comparatively low average coverage of the individual lots.

Table 4.1-3 – Columbia River Reach 1 Impervious Surface Comparison

Impervious Surface Areas				
	Total Impervious Area	% Land Covered by Impervious Surfaces	Mean Impervious % of Developed Lots	Median Impervious % of Developed Lots
Reach	1.6 ac	6.2%	16.4%	10.9%
Total Jurisdiction	29.4 ac	14.4%	46.3%	36.2%

205  **Overwater Roads & Structures-** Two private overwater structures are associated with the residential development in the eastern portion of this reach (denoted on Map 15 as J and K). Structure J is a residential deck that is not associated with boating. These 2 structures cover ~1,000 sf of the water's surface. The Port of Skamania maintains 2 public structures (denoted on Map 15 as H and I) at the Cascade Avenue boatlaunch, and one of them is removed on a seasonal basis to protect it from wave action caused by the winter's high east winds. There are no overwater roads, and other structures in in this "Fair" reach are limited to a concrete river height gage.

215  **Setbacks to OHWM-** Of the 19 total parcels in this reach, only 8 have been developed with structures, including only 3 with buildings in shoreline jurisdiction. The central tendencies for the distance of structures from the OHWM combine to equal ~30 ft and ~40 ft for buildings (Map 13). Structures in this context mean any building with a rooftop identified within Skamania County's GIS, as well as all other upland structures for parking, roads, or railroads. The setbacks in this reach are narrow relative to other portions of Stevenson's shoreline jurisdiction and this close proximity justifies this reach's rating of "Very Poor".

Table 4.1-4 – Columbia River Reach 1 Development Proximity to OHWM

Setbacks to OHWM				
	% of Lots with Construction	Smallest Setback	Mean Setback	Median Setback
Buildings	16.7%	1 ft	54 ft	24 ft
Any Structure	38.9%	1 ft	39 ft	24 ft

220

Urban Runoff- This reach contains only 11% of the total linear footage of shorelines in the Stevenson area, but also contains the outlets of Kanaka, Vallett, and Nelson creeks as well as stormwater outfalls.

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Together these outlets contribute stormwater runoff from 54% of the Urban Area. Treatment levels for this stormwater range from the recent engineered solution for the Chinidere subdivision to natural filtration by riparian vegetation along the streams to no treatment where runoff from pavement/rooftops directly enters the waterbody. While this reach contains few engineered treatment systems, the relative lack of dense development in most of the areas draining to this reach spares it from the “Very Poor” designation.

4.1.5 Public Access



Figure 4.1-2 Pebble Beach
A visual and physical access point in Columbia River Reach 1
Photo Credits: Ben Shumaker (2013), BergerABAM (2015).

230

The reach includes access to the Columbia River from the Port’s Pebble Beach. This small park is part of the larger Class IV – Sacred Place described in the Stevenson Comprehensive Plan and includes informal parking areas located in Columbia River Reach 1, approximately 0.1 miles of gravel trails, a picnic table, and park bench with views of the river. Physical access to the middle portion of the reach is limited because of the active operations along the BNSF tracks and the Stevenson Cemetery in the eastern end of the reach. The Port of Skamania’s Slaughterhouse Point provides a potential location for a public access site as part of a water trail. Public visual access to the shoreline is partially present in this reach by travelling SR 14 and smaller public roads, however the immediate near shore view is obstructed by the elevated rail bed and no formal waysides or viewpoints are present.

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4.1.6 Degraded Areas & Restoration Opportunities

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Degraded conditions in this reach include:

1. Bonneville impoundment of the Columbia River and inundation of floodplains.
2. Character and coverage of riparian vegetation.

3. Rip rap armoring of shorelines (BNSF/SR 14 berm).
4. Culverts (railroad/highway berm and Lutheran Church Road).
5. Unknown character of PHS listings.
6. Unknown character and functions of wetlands.
7. Ecosystem-wide water quality concerns.
8. Proximity of non-water-oriented and/or abandoned structures to OHWM.
9. Quantity & unknown quality of stormwater runoff.

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250

Specific opportunities to restore these degraded conditions will be addressed in detail in the Restoration Plan and may include replacing culverts, assessing habitat and wetland areas, preserving and enhancing canopy cover, etc.

4.2 Columbia River Reach 2 – Downtown Waterfront



Figure 4.2-1 Columbia River Reach 2
Downtown Stevenson's urbanized waterfront area

Photo Credits: Department of Ecology (2007).

255

Columbia River Reach 2 is located in the city and includes the downtown waterfront and ~4,175 linear feet of Columbia River shoreline. The reach starts at the eastern limits of the city at Kanaka Creek, and ends downstream at its western limits on the Columbia River, at the center of the BNSF railroad bridge over Rock Creek. There are 222 acres of total land and water area in this reach and 35 acres of land above the OHWM.

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Public agencies own 63% of land in this reach and 38% of shorelands are used by the public for recreational purposes. Commercial/industrial uses account for an additional 35% of land use, and the remainder is evenly split between undeveloped and residential. The reach includes two roads in addition to the BNSF tracks— Cascade Avenue and Leavens Street. Nineteen structures and their associated parking add to the impervious surfaces within the reach. Only 30% of the land is developed with Water-Oriented uses.

265

There are no known archaeological, cultural, or historical resources within the reach, however, a series of interpretive signs help visitors understand some historic events and activities in the area.

Table 4.2-1 – Columbia River Reach 2 Land Use Trends

Future Land Use						
Low Density Residential	High Density Residential	Low Intensity Trade	High Intensity Trade		Total	
0.0%	10%	19%	71%		100%	
Current Zoning						
Residential	Public	Resource	Commercial	Industrial	Total	
11%	32%	0%	40%	17%	100%	
Existing Land Use						
Undeveloped	Residential	Public	Resource	Commercial	Industrial	Total
14%	14%	38%	0%	27%	8%	100%
Shoreline Preferred Uses						
Undeveloped	Single –Family Residential	Water-Oriented	Non-Water Oriented		Total	
14%	10%	30%	47%		100%	
Land Ownership						
Private	Local Government	State or Federal Government		Total		
37%	63%	0%		100%		

4.2.1 Summary of Ecological Functions

Indicators of Ecological Functions—CR2

		Physical Environment			Biological Environment				Altered Conditions			Overall	
		Available Floodplain Area	Riparian Vegetation	Shoreline Stability	Fish-Blocking Culverts	Permanently Protected Areas	PHS Listings	Wetland Acreage	303(d) Listings	Impervious Surface Area	Overwater Roads & Structures		Setbacks to OHWM
Water Quality	Sediment Transport		↘	↗	↗	↗	↗		↘	↘		↗	↘
	Nutrient & Toxic Filtration	↘	↘			↗	↗		↘	↘		↗	↘
	Temperature Regulation		↘			↗	↗		↘			↗	↗
Water Quantity	Water Storage & Flow Regulation	↘	↘		↗		↗			↘	↘	↗	↘
	Input of Organics & LWM	↘	↘	↗		↗	↗			↘			↘
Habitat	Connectivity to Suitable Habitat		↘	↗	↗	↗	↗		↘	↘	↗		↗

270 **4.2.2 Physical Environment**

↘ Available Floodplain Areas- The available floodplain for the Columbia River has been inundated by, and is fully controlled by operations at, the Bonneville Dam. The US Army Corps of Engineers maintains flowage easements for all properties in the reach. The Department of Ecology’s Preliminary Channel Migration Zone Map for this reach was developed at a very coarse-scale, and recommends reliance on the Flood Insurance

275 Rate Maps and/or site-specific delineations to more precisely determine the locations of channel migration zones (CMZs). The “Very Poor” rating of this reach relates to the Corps’ current inundation of the floodplain and its authority to further inundate the properties of this reach.

280  **Riparian Vegetation-** Riparian vegetation covers only 52% of land in the Downtown Waterfront reach, with forest cover accounting for only 20% of all land areas. Most of the shoreline vegetation is found within the Port of Skamania’s park areas and along the residential shorelines. This reach contains the least vegetative cover of all reaches analyzed and has been deemed “Very Poor”. The limited vegetation within the shoreline jurisdiction is characterized by deciduous lowland riparian forest, which overhangs the shoreline edge providing allochthonous nutrient and energy inputs. The trees along the shoreline are a source of LWM recruitment. Specific degraded areas include the commercial/industrial areas operated by the Port of Skamania, Cascade Avenue and the BNSF railroad berm.

Table 4.2-2 – Columbia River Reach 2 Land & Water Areas

Land Cover						
Forested	Riparian Vegetation		Vegetated Subtotal	Non-Vegetated Land	LAND TOTAL	Water
	Shrub	Grass				
7.0 ac	3.5 ac	7.9 ac	18.4 ac	16.9 ac	35.3 ac	186.3 ac
19.8%	10.0%	22.5%	52.2%	47.8%	100%	-

290  **Shoreline Stability-** A mix of natural shoreline and armored slopes characterizes this “Good” rated reach, with the armoring occurring mostly along the industrial/manufacturing area of the eastern portion. As their name implies, the soils of this reach are classified as Stevenson soils having different slope categories. Stevenson soils are loams which are well drained, but offer a high availability of water storage. These soil types are not subject to high erosion hazards, and the erosion occurring along the Port of Skamania’s properties is a result of persistence wave action, not because of the soils inherent quality,

295 The terrain of this reach generally has minimal slope within shoreline jurisdiction (Map 4). The reach is not subject to liquefaction concerns (Map 5). According to the Stevenson Critical Areas and Geologic Hazards Map (Map 5A), there are no High Hazard geologic areas within the reach, however there are Moderate Hazard areas associated with the potentially unstable slopes (slopes greater than 25%) immediately adjacent to the OHWM.

300 The very western portion of this reach at the confluence with Rock Creek is seeing rapid aggradation as the Piper Road landslide overwhelms the sediment transport system. Shallow waters and partially dry lands result depending on the elevation of the Bonneville Pool.

4.2.3 Biological Environment

305  **Fish-Blocking Culverts-** One culvert is identified by WDFW in this reach at the eastern border and potentially just outside of shoreline jurisdiction. This culvert under 1st Street is categorized as a culvert/fishway and is considered 100% passable however many additional barriers exist further up Kanaka Creek outside of shoreline jurisdiction. This reach is rated as “Good” as a result.

 **Permanently Protected Areas-** Ownership in this “Good” rated reach is dominated by the City and the Port of Skamania County. As mitigation for a nearby dredging project ~0.22 miles of the shoreline area, from Stevenson Landing to East Point is required to be stabilized and restored and will be subject to ongoing

310 protective agreements between the Port and the City. The remainder of the reach is privately owned and not subject to permanent conservation covenants.



Priority Habitat & Species- A lacustrine littoral habitat at the outlet of Kanaka Creek borders this reach on the east and habitat supporting waterfowl concentrations borders the western edge. PHS species within this reach include the salmonids of the Columbia River, white sturgeon, and northern spotted owl. Monitored non-PHS species within the reach include the ring-necked snake and sand roller. Some threat to aquatic habitat exists based on the spread of milfoil. The condition of these habitat and species types has not been evaluated, but their presence is a positive ecological indicator, and, like the other Columbia River reaches, justify a "Good" rating.

315



Wetland Acreage- There is one wetland from the local inventory in this reach; it is adjacent to Cascade Avenue, totals 0.21 acres, drains to the Columbia River, and is considered an associated wetland. The presence of this wetland is a positive ecological indicator and justifies the "Good" rating of this reach.

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4.2.4 Altered Conditions



303(d) Listings- The Columbia River within this reach has a Category 5 listing for temperature and through a 3-state memorandum of understanding the EPA is developing total maximum daily load (TMDL) protocols to address the water quality deficiency. This reach is also subject to pollution from Dioxin as a Category 4A pollutant subject to a TMDL from the EPA. The Columbia is also a Category 2 water of concern for pH, PCBs, Chlordane, and 4,4'-DDE. The "Very Poor" rating results from these multiple listings.

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Impervious Surface Area- This reach is the most urbanized and the most degraded ("Very Poor") in terms of impervious surfaces. The 7.7 ac of impervious land cover is the most of any reach, and the average coverage of this reach's small lots is also greater than any other reach or the Stevenson's overall shoreline jurisdiction.

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Table 4.2-3 – Columbia River Reach 2 Impervious Surface Comparison

Impervious Surface Areas				
	Total Impervious Area	% Land Covered by Impervious Surfaces	Mean Impervious % of Developed Lots	Median Impervious % of Developed Lots
Reach	7.7 ac	21.9%	60.6%	74.8%
Total Jurisdiction	29.4 ac	14.4%	46.3%	36.2%



Overwater Roads & Structures- The Port of Skamania County maintains 3 public overwater structures in this reach (denoted on Map 15 as E, F, and G). The Stevenson Landing pier at Russell Street at 3,500 sf is the biggest of these, and its flanking dolphins provide moorage for tourboats on the river. While some cosmetic upgrades have been proposed for Stevenson Landing, no structural or in-water work is currently being considered. This reach also contains a number of old pilings, some of which are programmed for removal during the Port's waterfront restoration project. Until that time, the reach will remain ranked as "Poor".

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Setbacks to OHWM- Though more urbanized in terms of impervious surfaces close to the OHWM, this reach has surprisingly large setbacks for buildings. The "Good" rating is based on central tendencies for building setbacks which equal ~120 ft from the OHWM. Structures such as roads, parking areas and other development are typically located closer to the shoreline, but still nearly 100 ft away. A trend toward larger

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345 setbacks is similar to other reaches within city limits, which are typically larger than those of the reaches that have been pre-designated.

Table 4.2-4 – Columbia River Reach 2 Development Proximity to OHWM

Setbacks to OHWM				
	% of Lots with Construction	Smallest Setback	Mean Setback	Median Setback
Buildings	35.4%	20 ft	113 ft	121 ft
Any Structure	59.5%	0 ft	98 ft	87 ft

350 **Urban Runoff-** This reach makes up only 8% of the total linear footage in this report and accepts an even smaller amount of the overall Stevenson Urban Area’s stormwater (1%). Recent development in the catchment area for this area, including the Port of Skamania’s Tichenor Building and parking area and the City’s Cascade Avenue, use vegetated swales to control and treat stormwater before it enters the Columbia, however some direct runoff and/or untreated runoff still occurs, most notably at the Cascade Avenue boat launch. Because this reach accepts so little runoff and because the majority of what it does accept is treated, the reach has been rated as “Good”.

355 **4.2.5 Public Access**

This reach is categorized as a Class IV – Sacred Place by the 2013 Stevenson Comprehensive Plan and contains six public access points to the river as well as approximately 0.5 miles of trail which connects all of the access facilities and meanders along the riverfront. This trail along this reach was developed as part of a coordinated system (Figure 4.6-2) and is subject to active erosion issues which the Port of Skamania hopes to fix as part of a large restoration project which will also add paved accessibility and pedestrian amenities. The six physical access points, listed from east to west, are described in detail below.



Figure 4.2-2 Downtown Stevenson Public Access, Eastern Access Points
Motorized and non-motorized access for recreation on the Stevenson Waterfront.

Photo Credits: Port of Skamania County (Unknown)

365 **Cascade Boat Ramp** is located at the east end of the reach and includes a public boat launch (concrete ramp), restrooms with a changing cabana, picnic tables, a grass lawn area, parking, a floating dock, and a gravelly beach for physical access to the water. Informational signage educates visitors of the area’s history and enhances the visual access opportunity. Kanaka Creek, a non-SMA stream, enters the Columbia at the upstream edge of this park.

370 **East Point Kite Beach** is located immediately downstream from the boat launch and is a favorite with kiteboarders. This visual and physical access point is a dedicated launch site, gives safe, easy access to the river, provides additional parking with broad views, and is located near the restroom and changing cabana which also serves the Cascade Boat Ramp. Physical access is limited to those able to traverse steep, rugged terrain to the water.

375 **Leaven’s Point** is set between Stevenson Landing and East Point Kite Beach. This small park features river views and picnic opportunities close to the river. Physical access is limited to those able to traverse steep, rugged terrain to the water.

380 Leavens Point is the location for a large access improvement and restoration project planned by the Port of Skamania County. The project will include large amounts of fill, a more gradually sloped area for physical public access, trail, amenities, and riparian vegetation.

385 **Stevenson Landing** is cruise ship pier from which passengers access the city. The pier is located on the Columbia River at river mile 150, in the Russell Street right-of-way. The pier is open to the public year-round for views of the Columbia River.

390 **Teo Park** is located in downtown Stevenson on the Columbia River at the southern terminus of Russell Street, just upland of Stevenson Landing. This park includes picnic tables, restrooms, and a grassy lawn on the riverbank with views of the river and the Gorge. An informational kiosk and a kinetic sculpture public art installation enhance the visitor experience.

395 **Bob’s Beach** is a dedicated access for windsurfing on the Columbia River. The park is located west of Teo Park and Stevenson Landing and features a gently sloped grass lawn, covered changing cabana, a spacious, easy launching area, gravel parking area, benches, picnic tables, and a water fountain. The park offers views and easy physical access to the water.

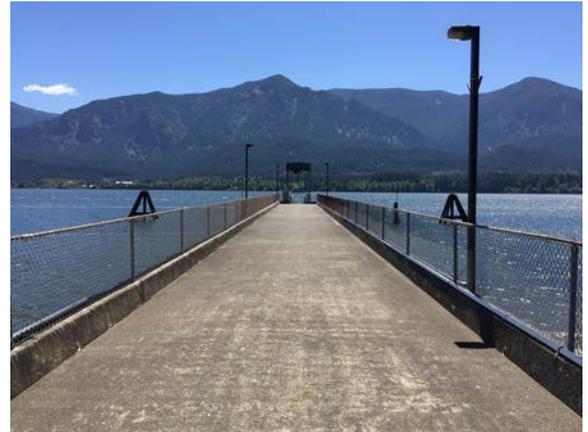


Figure 4.2-3 Downtown Stevenson Public Access, Central Access Points
Leavens Point, Stevenson Landing & Bob’s Beach provide visual, motorized and non-motorized access.

Photo Credits: BergerABAM (2015), BergerABAM (2015), Ben Shumaker (2013)

4.2.6 Degraded Areas & Restoration Opportunities

405 Degraded conditions in this reach include:

1. Bonneville impoundment of the Columbia River and inundation of floodplains.
2. Aggradation in lower Rock Creek.
3. Character and coverage of riparian vegetation.
4. Rip rap armoring of shorelines.
- 410 5. Active shoreline erosion along Port holdings.
6. Culverts (Kanaka Creek).
7. Unknown character of PHS listings.
8. Unknown character and functions of wetlands.
9. Ecosystem-wide water quality concerns.
- 415 10. Paved coverage (Cascade Avenue, Kanaka Creek Underpass, and parking areas).
11. Proximity of non-water-oriented and/or abandoned structures to OHWM.
12. Sheet pile at Leavens Point.
13. Abandoned pilings.
14. Quantity & unknown quality of stormwater runoff.

420 Specific opportunities to restore these degraded conditions will be addressed in detail in the Restoration Plan and may include dredging aggraded areas, incorporating soft armoring along river banks, preserving and enhancing canopy cover, assessing habitat and wetland areas, completing the Port/County Stevenson Waterfront Restoration & Enhancement Project, removing derelict piles, improving stormwater collection and treatment, etc.

425 4.3 Columbia River Reach 3 – West Urban Area



Figure 4.3-1 Columbia River Reach 3
Former industrial and transportation corridor

Photo Credits: Ben Shumaker (2015), Department of Ecology (2007), Ben Shumaker (2015).

Columbia River Reach 3 is located south of Rock Cove and west of the downtown waterfront. It includes ~8,000 linear feet of the Columbia River shoreline, and 396 acres of predesignated shoreline area. Only 34 acres of this reach are shorelands located above the OHWM. The reach is located outside the city limits and begins at the western boundary of Columbia River Reach 2 at the centerline of Rock Creek and ends downstream at the eastern boundary of Ashes Lake. The reach includes the full right-of-way for SR 14, the BNSF railroad, and privately owned properties. This reach is a shoreline of statewide significance.

430 Projected land use and existing zoning in this reach involve commercial or industrial trade uses, however, no shorelands are currently devoted to those uses. A 2007 fire destroyed the large Co-Ply mill in this reach.

435 While the property remains in use as an active place of business, more than 1/3rd of this the shoreline area in this reach is undeveloped (36%) and no land is currently devoted to Water-Oriented uses.

There are no known archaeological, cultural, or historical resources within the reach.

Table 4.3-1 – Columbia River Reach 3 Land Use Trends

Future Land Use						
	Low Density Residential	High Density Residential	Low Intensity Trade	High Intensity Trade	Total	
	0%	0%	91%	9%	100%	
Current Zoning						
	Residential	Public	Resource	Commercial	Industrial	Total
	0%	0%	4%	31%	65%	100%
Existing Land Use						
Undeveloped	Residential	Public	Resource	Commercial	Industrial	Total
36%	0%	39%	25%	0%	0%	100%
Shoreline Preferred Uses						
	Undeveloped	Single –Family Residential	Water-Oriented	Non-Water Oriented	Total	
	36%	0%	0%	64%	100%	
Land Ownership						
	Private	Local Government	State or Federal Government	Total		
	86%	1%	13%	100%		

440 **4.3.1 Summary of Ecological Functions**

Indicators of Ecological Functions—CR3

		Physical Environment			Biological Environment			Altered Conditions			Overall		
		Available Floodplain Area	Riparian Vegetation	Shoreline Stability	Fish-Blocking Culverts	Permanently Protected Areas	PHS Listings	Wetland Acreage	303(d) Listings	Impervious Surface Area		Overwater Roads & Structures	Setbacks to OHWM
Water Quality	Sediment Transport		↘	▬	↗	↘	▬	↘	↘			↘	↘
	Nutrient & Toxic Filtration	↘	↘			↘	▬	↘	↘		↘	↘	↘
	Temperature Regulation		↘			↘	↘		↘		↘	↘	↘
Water Quantity	Water Storage & Flow Regulation	↘	↘		↗		▬		↘	▬		↘	↘
Habitat	Input of Organics & LWM	↘	↘	▬		↘	↘		↘				↘
	Connectivity to Suitable Habitat		↘	▬	↗	↘	↘	▬	↘	▬	↘		↘

4.3.2 Physical Environment

↘ Available Floodplain Areas- The available floodplain for the Columbia River has been inundated by, and is fully controlled by operations at, the Bonneville Dam. The US Army Corps of Engineers maintains flowage

445 easements for all properties in the reach. The Department of Ecology’s Preliminary Channel Migration Zone Map for this reach was developed at a very coarse-scale, and recommends reliance on the Flood Insurance Rate Maps and/or site-specific delineations to more precisely determine the locations of channel migration zones (CMZs). The “Very Poor” rating of this reach relates to the Corps’ current inundation of the floodplain and its authority to further inundate the properties of this reach.

450  **Riparian Vegetation-** Riparian vegetation covers nearly two-thirds of the land in this reach, but forested lands make up only 28% of the land cover. This is composed of deciduous lowland riparian forest, which can be a source allochthonous inputs and for recruitment of LWM. However, this coverage is on the lower end of the range when compared to the other reaches of this report and is “Poor”. Specific degraded areas include former and/or sparsely used industrial sites and the berm supporting the BNSF railroad and SR 14.

455 **Table 4.3-2 – Columbia River Reach 3 Land & Water Areas**

Land Cover							
Forested	Riparian Vegetation			Vegetated Subtotal	Non-Vegetated Land	LAND TOTAL	Water
	Shrub	Grass					
9.6 ac	6.9 ac	5.6 ac	22.1 ac	12.1 ac	34.2 ac	396.7 ac	
28.2%	20.1%	16.4%	64.6%	35.4%	100%	-	

460  **Shoreline Stability-** A mix of natural shoreline and armored slopes characterizes the reach, with the armoring occurring mostly along the BNSF railroad/highway berm and in select locations of the industrial/manufacturing area at the far west of the reach. The reach’s soil types include Arents and Steever soils. Arents soils are composed of gravelly sandy loams and Steever soils are stony or gravelly clay loams. These soils both are Well Drained, and have Moderate availability of water storage.

465 Geologic hazards have not been mapped for many areas of this reach which are outside of city limits, but the areas of the reach with slopes greater than 25% have Moderate Hazard potentially unstable slopes (Map 5A) and the terrain is a result of the Cascade Landslide Complex. The railroad/highway berm has a High liquefaction potential in the event of earthquakes (Map 5).

The very eastern portion of this reach at the confluence with Rock Creek is seeing rapid aggradation as the Piper Road landslide overwhelms the sediment transport system. Shallow waters and partially dry lands result depending on the elevation of the Bonneville Pool. The relative lack of concerns in comparison to the other reaches characterized justifies the “Fair” rating.

470 **4.3.3 Biological Environment**

 **Fish-Blocking Culverts-** There are no culverts identified on the WDFW inventory within this reach and an “Excellent” rating is easily justified.

475  **Permanently Protected Areas-** This reach is rated as “Very Poor” because there are no areas subject to permanent protective covenants or environmentally protective deed restrictions and because the entirety of this reach is under private ownership.

 **Priority Habitat & Species-** The PHS priority habitat supporting waterfowl concentrations is located in this reach. PHS species within the reach include Columbia River salmonids, white sturgeon, and northern spotted owl. The only monitored non-PHS species within the reach is the ringneck snake. Some threat to aquatic habitat exists based on the spread of milfoil. The condition of these habitat and species types has not

480 been evaluated, but their presence is a positive ecological indicator, and, like the other Columbia River reaches, justify a “Good” rating.

1 Wetland Acreage- The “Fair” rating is applied as a placeholder to this reach which contains no mapped local inventory or NWI wetlands (Map 8).

4.3.4 Altered Conditions

485 **303(d) Listings-** The Columbia River within this reach has a Category 5 listing for temperature and through a 3-state memorandum of understanding the EPA is developing total maximum daily load (TMDL) protocols to address the water quality deficiency. This reach is also subject to pollution from Dioxin as a Category 4A pollutant subject to a TMDL from the EPA. The Columbia is also a Category 2 water of concern for pH, PCBs, Chlordane, and 4,4'-DDE. The “Very Poor” rating results from these multiple listings.

490 **Impervious Surface Area-** Large areas of the formerly industrial sites in this reach contain extensive impervious surfaces, which cover 6.6 ac in total. A comparison of developed lot coverage is not available for this reach or the Ashes Lake reach based on the aggregation of certain data used in the analysis. However, visual reconnaissance indicates that impervious coverage in this reach is similar to the Rock Cove reach and has been rated as “Poor”.

495 **Table 4.3-3 – Columbia River Reach 3 Impervious Surface Comparison**

Impervious Surface Areas				
	Total Impervious Area	% Land Covered by Impervious Surfaces	Mean Impervious % of Developed Lots	Median Impervious % of Developed Lots
Reach	6.6 ac	19.3%	??	??
Total Jurisdiction	29.4 ac	14.4%	46.3%	36.2%

500 **1 Overwater Roads & Structures-** A private ~1,000 sf pier with a building (denoted on Map 15 as A) is located in the western portion of this reach. The aquatic area of the shoreline also includes a number of derelict pilings at various locations in this reach, including a high concentration east west of the former Co-Ply site. There are no overwater roads and this reach has been rated as “Fair”.

2 Setbacks to OHWM- No properties in this reach have buildings in shoreline jurisdiction, but nearly half are developed with roads, paved or gravel parking areas and the railroad. This pre-designated reach has the closest combined central tendencies for setbacks to the OHWM at 20 ft. The “Poor” rating of the reach reflects the proximity of structures to the OHWM and lack of buildings.

505 **Table 4.3-4 – Columbia River Reach 3 Development Proximity to OHWM**

Setbacks to OHWM				
	% of Lots with Construction	Smallest Setback	Mean Setback	Median Setback
Buildings	0%	-	-	-
Any Structure*	42.9%	0 ft	24 ft	15 ft

*Based on data aggregated with Ashes Lake Reach. Average setbacks for structures include the proximity of Ash Lake Road and SR 14 to the OHWM of Ashes Lake.



Urban Runoff- While containing 15% of the linear footage of shorelines in the Stevenson Urban Area, this reach only accepts stormwater from 2% of that area. Separated from uphill drainage by the state highway and the railroad, the runoff entering the Columbia River in this reach comes only from shoreline properties. A “Very Good” rating for this reach is not justified because treatment of stormwater for these former industrial properties and transportation corridors is minimal and the reach is downstream from more degraded runoff areas.

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4.3.5 Public Access

Physical and visual access to the Columbia River waterfront is limited because of the continuous presence of the elevated rail bed of the BNSF tracks and SR 14 and private ownership. The reach does not include any park benches, boat launches with access to the river, or trails. At the June 8, 2015 community vision workshop, attendees recommended improved shoreline access to the Columbia River waterfront with a preference for continued public access along the shoreline. The scope and style of this access will largely depend on the type of development that occurs along this reach. Development with a commercial or tourist focus should result in greater public physical and visual access, including a marina if the property owners wish to pursue opportunities for the best site identified in a 1995 study covering the mid-Columbia Gorge region. Development with an industrial focus may result in shoreline public access that is limited to viewpoints, overlooks, or other forms of visual access for safety and security issues.

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4.3.6 Degraded Areas & Restoration Opportunities

Degraded conditions in this reach include:

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1. Bonneville impoundment of the Columbia River and inundation of floodplains.
2. Aggradation in lower Rock Creek.
3. Character and coverage of riparian vegetation.
4. Rip rap armoring of shorelines.
5. Unknown character of PHS listings.
6. Ecosystem-wide water quality concerns.
7. Paved coverage (roads and former industrial site).
8. Proximity of non-water-oriented and/or abandoned structures to OHWM.
9. Abandoned pilings.
10. Quantity & unknown quality of stormwater runoff.

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Specific opportunities to restore these degraded conditions will be addressed in detail in the Restoration Plan and may include dredging aggraded areas, incorporating soft armoring along river banks, preserving and enhancing canopy cover, assessing habitat areas, removing heritage piles, improving stormwater collection and treatment, etc.

540 **4.4 Rock Creek Reach 1**



Figure 4.4-1 Rock Creek Reach 1, A Study of Contrasts
Lower Rock Creek with dense development and rapid aggradation, Upper Rock Creek with vegetation and a bedrock channel
Photo Credit Ben Shumaker (2009), BergerABAM (2015).

545 Rock Creek Reach 1 includes the shoreline jurisdictional area associated with Rock Creek within the City's boundaries. On the east side of this stream, this reach covers the area within city limits from the approximate extension of Lasher Street downstream to the BNSF railroad trestle. This reach also runs along the west/south side of the stream from Ryan Allen Road at the upstream end to the BNSF railroad trestle at the downstream end. The southwestern boundary of this reach at the Rock Cove reach is hard to pinpoint, running southward over the Creek's deltaic deposits toward the trestle. This reach includes ~10,375 linear feet of shoreline, 44 acres of shorelands, and 4 acres of water within shoreline jurisdiction. This reach is not a shoreline of statewide significance.

550 A data collection error duplicated data for some of the parcels from Columbia River Reach 2 and included them within this reach. This prevents a similar reporting of existing land uses as completed in other reaches. Visual reconnaissance indicates that most of this reach located upstream from the Rock Creek Drive bridge is undeveloped or developed with residential uses. Public uses dominate the area near and downstream from the bridge, where the majority of the reach's Water-Oriented uses occur. In terms of zoning, the reach is primarily zoned as suburban residential, followed by smaller areas of multi-family residential, public use and recreation, and commercial zoning. There is both private and public land ownership within the reach. Some of the roads within the reach include SW Rock Creek Drive, First Falls View Road, HH Ave, Holly Street, NW Still Cove Lane, Stevenson Transfer Site Road, Neyland Road, Bounty Way, and Ryan Allen Road. The only known archaeological, cultural, or historical resource within the reach is the Skamania County Cemetery District's Iman Cemetery located near the Upper Falls.

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4.4.1 Summary of Ecological Functions

Indicators of Ecological Functions—RC1

		Physical Environment			Biological Environment				Altered Conditions			Overall	
		Available Floodplain Area	Riparian Vegetation	Shoreline Stability	Fish-Blocking Culverts	Permanently Protected Areas	PHS Listings	Wetland Acreage	303(d) Listings	Impervious Surface Area	Overwater Roads & Structures		Setbacks to OHWM
Water Quality	Sediment Transport		⬆️	⬇️	⬆️	⬆️	⬆️		⬇️	⬇️		⬇️	⬇️
	Nutrient & Toxic Filtration	⬇️	⬆️			⬆️		⬆️	⬇️	⬇️	⬆️	⬇️	⬆️
	Temperature Regulation		⬆️			⬆️	⬆️		⬇️		⬆️	⬇️	⬆️
Water Quantity	Water Storage & Flow Regulation	⬇️	⬆️		⬆️		⬆️			⬇️	⬇️	⬇️	⬇️
Habitat	Input of Organics & LWM	⬇️	⬆️	⬇️		⬆️	⬆️			⬇️			⬆️
	Connectivity to Suitable Habitat		⬆️	⬇️	⬆️	⬆️	⬆️	⬆️	⬇️	⬇️	⬆️	⬆️	⬆️

4.4.2 Physical Environment

565 **Available Floodplain Areas-** The floodplain for lower Rock Creek below the falls to the Columbia River confluence is subject to much of the same inundation and flowage easements as the Columbia River and Rock Cove. This inundation causes the sediments of Rock Creek to sink prior to its confluence with the Columbia River. The stream’s bed has risen since construction of the Bonneville Dam and with it, the stream’s capacity to hold floodwaters has been diminished. The capacity of the floodplain has been further reduced by the presence of dredge spoils deposited in the floodplain after the Piper Road Landslide of 2007. These deposits, located on County and private land on the east bank of Rock Creek and downstream from the pedestrian bridge, are intended to be temporary and must be removed according to the Corps permits issued for the emergency dredging. The available floodplain for upper Rock Creek above the falls has not been impacted by the Bonneville Dam or the flowage easements of the USACE. The rating for this indicator is “Poor”, reflecting the balance between the differing dynamics of the upper and lower stream. The Department of Ecology’s Preliminary Channel Migration Zone Map for this reach identifies the potential existence of CMZs and recommends better delineation of potential CMZs at the site-specific level.

575 **Riparian Vegetation-** With 91% total coverage, including 63% forest cover, this reach provides “Excellent” vegetative cover. The westside lowlands conifer-hardwood and deciduous lowland riparian forested shorelands are a source of allochthonous inputs and LWM recruitment. Where degraded areas exist in this reach they occur in the lower portion of Rock Creek at the City and County public works and service facilities and at the BNSF and SR 14 berms, where there is very little existing shoreline vegetation.

Table 4.4-1 – Rock Creek Reach 1 Land & Water Areas

Land Cover						
Forested	Riparian Vegetation		Vegetated Subtotal	Non-Vegetated Land	LAND TOTAL	Water
	Shrub	Grass				
27.3 ac	6.6 ac	5.7 ac	39.6 ac	3.9 ac	43.5 ac	4.0 ac
62.7%	15.2%	13.2%	91.1%	8.9%	100%	-

585 **Shoreline Stability-** The lower portion of this reach is armored, while the portions above Vancouver Avenue are more natural. Arents, Skamania, Steever and Stevenson soils all exist along this reach, with Steever’s stony clay loams and Stevenson’s loams as the primary soil types. All soils in this reach are Well Drained. The Stevenson soils have a High availability of water storage compared to the Moderate availability of the other reaches. Based on their slop the Steever soils of this reach present a High erosion hazard. Many portions of this reach are categorized as High Hazard areas based on the Debris Flow Hazard and Landslide areas, and Unstable Soils (Map 5A). The areas of the reach with slopes greater than 25% present a Moderate Hazard. The northern portion of the reach was adjacent to the Piper Road Landslide of 2007 and might be expected to be destabilized based on the changes in the watercourse of Rock Creek downstream of the 70’ waterfall. The lower portions of this reach have been overwhelmed by the amount of sediment that has entered the system as a result of the landslide, and the “Very Poor” rating is easily understood.

595 **4.4.3 Biological Environment**

600 **Fish-Blocking Culverts-** The WDFW inventory for this reach identifies the highway bridge as a passable crossing. Neither the railroad nor the Rock Creek Drive bridges are identified by WDFW, but both are passable. The reach is subject to an identified natural passage barrier for migrating Chinook and steelhead based on the dramatic 70’ waterfall located ~0.85 miles upstream from the Columbia River. There are no culverts identified on the WDFW inventory within this reach. This combination of passable manmade barriers and impassable natural barriers justifies the “Fair” rating for this reach.

605 **Permanently Protected Areas-** In the middle of this west/south bank of this reach, the full shoreline jurisdiction of the Angel Heights subdivision (2005) is covered by a conservation easement benefitting the City. This ~0.33 mile stretch of Rock Creek only allows uses that protect the public health and safety or involve stewardship. Further, 19 other uses are specifically prohibited as inconsistent with the easement. Much of the lower portion of this reach is under City and County ownership providing some confidence in responsible stewardship. The remainder of this “Excellent” reach is subject to private ownership without conservation covenants.

610 **Priority Habitat & Species-** The PHS priority habitat type within the reach includes palustrine aquatic habitat. PHS species within it include northern spotted owl and residential coastal cutthroat and rainbow trout, as well as migratory Chinook and steelhead. The monitored non-PHS species within the reach is the ringneck snake. Some threat to aquatic habitat exists based on the spread of milfoil and the Skamania County Noxious Weed Board has considered treatments in this reach. Having fewer overall listings than the Columbia River reaches, this reach carries a “Fair” rating. Future assessment of the condition of these habitat and species types may lead to a change of this indicator’s rating.

1 Wetland Acreage- The “Fair” rating is applied as a placeholder to this reach which contains no mapped local inventory or NWI wetlands (Map 8).

4.4.4 Altered Conditions

620 **303(d) Listings-** The lower portion of this reach below Rock Creek Drive is subject to the same Category 5 temperature listing as the Columbia River. The EPA has not yet developed total maximum daily load (TMDL) protocols to address this water quality deficiency. This listing does not include the upper portion of the reach, and there are no other types of 303(d) listings occur within this reach.

625 **Impervious Surface Area-** This highly urbanized reach contains 6.6 ac of total impervious surfaces, which exist at a higher proportion than the overall shorelines reviewed in this report. However, individual developed lots have less impervious surfaces when compared to the shorelines of the entire Stevenson Urban Area. Impervious surfaces are concentrated near and south of the bridge at Rock Creek Drive. The reach has been rated “Poor”.

Table 4.4-2 – Rock Creek Reach 1 Impervious Surface Comparison

Impervious Surface Areas				
	Total Impervious Area	% Land Covered by Impervious Surfaces	Mean Impervious % of Developed Lots	Median Impervious % of Developed Lots
Reach	6.6 ac	15.1%	22.1%	17.3%
Total Jurisdiction	29.4 ac	14.4%	46.3%	36.2%

630 **Overwater Roads & Structures-** This “Very Poor” reach has the most overwater roads & structures in Stevenson’s shoreline jurisdiction. The Rock Creek Drive bridge, a pedestrian-only bridge and the SR 14 bridge are existing public structures. A deteriorating private deteriorating dock (denoted on Map 15 as D) is located on private property between SR 14 and the BNSF railroad. Additionally, the BNSF railroad bridge marks the southern extent of this reach. In total, these structures cover ~14,000 sf of the stream. The Rock
635 Creek Drive and SR 14 bridges both have piers placed in the water. The City is seeking grant funding to replace the Rock Creek Drive bridge with a freespan structure. The BNSF bridge is proposed for replacement and preliminary designs indicate a removal of the bridgehead piers/revetments that constrict the channel under the bridge. The replacement project may also provide for the removal of some pilings and other dilapidated structures in the vicinity.

640 **Setbacks to OHWM-** Nearly half of the properties in this reach are developed in some fashion and most of the developed lots contain some type of building. The central tendencies for the location of these buildings combine to ~100 ft from the OHWM, and structures are typically located slightly closer. This reach is rated as “Good” and contrasts interestingly with the development setback trends of Rock Creek Reach 2 which has a lesser rating.

645 **Table 4.4-3 – Rock Creek Reach 1 Development Proximity to OHWM**

Setbacks to OHWM				
	% of Lots with Construction	Smallest Setback	Mean Setback	Median Setback
Buildings	40.4%	11 ft	93 ft	87 ft
Any Structure	47.4%	6 ft	88 ft	77 ft

Urban Runoff- The shoreline for this reach of Rock Creek accounts for 20% of the total shoreline linear footage in this report and accepts stormwater runoff from 9% of the Stevenson Urban Area. The runoff it does accept has minimal treatment. While WSDOT’s engineered system treats stormwater from the state highway, far more untreated runoff is entering this reach. Within shoreline jurisdiction, this happens directly from parking lots and other paved areas. Of most concern is the lack of treatment of runoff entering at Vancouver Avenue’s outfall, which drains a large section of Stevenson’s historic residential core. This reach has been rated as “Very Poor” based on these trends.

4.4.5 Public Access

The reach is part of a Class IV – Sacred Place described in the Stevenson Comprehensive Plan and includes visual public access from the Mill Pond Trail and pedestrian walkways along the SW Rock Creek Drive Bridge, which provides views of Rock Creek. The County Fairgrounds are located on the west side of Rock Creek, south of SW Rock Creek Drive and provide informal physical access to the stream. There is a pedestrian bridge implemented as part of a coordinated pedestrian circulation plan (Figure 4.6-2) to connect the Fairgrounds with downtown Stevenson.



Figure 4.4-2 Rock Creek Reach 2
A potential public access site and pedestrian bridge on lower Rock Creek
Photo Credits: Michelle Russek (2012), Ben Shumaker (2015).

At the June 8, 2015 community vision workshop conducted for the SMP update, stakeholders stated that sedimentation from the Piper Road Landslide is causing scenic enjoyment issues for recreationalists and visitors. The attendees also discussed how during low flows or low dam levels, this sedimentation prevents fishers and kayakers from travelling between Rock Creek to the Columbia River. Additionally, stakeholders suggested improving the surfacing and amenities offered along the trails near Rock Creek and providing continuous public access along the shoreline. Access to the Rock Creek Falls is described below. Potential visual access could be developed on the Angel Heights Park site. Other projects considered include development of a public physical access and picnic site at the location of the dilapidated tug boat dock between the SR14 and railroad bridges.

4.4.6 Restoration Opportunities



Figure 4.4-3 Potential Restoration Opportunities, Rock Creek Reach 1
Dilapidated structures and City-owned facilities present opportunities for restoration.

Photo Credits: BergerABAM (2015), Ben Shumaker (2013), Ben Shumaker (2013)

4.4.6 Degraded Areas & Restoration Opportunities

Degraded conditions in this reach include:

- 675 1. Bonneville impoundment of the Columbia River and inundation of floodplains.
2. Aggradation in lower Rock Creek.
3. Shoreline instability near the Piper Road Landslide.
4. Character and coverage of riparian vegetation (lower Rock Creek).
5. Rip rap armoring of shorelines.
- 680 6. Presence of piers in Rock Creek for the SR 14 and Rock Creek Drive bridges.
7. Unknown character of PHS listings.
8. Ecosystem-wide water quality concerns.
9. Paved coverage (roads and parking areas).
- 685 10. Proximity of non-water-oriented and/or abandoned structures to OHWM (abandoned residential and former transportation structures).
11. Abandoned pilings.
12. Quantity & unknown quality of stormwater runoff.
13. Quality of stormwater entering from Vancouver Avenue stormwater outfall.

690 Specific opportunities to restore these degraded conditions will be addressed in detail in the Restoration Plan and may include dredging aggraded areas, incorporating soft armoring along river banks, preserving and enhancing canopy cover, assessing habitat areas, removing heritage piles, improving stormwater collection and treatment, etc. Additional solutions will be based in part on the June 8, 2015 community vision workshop where it was stated that infrastructure at the mouth of Rock Creek constrains natural processes such as stream flow/mobility.

695 4.5 Rock Creek Reach 2

700 Rock Creek Reach 2 includes shoreline jurisdictional area associated with the north/east bank of Rock Creek in the unincorporated Urban Area. This includes the area ~5,325 linear feet from the City boundary at about Lasher Street upstream to the urban area boundary just north of Ryan Allen Road. The reach includes 30 acres of land and 7 acres of water. The City is choosing to predesignate this reach in preparation for future annexation. This reach is not a shoreline of statewide significance.

Projected land uses in this reach have a residential focus. However, currently only 25% of the land is used for residential purposes. County ownership of 37% of this reach will likely preclude future residential

development. None of the land in this reach is currently used for water-oriented purposes. There are no known archaeological, cultural, or historical resources within the reach.

705 **Table 4.5-1 – Rock Creek Reach 2 Land Use Trends**

Future Land Use						
	Low Density Residential	High Density Residential	Low Intensity Trade	High Intensity Trade	Total	
	93%	0%	3%	3%	100%	
Current Zoning						
	Residential	Public	Resource	Commercial	Industrial	Total
	100%	0%	0%	0%	0%	100%
Existing Land Use						
Undeveloped	Residential	Public	Resource	Commercial	Industrial	Total
41%	25%	20%	14%	0%	0%	100%
Shoreline Preferred Uses						
	Undeveloped	Single –Family Residential	Water-Oriented	Non-Water Oriented	Total	
	41%	25%	0%	33%	100%	
Land Ownership						
	Private	Local Government	State or Federal Government	Total		
	61%	37%	1%	100%		

4.5.1 Summary of Ecological Functions

Indicators of Ecological Functions—RC2														
		Physical Environment			Biological Environment			Altered Conditions			Overall			
		Available Floodplain Area	Riparian Vegetation	Shoreline Stability	Fish-Blocking Culverts	Permanently Protected Areas	PHS Listings	Wetland Acreage	303(d) Listings	Impervious Surface Area		Overwater Roads & Structures	Setbacks to OHWM	Urban Runoff
Water Quality	Sediment Transport		⬆️	⬆️	⬆️	⬆️		⬆️	⬆️	⬆️			⬆️	⬆️
	Nutrient & Toxic Filtration	⬆️	⬆️			⬆️		⬆️	⬆️	⬆️		⬆️	⬆️	⬆️
	Temperature Regulation		⬆️			⬆️	⬆️		⬆️			⬆️	⬆️	⬆️
Water Quantity	Water Storage & Flow Regulation	⬆️	⬆️		⬆️			⬆️		⬆️	⬆️		⬆️	⬆️
	Habitat			⬆️		⬆️	⬆️			⬆️		⬆️	⬆️	⬆️
	Input of Organics & LWM	⬆️	⬆️	⬆️		⬆️	⬆️			⬆️		⬆️	⬆️	⬆️
	Connectivity to Suitable Habitat		⬆️	⬆️	⬆️	⬆️	⬆️	⬆️		⬆️	⬆️	⬆️	⬆️	⬆️

4.5.2 Physical Environment

710  **Available Floodplain Areas-** The floodplain for the very southern portion of this reach below the falls subject to much of the same inundation and flowage easements as the Columbia River and Rock Cove. This inundation causes the sediments of Rock Creek to sink prior to its confluence with the Columbia River. The stream’s bed has risen since construction of the Bonneville Dam and with it, the stream’s capacity to hold floodwaters has been diminished. The available floodplain for upper Rock Creek above the falls has not been impacted by the Bonneville Dam or the flowage easements of the USACE. The rating for this indicator is “Good”, reflecting the limited coverage of lower Rock Creek in this reach. The Department of Ecology’s Preliminary Channel Migration Zone Map for this reach identifies the potential existence of CMZs and recommends better delineation of potential CMZs at the site-specific level.

715
720  **Riparian Vegetation-** The most vegetated of all reaches, the “Excellent” vegetative cover adds up to 94% of all land within the reach, including 75% covered by forest. These forests are westside lowlands conifer-hardwood and deciduous lowland riparian, and they provide a source of LWM recruitment and allochthonous inputs. Degraded areas in this reach are localized to the area affected by the Piper Road Landslide, where the exposed scarp and landslide mass have little regrowth.

Table 4.5-2 – Rock Creek Reach 2 Land & Water Areas

Land Cover							
Forested	Riparian Vegetation			Vegetated Subtotal	Non-Vegetated Land	LAND TOTAL	Water
	Shrub	Grass					
22.6 ac	1.3 ac	4.7 ac	28.6 ac	1.8 ac	30.4 ac	6.5 ac	
74.4%	4.2%	15.5%	94.1%	5.9%	100%	-	

725  **Shoreline Stability-** Shoreline armoring is not evident in this reach. Steeper soils predominate, with very small pockets of Stevenson soils at the very upper and very lower portions. The Steeper soils are Well Drained stony and gravelly clay loams. They have a Moderate availability of water storage and present a Severe erosion hazard because of the steep slopes that are present.

730 A large portion of the center of this reach was part of the Piper Road Landslide of 2007 and is still subject to some scarp toppling and slow rotational ground movement. This area is the best known, and highest hazard area characterized in this report and the landslide has deposited an overwhelming amount of sediment into the reach. This “Very Poor” reach also includes Debris Flow Hazards, Unstable Soils and other High Hazard areas as well as Moderate Hazard areas having slopes greater than 25% (Map 5A).

735 4.5.3 Biological Environment

 **Fish-Blocking Culverts-** This reach is subject to an identified natural passage barrier based on the 70’ waterfall located ~0.85 miles upstream from the Columbia River. There are no culverts identified on the WDFW inventory within this reach; however the natural barriers of this reach justify its “Very Poor” rating.

740  **Permanently Protected Areas-** No areas in this reach are subject to permanent protective covenants or environmentally protective deed restrictions. County ownership provides some protection of the area near the 2007 Piper Road landslide. However, Skamania County has recently sold property within this reach to private owners, and it is unknown whether this trend will continue and the “Fair” rating is appropriate.

745  **Priority Habitat & Species-** No PHS priority habitat types are designated within the reach. PHS species within it include resident coastal cutthroat, winter steelhead, rainbow trout, and northern spotted owl. Some threat to aquatic habitat exists based on the spread of milfoil. The comparative lack of PHS listings in this reach is interpreted as a negative ecological indicator, as reflected in the “Poor” rating.

 **Wetland Acreage-** The “Fair” rating is applied as a placeholder to this reach which contains no mapped local inventory or NWI wetlands (Map 8).

4.5.4 Altered Conditions

750  **303(d) Listings-** There are no 303(d) listings within this “Excellent” reach.

 **Impervious Surface Area-** In terms of both total coverage (1.1 ac) and reach-wide percentage of coverage (3.6%), this reach has less overall pavement, gravel, or rooftops than any other. The larger lot size of the properties in this reach contributes to the average impervious coverage that less than half of the next closest reach. The “Excellent” rating reflects the lack of comparable reaches within in this analysis.

755 **Table 4.5-3 – Rock Creek Reach 2 Impervious Surface Comparison**

Impervious Surface Areas				
	Total Impervious Area	% Land Covered by Impervious Surfaces	Mean Impervious % of Developed Lots	Median Impervious % of Developed Lots
Reach	1.1 ac	3.6%	7.9%	4.5%
Total Jurisdiction	29.4 ac	14.4%	46.3%	36.2%

 **Overwater Roads & Structures-** Ryan Allen Road crosses Rock Creek at the westernmost portion of this reach. Its freespan from bank to bank covers ~2,000sf and is located ~30 ft above water level. No other roads or structures have been constructed over the waters of this “Good” reach.

760  **Setbacks to OHWM-** Only a quarter of the properties in this reach are developed with buildings, but central tendencies combine to equal ~75 ft, these buildings’ location is closer to the OHWM than the other Rock Creek reach. More than half of the properties contain some kind of developed structures, and the central tendencies in this case combine to equal ~100 ft. The reach has a “Fair” rating overall.

Table 4.5-4 – Rock Creek Reach 2 Development Proximity to OHWM

Setbacks to OHWM				
	% of Lots with Construction	Smallest Setback	Mean Setback	Median Setback
Buildings	23.0%	71 ft	77 ft	74 ft
Any Structure	61.5%	0 ft	95 ft	89 ft

765  **Urban Runoff-** Unlike most others, this reach drains a proportionate amount of the Stevenson Urban Area (13%) compared to its linear footage (10%). While engineered treatment systems are relatively infrequent, the lack of development density in the areas draining to this reach makes this a lesser concern and the “Good” designation is appropriate.

770 **4.5.5 Public Access**

Despite the large amount of public ownership in this reach, there is limited public access. Visual public access is limited to the Ryan Allen Road bridge. Physical public access does not currently exist.



Figure 4.5-1 Upper & Lower Rock Creek Falls
Upper Falls as seen from Rock Creek Reach 1, Lower Falls showing inaccessibility and mass wasting based on the Piper Road Landslide
Figure Credit: Tamara Tippel (2008), Department of Transportation (2007).

775 Rock Creek Falls, especially Upper Rock Creek Falls, is identified as a potential Class IV – Sacred Place in the Comprehensive Plan. Development of amenities at this location has been debated in the past and often declined to keep this hidden wonder a locals-only amenity. At the June 8, 2015 community vision workshop conducted for this update, stakeholders suggested improving the trails near Rock Creek waterfalls. If developed as a visual public access site, the County-owned property in this reach could be considered for accessory parking, access trails, and a picnic area. Physical access to this reach is likely to remain difficult.

780 **4.5.6 Degraded Areas & Restoration Opportunities**

Degraded conditions in this reach include:

1. Bonneville impoundment of the Columbia River and inundation of floodplains.
2. Aggradation in lower Rock Creek.
3. Shoreline instability near the Piper Road Landslide.
- 785 4. Character and coverage of riparian vegetation (Piper Road Landslide).
5. Unknown character of PHS listings.
6. Proximity of non-water-oriented and/or abandoned structures to OHWM.
7. Quantity & unknown quality of stormwater runoff.

790 Specific opportunities to restore these degraded conditions will be addressed in detail in the Restoration Plan and may include dredging aggraded areas, preserving and enhancing canopy cover, increasing connectivity between sections of Rock Creek, assessing habitat areas, improving stormwater collection and treatment, etc.

4.6 Rock Cove

795 The Rock Cove reach includes the waterbody otherwise known as the Stevenson Mill Pond, Stevenson Lake, Rock Creek Pond, or Hegewald Mill Pond. Rock Cove is located in the city, is connected to Rock Creek Reach 1 at its mouth, and is to the north of Columbia River Reach 3, separated by the highway/railroad berm. The reach includes all of Rock Cove, the northern fill slope of SR 14, and western portions of the Skamania County Fairgrounds, the Columbia Gorge Interpretive Center, other County-owned properties, and three residential properties. Including the islands in the cove, there are ~18,800 linear feet of shoreline, 69 acres of water, and 35 acres of shorelands. There is presently a lack of clarity regarding whether this reach is a shoreline of
800 statewide significance.



Figure 4.6-1 Rock Cove
An aerial photo showing early sedimentation impacts from the Piper Road landslide
Figure Credit: Department of Ecology (2007).

More than 60% of land in this reach is owned by public agencies and 82% of the land is developed with some type of use. The majority of land (56%) is used for commercial purposes, and 54% of land use is Water-Oriented. Projected land uses focus on adding commercial and public uses.

805 Outside of the resources curated by the Interpretive Center, there are no known archaeological, cultural, or historical resources within the reach.

Table 4.6-1 – Rock Cove Land Use Trends

Future Land Use						
	Low Density Residential	High Density Residential	Low Intensity Trade	High Intensity Trade	Total	
	0%	2%	98%	0%	100%	
Current Zoning						
	Residential	Public	Resource	Commercial	Industrial	Total
	14%	55%	0%	30%	0%	100%
Existing Land Use						
Undeveloped	Residential	Public	Resource	Commercial	Industrial	Total
18%	10%	16%	0%	56%	0%	100%
Shoreline Preferred Uses						
	Undeveloped	Single –Family Residential	Water-Oriented	Non-Water Oriented	Total	
	18%	4%	54%	25%	100%	
Land Ownership						
	Private	Local Government	State or Federal Government	Total		
	39%	55%	6%	100%		

4.6.1 Summary of Ecological Functions

Indicators of Ecological Functions—RCo

	Physical Environment			Biological Environment				Altered Conditions			Overall	
	Available Floodplain Area	Riparian Vegetation	Shoreline Stability	Fish-Blocking Culverts	Permanently Protected Areas	PHS Listings	Wetland Acreage	303(d) Listings	Impervious Surface Area	Overwater Roads & Structures		Setbacks to OHWM
Water Quality	Sediment Transport	↗	↗	↗	↗		↗	↘	↘		↘	↗
	Nutrient & Toxic Filtration	↘	↗		↗		↗	↘	↘	↗	↘	↘
	Temperature Regulation		↗		↗	↗		↘		↗	↘	↗
Water Quantity	Water Storage & Flow Regulation	↘	↗	↗			↗		↘	⊖	↘	↘
	Input of Organics & LWM	↘	↗	↗		↗	↗		↘			↗
Habitat	Connectivity to Suitable Habitat		↗	↗	↗	↗	↗		↘	⊖	↗	↗

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4.6.2 Physical Environment

↘ **Available Floodplain Areas-** The available floodplain for Rock Cove has been inundated by, and is fully controlled by operations at, the Bonneville Dam. The US Army Corps of Engineers maintains flowage easements for all properties in the reach. The sedimentation of Rock Creek impacts Rock Cove as well, and the lake’s capacity to hold floodwaters has been diminished. Rock Cove is a lake and not subject to channel migration. The “Very Poor” aspects of this reach relate to the Corps’ current inundation of the floodplain and its authority to further inundate the properties of this reach.

815

↗ **Riparian Vegetation-** Similar in character to the Columbia River Reach 1 east of Stevenson, this “Good” rated reach provides vegetative cover over 77% of the land in this reach, including 37% of the land that is forested. The forested areas along the Cove and on its islands are a source of allochthonous nutrient and energy inputs and LWM recruitment. Similar to other reaches, these forested areas include westside lowlands conifer-hardwood forest and deciduous lowland riparian forest. This reach is unique from the other reaches of this characterization based on the large open-lawn areas of the County Fairgrounds and Columbia Gorge Interpretive Center, which increases grass covered lands to 28%. Degradation exists along the transportation corridors of Rock Creek Drive and SR 14, and at a former industrial site on the west end of the Cove.

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Table 4.6-2 – Rock Cove Land & Water Areas

Land Cover						
Forested	Riparian Vegetation		Vegetated Subtotal	Non-Vegetated Land	LAND TOTAL	Water
	Shrub	Grass				
12.6 ac	4.1 ac	9.7 ac	26.4 ac	8.1 ac	34.6 ac	4.0 ac
36.5%	12.0%	27.9%	76.5%	23.5%	100%	-

830  **Shoreline Stability-** A mix of natural shoreline and armored slopes are present in this reach, with the natural areas located primarily along the islands and the Columbia Gorge Interpretive Center property. The reach's soil types include Arents, Bonneville and Steever soils. Arents soils are composed of gravelly sandy loams. Bonneville soils are stony sandy loams. Steever soils are stony or gravelly clay loams. Arents and Steever soils both are Well Drained, and have Moderate availability of water storage. Bonneville soils are Somewhat Excessively Drained, have a Very Low availability of water storage, and a Slight erosion hazard. The Rock Cove reach is rated as "Good" and has limited Geologic Hazards. The slopes greater than 25% present a Moderate Hazard as potentially unstable slopes (Map 5A). The greatest hazard in the reach is the High liquefaction potential of the railroad/highway berm if an earthquake were to occur.

4.6.3 Biological Environment

840  **Fish-Blocking Culverts-** There are no culverts identified on the WDFW inventory within this reach, however, local reconnaissance identified a culvert in the western portion of this reach for Foster Creek. The ability of fish to pass through this culvert is unknown. The presence of this culvert is all that prevents application of the "Excellent" rating.

845  **Permanently Protected Areas-** Between the Columbia Gorge Interpretive Center, Skamania County, and rights-of-way for the City's Rock Creek Drive and WSDOT's SR 14, the entire shoreline is stewarded by public or non-profit entities. These public and non-profit entities will ensure that a degree of responsible environmental protection during shoreline use and development within this "Good" rated reach; however, no areas in this reach are subject to permanent protective covenants or environmentally protective deed restrictions.

850  **Priority Habitat & Species-** The PHS priority habitat types within the reach support waterfowl concentrations and palustrine aquatic habitat. The PHS species within the reach include northern spotted owl, Canada goose, Chinook, steelhead, and resident and rainbow trout and coastal cutthroat. The only monitored non-PHS species within the reach is the ringneck snake. Some threat to aquatic habitat exists based on the spread of milfoil. This reach shares the "Good" rating with the Columbia River reaches which also serve several species and habitat purposes.

855  **Wetland Acreage-** A locally performed wetland inventory identifies a 0.03-acre wetland upland of Rock Creek Drive near the Ryan Allen Road intersection and a 0.27 acre emergent wetland on the upland side of Rock Creek Drive near the Rock Cove Assisted Living Facility. Neither is identified on the NWI maps (Map 8). The presence of these wetlands is a positive ecological indicator and justifies the "Good" rating of this reach.

4.6.4 Altered Conditions

860  **303(d) Listings-** This reach is subject to the same Category 5 temperature listing as the Columbia River. The EPA has not yet developed total maximum daily load (TMDL) protocols to address this water quality deficiency. No other 303(d) listings occur within this reach.

 **Impervious Surface Area-** A total of 5.7 ac of impervious areas are located in this reach which has a higher proportion of such surfaces than that of the overall jurisdiction characterized in this report. However, the proportion of each developed lot that is covered by impervious surfaces is less than the overall

865 proportion, a difference is explained in part by the reach’s comparatively large lot sizes. The “Poor” designation of this reach reflects its similarity to Columbia River Reach 3 and Rock Creek Reach 1.

Table 4.6-3 – Rock Cove Impervious Surface Comparison

Impervious Surface Areas				
	Total Impervious Area	% Land Covered by Impervious Surfaces	Mean Impervious % of Developed Lots	Median Impervious % of Developed Lots
Reach	5.7 ac	16.5%	25.3%	21.9%
Total Jurisdiction	29.4 ac	14.4%	46.3%	36.2%

870 **1 Overwater Roads & Structures-** Two apparently communal overwater structures are located adjacent to each other in the northern portion of this in this reach along Rock Creek Drive (denoted on Map 15 as B and C). Ownership of these 2 linear docks is likely private, however they are located on Skamania County property, accessed from City right-of-way, and rarely used. The total surface area of these structures is ~1,000 sf. Rock Cove also contains numerous pilings driven in during its history as a mill pond. There are no overwater roads and this reach has been rated as “Fair”.

875 **2 Setbacks to OHWM-** Nearly half of the properties in this reach contain buildings, and their setbacks average nearly 100 ft from the OHWM. Roads and other structures are even more ubiquitous and, though the closest structure is only 15 ft away, when combined the central tendencies for setbacks are still ~100 ft from the OHWM. The “Good” rating of this reach reflects the larger setbacks and the larger trend separating city reaches from predesignated reaches.

880 **Table 4.6-4 – Rock Cove Development Proximity to OHWM**

Setbacks to OHWM				
	% of Lots with Construction	Smallest Setback	Mean Setback	Median Setback
Buildings	45%	71 ft	108 ft	96 ft
Any Structure	80%	15 ft	88 ft	92 ft

885 **3 Urban Runoff-** Rock Cove receives runoff from 17% of the Stevenson Urban Area while making up 36% of shoreline linear footage. Runoff enters primarily from Foster Creek and from storm systems along SR 14 and Rock Creek Drive. Treatment levels for this runoff are mixed, including engineered detention ponds for new subdivisions, pervious pavement and wet wells for Skamania County, and untreated runoff from roads and parking areas. The Angel Heights & Hidden Ridge subdivisions maintain engineered systems prior to contributing runoff to this reach, as does the City for some transportation corridors. Natural filtration by soil filtration and vegetation uptake is relied on within Foster Creek, and limited amounts of untreated runoff enter the Cove. While on the cusp of “Fair, the “Poor” rating is more appropriate for this reach based on the density of development in the drainage area and overall lack of stormwater treatment.

4.6.5 Public Access

The entire Rock Cove reach is considered a Class IV – Sacred Place in the Stevenson Comprehensive Plan. This Sacred Place includes visual and physical access to Rock Cove from the Columbia Gorge Interpretive Center, Rock Creek Park, and the Skamania County Fairgrounds. The reach includes interpretive signs, park benches

895 with views of the river, an informal nonmotorized boat launch with access to the water on the western side of Rock Cove, walkways, and the Mill Pond Trail.

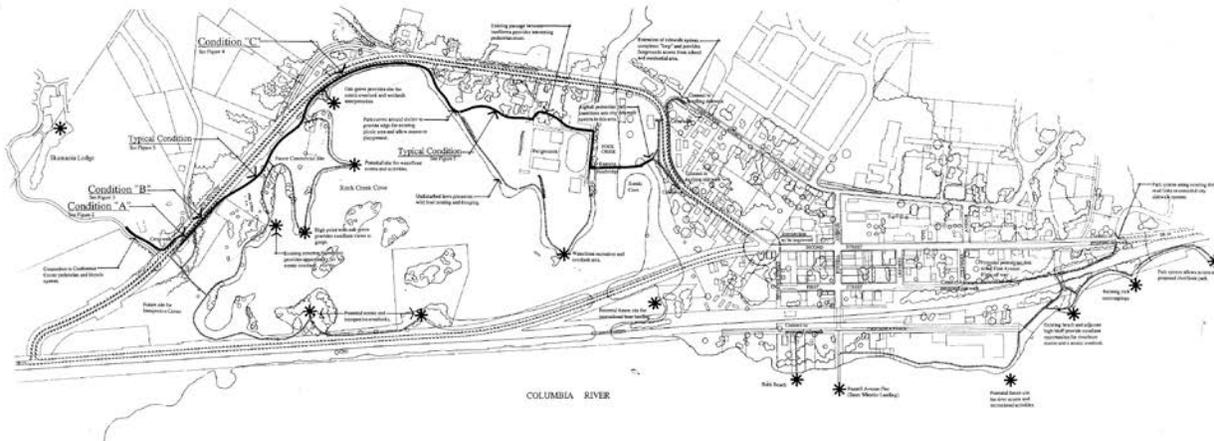


Figure 4.6-2 Pedestrian & Bicycle Links for Rock Cove, Columbia River Reach 1, & Columbia River Reach 2
A plan from 1991, partially implemented
Figure Credit: WalkerMacy (1991).

900 The multi-use Mill Pond Trail along the Cove is a result of a long term effort to connect Skamania Lodge to downtown Stevenson, and easement exists to provide additional pedestrian pathways along the western, county-owned property including the assisted living facility and the currently vacant developable parcels to its north. The Comprehensive Plan describes potential enhancements for this area, including landscaping plans for publicly owned areas and dredging of sediments deposited after the Piper Road Landslide. Stakeholders at the June 8, 2015 community vision workshop recommended public access improvements such as: (1) improving the existing boat launch, which is in a state of disrepair; (2) improving access for recreational activities including fishing, boating, swimming, and kayaking; and (3) improving shoreline access to the Columbia River waterfront, with a preference for continuous public access along the City’s shoreline rather than disconnected segments of differing surfacing and amenity levels.

905
Metal strapping and other metal debris from structures associated with the former mill on Rock Cove as identified in the 1997 Rock Cove Environmental Evaluation and Comprehensive Plan. This derelict metal was
910 described as hazardous to recreational users of the Cove.

4.6.6 Degraded Areas & Restoration Opportunities



Figure 4.6-3 Potential Restoration Opportunities, Rock Cove
Pilings and other relics of Rock Cove’s industrial past.

Photo Credits: BergerABAM (2015), Ben Shumaker (2013)

Degraded conditions in this reach include:

- 915
1. Bonneville impoundment of the Columbia River and inundation of floodplains.
 2. Aggradation in lower Rock Creek.
 3. Character and coverage of riparian vegetation.
 4. Rip rap armoring of shorelines.
 5. Culverts (Foster Creek).
- 920
6. Unknown character of PHS listings.
 7. Unknown character and functions of wetland.
 8. Ecosystem-wide water quality concerns.
 9. Paved coverage (roads and parking areas).
- 925
10. Proximity of non-water-oriented and/or abandoned structures to OHWM (abandoned former industrial fences, metal strapping and debris, and concrete structures).
 11. Abandoned pilings.
 12. Quantity & unknown quality of stormwater runoff.

Specific opportunities to restore these degraded conditions will be addressed in detail in the Restoration Plan and may include dredging aggraded areas, replacing the culvert for Foster Creek under Rock Creek Drive, incorporating soft stabilization along banks, preserving and enhancing canopy cover, assessing habitat and wetland areas, removing heritage piles, removing former industrial fences and structures, improving stormwater collection and treatment, etc.

4.7 Ashes Lake

- 935
- The Ashes Lake reach includes only the extreme eastern portion of Ashes Lake, two road rights-of-way (Ash Lake and Mallicott), and small portions of privately owned properties. This reach is located within the Stevenson Urban Area, west of Skamania Lodge and north of SR 14, and is being pre-designated. The Columbia River frontage south of the highway and railroad is part of Columbia River Reach #3, previously described. The shoreline jurisdictional area of this reach includes all lands extending landward for 200 feet from the OHWM, including floodplains within 200 feet. This reach is not a shoreline of statewide significance.
- 940
- Land uses in this reach are projected to involve commercial trade, though 63% of the reach is currently undeveloped. The primary existing land use within this reach is road right-of-way, with smaller areas that are undeveloped and private/commercial forest. The reach includes no known archaeological, cultural, or historical resources.

Table 4.7-1 – Ashes Lake Land Use Trends

Future Land Use						
	Low Density Residential	High Density Residential	Low Intensity Trade	High Intensity Trade	Total	
	0%	0%	100%	0%	100%	
Current Zoning						
	Residential	Public	Resource	Commercial	Industrial	Total
	0%	0%	37%	63%	0%	100%
Existing Land Use						
Undeveloped	Residential	Public	Resource	Commercial	Industrial	Total
63%	0%	0%	37%	0%	0%	100%
Shoreline Preferred Uses						
	Undeveloped	Single –Family Residential	Water-Oriented	Non-Water Oriented	Total	
	63%	0%	0%	37%	100%	
Land Ownership						
	Private	Local Government	State or Federal Government	Total		
	100%	0%	0%	100%		

945

4.7.1 Summary of Ecological Functions

Indicators of Ecological Functions—AL

		Physical Environment			Biological Environment				Altered Conditions			Overall	
		Available Floodplain Area	Riparian Vegetation	Shoreline Stability	Fish-Blockng Culverts	Permanently Protected Areas	PHS Listings	Wetland Acreage	303(d) Listings	Impervious Surface Area	Overwater Roads & Structures		Setbacks to OHWM
Water Quality	Sediment Transport		↘	↗	↗	↗	↘	↘	↗	↘		↘	↗
	Nutrient & Toxic Filtration	↘	↘			↗	↘	↗	↗		↘	↘	↘
	Temperature Regulation		↘			↗	↘	↗	↗		↘	↘	↘
Water Quantity	Water Storage & Flow Regulation	↘	↘		↗		↘			↘	↗	↘	↘
Habitat	Input of Organics & LWM	↘	↘	↗		↗	↘			↘			↘
	Connectivity to Suitable Habitat		↘	↗	↗	↗	↘	↘		↘	↗	↘	↗

4.7.2 Physical Environment

↘ **Available Floodplain Areas-** The available floodplain for Ashes Lake has been inundated by, and is fully controlled by operations at, the Bonneville Dam. The US Army Corps of Engineers maintains flowage easements for all properties in the reach. Ashes Lake is a lake and not subject to channel migration. The “Very

950

Degraded” aspects of this reach relate to the Corps’ current inundation of the floodplain and its authority to further inundate the properties of this reach.

955  **Riparian Vegetation-** Specific percentages of vegetative cover have not been developed for this reach, based on its small size. However, the land is primarily non-vegetated based on the presence of Ash Lake and Mallicott roads. Where vegetation exists in this “Very Poor” reach, it includes westside lowlands conifer-hardwood forest, deciduous lowland riparian forest, and some shrub and grass lands. The forested area along Ashes Lake is a source of LWM recruitment and allochthonous inputs to the aquatic system.

960  **Shoreline Stability-** The stony and gravelly clay loam Steever soils of this reach are partially armored along this reach. These soils are well drained and have Moderate ratings for both available water storage and erosion hazards. The fine-grained analysis leading to Stevenson’s 2008 Critical Areas Map does not cover this reach and Skamania County’s coarse-scale mapping does not identify hazards, however areas of the reach with slopes greater than 25 percent may be potentially unstable.

965 Knowledge of Geologic Hazard Areas in this reach is less robust than in other reaches within city limits. However, areas with slopes greater than 25% present a Moderate geologic hazard, and other factors affecting shoreline stability are expected to be similar to Rock Cove, a similar road-constricted impoundment of the Columbia River backwaters. These reaches share the “Good” rating.

4.7.3 Biological Environment

970  **Fish-Blocking Culverts-** The culverts under Ash Lake Road and the SR 14/BNSF berm are located outside of the Stevenson Urban Area, and there are no culverts identified on the WDFW inventory within this reach and an “Excellent” rating is easily justified.

975  **Permanently Protected Areas-** No permanently protected areas have been identified in this reach. However, the “Good” rating reflects the environmental stewardship required of public agencies for the Ash Lake Road and SR 14 rights-of-way along the water’s edge provide some assurance of responsible shoreline development.

980  **Priority Habitat & Species-** The PHS priority habitat types within the reach support waterfowl concentrations. The PHS species within the reach include northern spotted owl and the ringneck snake, a monitored species. Some threat to aquatic habitat exists based on the spread of milfoil. Since this reach supports fewer priority species than the Rock Cove reach, it carries a “Fair” rating.

 **Wetland Acreage-** The “Fair” rating applies to this reach as a neutral placeholder since it contains no mapped local inventory or NWI wetlands (Map 8).

4.7.4 Altered Conditions

 **303(d) Listings-** There are no 303(d) listings within this “Excellent” reach.

985  **Impervious Surface Area-** A comparison of full percentages of impervious surface coverage in this reach is not available at this time. However, the reach is characterized as “Very Poor” based on the presence of the paved Ash Lake Road and the graveled Mallicott Road which cover 1.6 ac of this small reach.

Table 4.7-2 – Ashes Lake Impervious Surface Comparison

Impervious Surface Areas				
	Total Impervious Area	% Land Covered by Impervious Surfaces	Mean Impervious % of Developed Lots	Median Impervious % of Developed Lots
Reach	1.6 ac	??	??	??
Total Jurisdiction	29.4 ac	14.4%	46.3%	36.2%

990  **Overwater Roads & Structures-** This “Excellent” reach contains no overwater roads or structures.

 **Setbacks to OHWM-** No buildings are located in this reach, and the closest structure on any lot within the reach is 106 ft from the OHWM. However, the method of data collection combined the roads of this reach with Columbia River Reach 3. Visual reconnaissance confirms that structures associated with the roads of this reach are located as close as 25 ft to the OHWM, and justify its “Poor” rating.

995 **Table 4.7-3 – Ashes Lake Development Proximity to OHWM**

Setbacks to OHWM				
	% of Lots with Construction	Smallest Setback	Mean Setback	Median Setback
Buildings	0%	-	-	-
Any Structure*	33.3%	106 ft	106 ft	106 ft

*Based only on lots, road data is aggregated with Columbia River Reach 3 and located closer to the OHWM than 106 ft.

1000  **Urban Runoff-** Thought it only contains 1% of the total shoreline linear footage of the area, this reach accepts stormwater from 5% of the Stevenson Urban Area. There is a relative lack of development within that drainage area and most runoff occurs from gravel roads with some natural filtration. The “Fair” rating is appropriate at this time.

4.7.5 Public Access

1005 The Ashes Lake reach includes very limited public physical access to Ashes Lake and the Columbia River. The Ash Lake-Mallicott road corridor functions as an informal portion of the bicycle/pedestrian Trail of the Gods between Stevenson and the Bridge of the Gods. There are no boat ramps, interpretive signs, or parks. There is a small area along Ash Lake Road that some may use as a pull-off for viewing the lake, but sight lines are limited. Ashes Lake is also visible from the SR 14 travel corridor.

4.7.6 Degraded Areas & Restoration Opportunities

Degraded conditions in this reach include:

- 1010 1. Bonneville impoundment of the Columbia River and inundation of floodplains.
- 2. Character and coverage of riparian vegetation.
- 3. Rip rap armoring of shorelines.
- 4. Unknown character of PHS listings.
- 5. Unknown character and functions of wetland.
- 6. Paved coverage (roads).

1015

7. Proximity of non-water-oriented and/or abandoned structures to OHWM.
8. Quantity & unknown quality of stormwater runoff.

Specific opportunities to restore these degraded conditions will be addressed in detail in the Restoration Plan and may include incorporating soft armoring along banks, preserving and enhancing canopy cover, assessing habitat areas, removing heritage piles, improving stormwater collection and treatment, etc.

1020

5.0 Use Analysis

The SMA and the state’s shoreline guidelines (WAC 173-26-176) acknowledge and support increased human use of shoreline properties. This use, according to the state legislature, is subject to “ever increasing pressures of additional uses,” which must be managed through increased coordination so as to avoid “the inherent harm [of] an uncoordinated and piecemeal development of the state’s shorelines.” In short, the state wants to see shorelines put to their highest and best use. As the shoreline guidelines state (WAC 173-26-201(2)(d)), the preferences and priorities for shoreline uses involve:

- Reserve appropriate areas for protecting and restoring ecological functions to control pollution and prevent damage to the natural environment and public health.
- Reserve shoreline areas for water-dependent and associated water-related uses.
- Reserve shoreline areas for other water-related and water-enjoyment uses that are compatible with ecological protection and restoration objectives.
- Locate single-family residential uses where they are appropriate and can be developed without significant impact to ecological functions or displacement of water-dependent uses.
- Limit non-water –oriented uses to those locations where the above described uses are inappropriate or where non-water-oriented uses demonstrably contribute to the objectives of the SMA.

This section of the inventory and characterization report discusses the current uses of Stevenson’s shorelines, whether current uses are preferred or water-oriented, analyzes potential future uses of shoreline areas, and provides recommendations for accommodating such uses in the future. This discussion is possible based on a detailed analysis of GIS data for every legal lot of record and right-of-way in shoreline jurisdiction. The GIS data included information collected specifically for this effort, developed during preparation of the 2013 Stevenson Comprehensive Plan, and maintained by the Skamania County Assessor’s Office for their operations.

5.1 Land Ownership

Ownership trends are markedly different between the areas within Stevenson’s existing city limits and the urban expansion area (i.e., predesignated) considered in this report. Within the City’s jurisdiction, ownership is split, with 53.9% private and 46.1% public. However, in the urban expansion area, private ownership increases to 70.0%. Skamania County—holding 22.1% of all shoreline areas considered in this report—is the single largest public shorelines landowner for both city and county jurisdiction areas. The largest private landholding within the City belongs to the nonprofit Columbia Gorge Interpretive Center, which encompasses approximately 65.4 acres for the museum’s grounds and the waters of Rock Cove. The largest private landholding outside city limits is the approximately 70-acre site of the old Co-Ply plywood mill. Map 11 and Table 5.1-1 below present ownership type by jurisdiction within the City’s shoreline jurisdiction.

Table 5.1-1 – Existing Ownership by Jurisdiction

Ownership Type	City Jurisdiction		County Jurisdiction (Predesignated)		Combined		
	Acreage	Percent	Acreage	Percent	Acreage	Percent	
Public	Cemetery	0.6	0.6%	2.7	2.7%	3.3	1.6%
	City	8.7	8.2%	0.0	0.0%	8.7	4.2%
	County	28.2	26.8%	16.9	17.1%	45.1	22.1%
	Federal	-	-	0.5	0.5%	0.5	0.2%
	Port	8.2	7.8%	2.7	2.7%	10.9	5.3%
	State	2.9	2.7%	6.8	6.9%	9.7	4.7%
Private	56.9	53.9%	68.9	70.0%	125.8	61.7%	
Total	105.5	100%	98.4	100%	204.0	100%	

5.2 Land Use and Water Dependency

5.2.1 Future Land Use & Zoning

40 The existing land uses within the City’s shoreline jurisdiction are dominated by undeveloped lands which make up 33.7% of shoreline jurisdiction. As accounted for in the 2013 Stevenson Comprehensive Plan, the remaining land usage involves public uses—city, county, state, and federal uses—at 26.9%, tourism uses are 15.5%, 12.8% are single-family residential, 6.3% are timber related, 2.6% involve multi-family residential, 1.3% manufacturing, and only 0.8% are other types of commercial uses.

45 The 2013 Stevenson Comprehensive Plan also projects land usage in the City and urban expansion area, defining 4 broad categories of land use for low and high density/intensity residential and trade uses and an “Urban Reserve” category for lands that should be held for uses those categories but which cannot yet be developed until municipal services are available. These Future Land Use designations act as umbrellas for different categories of zoning districts. Table 5.2-1 provides the summary of these different
50 designations as they apply to the areas reviewed by this report.

5.2.2 Preferred and Water-Dependent Uses

Highest and best utilization of shoreline areas involves accommodating water-oriented uses while discouraging non-water-oriented uses.

Water-oriented uses include varying degrees of reliance on and connection to shorelines of the state.

- 55
- “Water-Dependent Use” means a use or portion of a use which cannot exist in a location that is not adjacent to the water and which is dependent on the water by reason of the intrinsic nature of its operations (WAC 173-26-020(39)).
 - “Water-Related Use” means a use or portion of a use which is not intrinsically dependent on a waterfront location but whose economic viability is dependent upon a waterfront location
60 because:
 - The use has a functional requirement for a waterfront location such as the arrival or shipment of materials by water or the need for large quantities of water; or

Table 5.2-1 – Future Land Use and Zoning Designations

Future Land Use Designation	City Jurisdiction		County Jurisdiction (Predesignated)		Combined	
	Acreage	Percent	Acreage	Percent	Acreage	Percent
Low Density Residential	26.7	0.6%	38.3	38.9%	65.0	31.9%
High Density Residential	11.5	8.2%	-	-	11.5	5.7%
Urban Reserve: High Density Residential	0.6	26.8%	-	-	0.6	0.3%
Low Intensity Trade	41.4	0.0	10.5	10.7%	51.9	25.4%
Urban Reserve: Low Intensity Trade	0.2	7.8%	25.0	25.4%	25.2	12.3%
High Intensity Trade	25.2	2.7%	-	-	25.2	12.3%
Urban Reserve: High Intensity Trade	-	-	24.7	25.1%	24.7	12.1%
Total	105.5	100%	98.4	100%	204.0	100%

Zoning Types	City Jurisdiction		County Jurisdiction (Predesignated)		Combined	
	Acreage	Percent	Acreage	Percent	Acreage	Percent
Low Density Residential Districts	30.2	28.6%	-	-	30.2	14.8%
High Density Residential Districts	14.2	13.4%	40.4	41.0%	54.5	26.7%
Public Districts	30.4	28.8%	-	-	30.4	14.9%
Low Intensity Trade Districts	10.5	9.9%	35.9	36.5%	46.4	22.8%
High Intensity Trade Districts	20.3	19.2%	22.1	22.5%	42.4	20.8%
Total	105.5	100%	98.4	100%	204.0	100%

- 65 – The use provides a necessary service supportive of the water-dependent uses and the proximity of the use to its customers makes its service less expensive and/or more convenient (WAC 173-26-020(43)).
- “Water-Enjoyment Use” means a recreational or other use that facilitates public access to the shoreline as a primary characteristic of the use, or a use that provides for recreational use or aesthetic enjoyment of the shoreline for a substantial number of people as a general characteristic of the use and which, through location, design, and operation, ensures the public’s ability to enjoy the physical and aesthetic qualities of the shoreline. In order to qualify as a water-enjoyment use, the use must be open to the public and the shoreline-oriented space within the project must be devoted to the specific aspects of the use that foster shoreline enjoyment (WAC 173-26-020(40)).
- 70
- 75

80 “Non-Water-Oriented Uses,” then, are uses that are not water-dependent, water-related, or water-
enjoyment, and might include baseball fields, doctor’s offices, vacuum repair shops, or box factories. Non-
water-oriented uses may be vital contributors to the local economy or provide important services for local
residents, but they are discouraged in shoreline areas because they do not rely on a shoreline location for
their operation.

85 As these definitions apply to Washington’s shorelines, a ferryboat dock would be considered a water-
dependent use, and the ticketing office and/or vehicle waiting areas would be considered water-related. A
dockside restaurant would be considered water-enjoyment, but a gas station for ferried vehicles or a
boardwalk souvenir shop would be a non-water-oriented use. In an industrial scenario, a harbor and crane
transferring raw materials or goods from truck to barge would be considered a water-dependent use. A
grain silo or warehouse storing the goods prior to transshipment would be a water-related use. A green
space providing visual access to the water would be a water-enjoyment use, but a warehouse or factory
for goods that are not shipped by water would be a non-water-oriented use.

90 In a Stevenson-specific scenario, the tour boat pier is considered a water-dependent use. A retail
operation selling or renting sail- or kiteboards is considered water-related, while the windsurfing or
kiteboarding launch site is considered a water-dependent use. A restaurant open to the public with a view
of the water would also be considered water-enjoyment, but a drive-through savings bank, even with a
similar view, would be a non-water-oriented use.

Table 5.2-2 – Existing Water-Oriented Uses

Land Areas (Excluding Water)				
Status	Preferred Use	Acreeage	% Developed Land	% Developed & Undeveloped Land
Developed Land	Water-Dependent	1.5	1.1%	0.7%
	Water-Related	0.3	0.3%	0.2%
	Water-Enjoyment	30.3	22.4%	14.9%
	Total Water-Oriented	32.1	23.8%	15.8%
	Single-Family	26.1	19.3%	12.8%
	Other Non-Water-Oriented	76.9	56.9%	37.7%
	Total Non-Water-Oriented	103.0	76.2%	50.5%
	<i>Subtotal</i>	135.2	100%	n/a
Undeveloped Land	<i>Subtotal</i>	68.8	n/a	33.7%
All Land	Total	204.0	100%	100%

95 Though preferred under the SMA, water-oriented uses are relatively absent along Stevenson’s shorelines.
The majority of developed lands are not developed with uses preferred by the SMA and 19.3% of
developed lands are used as single-family residences. This leaves only 23.8% of land used for water-
oriented purposes and a shocking 1.1% (1.5 acres) of all developed land in the shoreline jurisdiction
100 analyzed in this report is dependent on its shoreline location.

5.3 Projected Shoreline Use and Potential Use Conflicts

105 The SMA requires that jurisdictions analyze future demand for shoreline space and ensure that the uses are consistent with the SMA. The City's shoreline jurisdictional area includes an urban waterfront with intensive transportation and commercial uses, and so it is required to coordinate with DNR and Port authorities to ensure consistency with harbor area statutes and regulations as well as with port plans. The City must also identify measures and strategies to encourage appropriate use of these shoreline areas in accordance with the SMA and the Stevenson comprehensive plan, while also determining allowable uses, resolving potential use conflicts, and planning for the restoration of ecosystem-wide processes and shoreline ecological functions over time.

110 The Planning Director of the City of Stevenson provided information about several shoreline development opportunities and potential shoreline use conflicts within the City during a June 2, 2015 teleconference with BergerABAM staff. These development opportunities consider balanced development of industrial, commercial, residential, recreational, and other uses, while also aiming to incorporate solutions for shoreline protection and the preservation of ecological processes and functions. Table 5.3-1 Projected

115 Shoreline Uses and Potential Conflicts provides some information on the various shoreline development opportunities and potential conflicts within the City grouped by waterbody and reach. Projected shoreline uses and potential use conflicts are summarized below for all reaches within the City and predesignated areas, with the exceptions of Rock Creek Reach 2 and Ashes Lake, where no development opportunities were identified.

Table 5.3-1 – Projected Shoreline Uses and Potential Conflicts

Waterbody	Reach	Site	Existing Use	Potential Use Change/Conflicts	Public Access Opportunities
Columbia River	CR-1 (pre-designated)	Stevenson Cemetery	Non Water-Oriented, Cemetery	Limited potential for changes of use. Current use unlikely to conflict with adjacent parcels. Normal maintenance and repair of existing structures not anticipated to conflict with shoreline preferred uses.	Publicly-owned, potential for visual access improvements
	CR-1 (pre-designated)	Slaughterhouse Point (small bump-out in center of reach)	Undeveloped	Port has expressed a desire for possible water access/recreational use and/or habitat mitigation site for downtown Port development. Future development unlikely to conflict with adjacent parcels, but may conflict with SMA preference to protect and enhance ecological functions.	Publicly-owned, potential water-only access to picnic or camping area
	CR-1 (pre-designated)	Pebble Beach	Water-Dependent/ Enjoyment, recreation site	Port has had some discussion about providing improved or additional recreation. Presence of BNSF railroad creates potential use conflicts at this site, and development could conflict with shoreline protection and enhancement goals.	Publicly-owned, potential to expand/improve amenities
	CR-2	East Point Launch, Port Industrial Site	Water-Dependent/ Related, Non Water-Oriented, recreation site and industrial buildings	Water access at this area is a motorized boat launch and the main kiteboarding site. Port is permitted to restore the Columbia River shoreline in the western part of this site to extend the OHWM ~60' waterward. Use conflicts exist between recreational users and industrial users for parking spaces and traffic operations. A 1995 fatal flaw analysis identified this area for a possible marina. Expansion of existing cidery with restaurant and tasting room has been considered. This would add a preferred Water-Enjoyment use, but present potential conflicts related to parking and industrial traffic operations. Future development of this site could conflict with preference for protecting and enhancing shoreline ecological functions if the Columbia River restoration project is not completed.	Publicly-owned, potential for Water-Enjoyment business expansion, improvement of the trail and addition of recreational amenities

Table 5.3-1, Continued

Waterbody	Reach	Site	Existing Use	Potential Use Change/Conflicts	Public Access Opportunities
Columbia River	CR-2	Narrow, Port-owned outparcels	Water-Enjoyment/Related, Non Water-Oriented	Port has discussed redevelopment of this site and removal of the water-related maintenance building and vacant residence. Restaurant building likely to remain. Port is permitted to restore the Columbia River shoreline adjacent to this site, add a non-motorized physical access point, move the OHWM ~80' south and prevent active erosion which threatens the foundation of the restaurant building. Future development of this site could conflict with preference for protecting and enhancing ecological functions and could limit existing visual access to the shoreline from Cascade Avenue.	Publicly-owned, potential for Water-Oriented business expansion, improvement of the trail and addition of recreational amenities
	CR-2	Stevenson Landing	Water-Dependent/Enjoyment	Site is used as a park. Port would like to redevelop a portion of this for water-oriented businesses, and improve aesthetics of the pier at the landing. This site is the western terminus of the permitted restoration project and will move the OHWM waterward. Teo Park to the west of the landing is unlikely to change use. Conflicts (noise, wind shadow) with adjacent uses exist when tourboats are docked at Stevenson Landing. Future development could conflict with visual access from Cascade Avenue and the SMA preference for protection and enhancement of ecological functions.	Publicly-owned, potential for Water-Oriented business addition, improvement of the trail and addition of recreational amenities
	CR-2	Hotel site (12 units)	Water-Enjoyment	Based on assumed profitability, potential for redevelopment is low. Site is subject to easement for public trail along the shoreline which connects Stevenson Landing to Bob's Beach. Parking conflicts exist and may increase between this site and Bob's Beach.	Privately-owned, potential to improve trail surfacing in public easement

Table 5.3-1, Continued

Waterbody	Reach	Site	Existing Use	Potential Use Change/Conflicts	Public Access Opportunities
Columbia River	CR-2	Bob's Beach, Port Office	Water-Dependent/Related	<p>Site is the main windsurfing location. Change of use is unlikely, but Port has discussed adding amenities to the site, including expanded rigging areas, additional physical access, a bathroom and paved parking. Port has discussed demolishing and rebuilding on the site of an abandoned garage adjacent to a wetland and adding a deck to the office building as potential use for weddings.</p> <p>Parking conflicts exist and may increase between this site and the adjacent hotel. Some wind shadow conflicts are possible when a tourboat is docked at Stevenson Landing. Some conflicts may arise with residential properties west of this site.</p> <p>Future development could conflict with SMA preference for protecting and enhancing shoreline ecological functions.</p>	Publicly-owned, potential for new physical access at western edge of site, improvement and addition of recreational amenities
	CR-2	Residential Properties	Single-Family Residential, undeveloped	<p>Future Land Use and Zoning maps were recently changed to designate these properties as residential. Change in use is unlikely, though development of vacant sites is assumed. Sedimentation at the mouth of Rock Creek is changing the character and may lead to requests for changes of use</p> <p>Use conflicts may occur on the eastern edge of this site and with recreationalists on the water searching for a convenient respite site.</p> <p>Future development may conflict with ecological function preferences of the SMA and public visual access from Cascade Avenue.</p>	Privately-owned, potential to preserve visual access from Cascade Avenue. Unknown potential for physical access may develop based on sedimentation trends near Rock Creek

Table 5.3- 1, Continued

Waterbody	Reach	Site	Existing Use	Potential Use Change/Conflicts	Public Access Opportunities
Columbia River	CR-3 (predesignated)	Former industrial sites, including site of former Co-Ply mill	Non Water-Oriented, undeveloped, commercial (upland)	<p>Sites are zoned by county as industrial. Private owners may be interested in annexation if development requires water and/or sewer. Future Land Use map would permit either industrial or commercial City zoning.</p> <p>Potential future uses include industrial development and reestablishment of barge dock for shipment of goods. The western portion of the site contained the fewest barriers for development of a regional marina based on a 1995 study of the Oregon and Washington shorelines of the mid-Columbia River, but current owners have stated development of a marina is unlikely.</p> <p>Site access conflicts may develop with the BNSF railroad, but conflicts with other adjacent uses is unlikely. Future development may conflict with shoreline preferred uses, including protection and enhancement of ecological functions and water-orientation of uses.</p>	Privately-owned, nature and scope of access opportunities will depend on character of future development. Continuous public pedestrian access unlikely if developed for industry, however viewing areas or other forms of access can be incorporated if appropriate (safety concerns exist based on BNSF and if working industrial uses develop)
	RC-1	Trailer Park Site	Water-Dependent (abandoned), Non Water-Oriented	<p>This site involves the greatest likelihood for changes of use from the existing mobile home park (upland area) and abandoned barge dock. Owners have expressed a desire to sell the property for redevelopment. BNSF has expressed a desire to replace the bridge of Rock Creek at the southwestern edge of this site.</p> <p>Noise conflicts may occur between this site and the BNSF and SR 14 corridors, but conflicts with other adjacent uses is unlikely. Future development could conflict with water-orientation and ecological function preferences of the SMA.</p>	Privately-owned, potential for new physical access at abandoned barge dock and pedestrian trail access from/under SR 14 and/or BNSF line depending on current sedimentation trends from Rock Creek
Rock Creek					

Table 5.3-1, Continued

Waterbody	Reach	Site	Existing Use	Potential Use Change/Conflicts	Public Access Opportunities
Rock Creek	RC-1	Lower Rock Creek, east bank	Water-Enjoyment, Non Water-Oriented, undeveloped	<p>Development and change of use is highly likely. The Future Land Use designation of these properties is High Intensity Trade. Commercial development is expected on the undeveloped site. The County-owned site includes a pedestrian bridge over Rock Creek and non-water oriented utility uses which may be redeveloped for commercial purposes. This area also includes Rock Creek Drive bridge, which is scheduled for replacement by the City with a freespanning structure with greater freeboard.</p> <p>This area is subject to uncertainty regarding the location of the OHWM based on dredging and the placement of materials dredged after the 2007 Piper Road Landslide.</p> <p>Use conflicts may occur with neighboring residential properties and between vehicular and pedestrian traffic. Future development could conflict with preferred uses from the SMA, including protection and enhancement of ecological functions and water-orientation of uses.</p>	Publicly- and Privately-owned, opportunities exist to provide continuous pedestrian access along Rock Creek with a potential connection under SR 14. Expanded and new public amenities could be added near the bridges, including improved visual and physical access.
	RC-1	Rock Creek Drive Bridge Area, east bank	Single-Family Residential	<p>Change of use is likely for one abandoned, city-owned home, which could be used for transportation and/or stormwater management purposes, unlikely otherwise. Changes to traffic patterns present the most likely use for this area depending on the location for the replacement of Rock Creek Drive Bridge. Future development may conflict with the SMA preference to protect and enhance shoreline ecological functions.</p>	Publicly- and Privately-owned, opportunities exist to provide additional visual and physical access at city-owned residential
	RC-2 (predesignated)	Piper Road Landslide Area	Undeveloped	<p>Change of use unlikely. Use conflicts may occur based on sedimentation from landslide area or stormwater intrusion into unstable area from uplands.</p>	Publicly- and Privately-owned, limited potential for visual or physical access

Table 5.3-1, Continued

Waterbody	Reach	Site	Existing Use	Potential Use Change/Conflicts	Public Access Opportunities
Rock Creek	RC-2	Upper Rock Creek Falls	Undeveloped	Low-to-moderate likelihood of land use change. If changes occur, it could generate use conflicts between neighboring residences, the County Transfer Station on uplands, and shoreline preferred uses, especially if an overlook or picnic site is developed at Upper Rock Creek Falls. Site has a Future Land Use Designation as Urban Reserve High Intensity Trade, which would facilitate continued use of the Transfer Station and development of an industrial park adjacent to it.	Publicly- and Privately-owned, opportunities exist to provide public visual access to Upper Rock Creek Falls.
	RC-1 & 2	Upper Rock Creek, both banks	Single-Family Residential, cemetery, undeveloped	Residential subdivision and expanded single-family residential uses are likely. Use conflicts with adjacent properties may develop around the County Transfer Station and Upper Rock Creek Falls. Future development may conflict with the preference for to protect and enhance shoreline ecological functions.	Publicly- and Privately-owned, opportunities exist to provide additional visual and physical access at city right-of-way for Iman Cemetery Road
	RC-1	Angel Heights Conservation Area	Single-Family Residential, Undeveloped	Change of use and use conflicts are unlikely based on conservation covenant. Some development is possible to enhance the undeveloped park property owned by the homeowner's association.	Privately-owned, limited potential private visual access improvement
	RC-1	Food Bank Building	Non Water-Oriented	County has considered selling property for reuse or redevelopment. Use conflicts may occur depending on traffic pattern changes for replacement of Rock Creek Drive bridge.	Publicly-owned, potential for improved physical & visual access
	RC-1	City Wastewater Treatment Plant	Water-Related	Expansion of treatment works expected without change of use. Use conflicts likely based on odors and other aesthetics. Traffic operations for waste hauling may conflict with neighboring Fairgrounds operations. Other repair of existing structures is not anticipated to conflict with shoreline preferred uses	Publicly-owned, potential for new physical access, enhancement of pedestrian amenities and visual access

Table 5.3-1, Continued

Waterbody	Reach	Site	Existing Use	Potential Use Change/Conflicts	Public Access Opportunities
Rock Cove & Rock Creek	RC-2, Rock Cove	Skamania County Fairgrounds	Water-Dependent/ Enjoyment, Non Water-Oriented	Low likelihood of land use change. Site may possibly accommodate water-oriented shoreline recreational expansion. Use conflicts are limited but may be affected by noises, odors, and traffic from adjacent transportation and utility uses by the City, state, and railroad.	Publicly-owned, opportunities exist to resurface the trail and enhance recreational amenities and non-motorized physical access to the shoreline
		Old Hegewald Mill Site	Undeveloped	County is actively working to sell this property for redevelopment through a possible public-private partnership. Public visioning performed by the County indicated a preference for water-oriented business along with public access improvements. Phase I and II environmental site assessments have been performed and indicate clean-up of contaminants is unnecessary. Use conflicts with adjacent properties are unlikely, but future development may conflict with SMA preferences for to protect and enhance shoreline ecological functions.	Publicly-owned, potential to develop a trail within the existing easement, enhance physical access and develop Water-Oriented businesses with provide additional visual and physical access
		Assisted Living Facility	Non Water-Oriented	Site is unlikely to redevelop. There is an existing easement along the water and the southern edge of the site,. The owner identifies construction of a pathway in the easement as conflicting with the safety of the facility's infirm residents. Use conflicts are unlikely and repair of existing structures is not anticipated to conflict with shoreline preferred uses	Publicly-owned, potential to develop a trail within the existing easement and/or enhance visual access on south side of site
Ashes Lake		Interpretive Center	Water-Enjoyment, Non Water-Oriented	Site is open to expanding recreational uses on property, including concessionaire for watercraft rentals. Owner is seeking access directly to SR 14. Use conflicts unlikely.	Publicly-owned, potential for improved physical & visual access
		Ash Lake Road, SR 14	Non Water-Oriented	Use changes and conflicts unlikely.	Publicly-owned, route for Trail of the Gods

6.0 Shoreline Environment Designations

This section is an overview of shoreline environment designations in accordance with Ecology guidelines (WAC 173-26-211). The Ecology guidelines state that master programs must contain a system that classifies shoreline areas into specific designations that take into account existing land use, the biological and physical character of the shoreline, and the goals and aspirations of the community. The shoreline environment designations should be assigned in such a way that existing shoreline ecological functions are protected (i.e., no net loss) with the proposed patterns and intensity of development and should be consistent with policies for restoration of degraded shorelines and the local comprehensive plan. The six shoreline environmental designations developed by Ecology are listed here in order from most restrictive to least restrictive:

- Aquatic;
- Natural;
- Rural conservancy;
- Shoreline residential
- Urban conservancy; and
- High intensity.

These WAC designations are different from what is currently in effect in the City and County. In order to comply with Washington requirements, the City will need to update its shoreline environment designations to be consistent with WAC 173-26-211. The six environment designations are described below.

Aquatic

The purpose of the “aquatic” designation is to protect, restore, and manage the unique characteristics and resources of the areas waterward of the ordinary high-water mark. Uses may include new over-water structures only for water dependent uses, public access, or ecological restoration. The multiple, shared use of over-water facilities should be encouraged in order to reduce the impacts of shoreline development and increase effective use of water resources. All developments and uses on navigable waters or their beds should be located and designed to minimize interference with surface navigation, to consider impacts to public views, and to allow for the safe, unobstructed passage of fish and wildlife, particularly those species dependent on migration. Uses that adversely impact the ecological function of freshwater habitats should not be allowed, except when necessary to achieve the objectives of RCW 90.58.020, and if their impacts are mitigated according to WAC 173-26-201.

Natural

The purpose of the “natural” environment designation is to protect shoreline areas that are intact or minimally degraded and are relatively free of human influence. Only very low intensity uses will be allowed in order to maintain ecological functions and ecosystem-wide processes. The management policies for this designation would restrict any use that would substantially degrade the ecological functions or natural character of the shoreline area such as commercial, industrial, non-water oriented recreation, roads, utility corridors, parking areas, significant vegetation removal, or shoreline modification. The following uses may be allowed if they are consistent with the purpose of this environmental designation:

- Commercial forestry that meets the conditions of the State Forest Practices Act

- Agricultural uses of a very low intensity
- Some single-family residential development with a density and intensity that are limited as necessary to protect ecological functions
- 45 • Scientific, historical, cultural, educational research uses, and low-intensity water-oriented recreational access uses.

Rural Conservancy

The purpose of the "rural conservancy" designation is intended for areas outside of cities and their urban growth areas and protects ecological functions, conserves existing natural resources and valuable historic and cultural areas in order to provide for sustained resource use, achieve natural floodplain processes, and provide recreational opportunities. This environment designation is not appropriate for locations within cities or urban growth areas.

Shoreline Residential

The purpose of the "shoreline residential" designation is to accommodate residential development, appurtenant structures, and appropriate public access and recreational uses that are consistent with maintaining ecological functions and ecosystem-wide processes. Local governments may establish two or more different "shoreline residential" environments to accommodate different shoreline densities or conditions. Multi-family and multi-lot residential and recreational developments should provide public access and joint use for community recreational facilities. Access, utilities, and public services should be available and adequate to serve existing needs and/or planned future development. Commercial development should be limited to water-oriented uses.

Urban Conservancy

The purpose of the "urban conservancy" designation is to protect and restore ecological functions of open space, floodplain, and other sensitive lands where they exist in urban and developed settings while allowing a variety of compatible uses. Potential uses should preserve the natural character of the area or promote the preservation of open space, floodplain, or sensitive lands directly or over the long term. Uses that result in the restoration of ecological functions should be allowed if the use is otherwise compatible with the purpose of the environment and the setting. Public access and public recreation objectives should be implemented whenever feasible and significant ecological impacts can be mitigated. Water-oriented uses should be given priority over non-water-oriented uses. For shoreline areas adjacent to commercially navigable waters, water-dependent uses should be given highest priority. Mining and related activities may be an appropriate use within the urban conservancy environment when conducted in a manner consistent with the environment policies and the provisions of WAC 173-26-241 (3)(h), RCW 36.70A.170, and WAC 365-190-070.

High Intensity

The purpose of the "high-intensity" environment is to allow high-intensity water-oriented commercial, transportation, and industrial uses while protecting existing ecological functions and restoring ecological functions in previously degraded areas. First priority should be given to water-dependent uses, while second priority should be given to water-related and water-enjoyment uses. Non-water-oriented uses should not be allowed except as part of mixed-use developments or in limited situations where they do not conflict with or limit opportunities for water-oriented uses or where there is no direct access to the shoreline. Full utilization of existing urban areas should be achieved before further expansion of intensive

development is allowed. Consideration should be given to the potential for displacement of non-water-oriented with water-oriented uses when analyzing full utilization of urban waterfronts. Where feasible, visual and physical public access should be required. Aesthetic objectives should be implemented by means such as sign control regulations, appropriate development siting, screening and architectural standards, and maintenance of natural vegetative buffers.

6.1 Recommended Shoreline Environmental Designations

Using the shoreline environment designations defined by the Ecology guidelines (WAC 173-26-211), preliminary shoreline environment designations were developed for each shoreline reach within the City and pre-designated for the two reaches within Skamania County. The City's original shorelines management master program (1973) does not include pre-designated areas and designates only urban, conservancy, and natural shoreline environments.

The preliminary recommendations for reaches in the City are shown in Table 6.0-1 – Reach Summary and Recommended Shoreline Environment Designations

In cases where multiple shoreline environment designations are recommended for a given shoreline reach, the table shows specifications for each designation. The recommendations take into account the existing land use(s), the biological and physical characteristics of the shoreline, the existing shoreline environment designations, and the goals and aspirations of the City. The attributes that were considered included the following:

- Existing Land Use: percent land use type by reach
- Future Land Use: percent future land use designation by reach (composite rating based on ICR Chapter 4)
- Zoning: percent zoning type by reach
- Ecological Functions: overall performance by reach
- Existing Shoreline Environment Designation: City of Stevenson, 1973

In general, water areas were designated as "Aquatic", areas subject to active landslides and conservation covenants as "Natural", residential areas as "shoreline residential," and commercial or industrial use areas as "Urban Conservancy" or "High Intensity". The "Rural Conservancy" shoreline environment designation was avoided as inapplicable within city limits and urban growth areas.

Further consideration and refinement of these preliminary recommendations will be part of the ongoing SMP update process as a draft SMP and maps are prepared, reviewed, and revised as necessary. As part of this iterative process, the City may opt to create one or more locally-tailored SEDs to reflect unique circumstances, as consistent with the SMA and WAC.

Table 6.0-1 – Reach Summary and Recommended Shoreline Environment Designations

Waterbody	Reach	Factors Used to Recommend Designations					Recommended Shoreline Environment Designations
		Existing Land Use	Future Land Use	Existing Zoning	Ecological Functions	1973 Shoreline Environment Designation	
Columbia River	CR-1 East Urban Area (pre-designated)	Public, Residential	LIT, LDR	CCO	Poor (Very Poor to Good)	Urban	Shoreline Residential (residential areas), Urban Conservancy (all other areas)
	CR-2 Downtown Stevenson	Public, Commercial,	HIT, LIT, HDR	CO, ID, R3	Very Poor (Very Poor to Good)	Urban	High Intensity (CO & ID areas), Shoreline Residential (R3 areas)
	CR-3 West Urban Area (pre-designated)	Public, Commercial, Undeveloped, Resource	LIT, HIT	ID, CR	Very Poor (Very Poor to Poor)	Urban	High Intensity (ID areas), Urban Conservancy (all other areas)
Rock Creek	RC-1 Lower Rock Creek & Upper w/i city	Public, Residential, Undeveloped	LDR, HIT, LIT	PR, SR, R3, CO	Poor (Very Poor to Fair)	Natural, Conservancy, Urban	High Intensity (CO & PR areas), Natural (conservation covenant & hazard areas) Shoreline Residential (all other areas)
	RC-2 Upper Rock Creek w/i county (pre-designated)	Undeveloped, Residential, Public	LDR, HIT	R1	Excellent (Fair to Excellent)	Natural, Conservancy	Natural (Hazard areas), Shoreline Residential (all other areas)
Rock Cove		Commercial, Undeveloped, Public	LIT	PR, CR, SR, R3	Good (Poor to Good)	Urban	High Intensity (CR areas), Shoreline Residential (R3 areas), Natural (islands)
Ashes Lake		Undeveloped, Resource	LIT	CR, ID	Very Poor (Very Poor to Good)	Conservancy	Urban Conservancy
Key:		Future Land Use		Existing Zoning			
	LDR-Low Density Residential	HDR-High Density Residential		SR-Suburban Residential		R1-Single-Family Residential	
	LIT-Low Intensity Trade	HIT-High Intensity Trade		PR-Public Use & Recreation		CCO-Community Commercial	
				CR-Commercial Recreation		CO-Commercial	
				ID-Manufacturing			

7.0 References

To keep this Inventory and Characterization report readable and accessible to broad audiences, the authors avoided providing specific citations within the text unless a passage was quoted or a figure used to illustrate a concept. However, WAC requirements necessitate a complete list of resources used to develop this report. This bibliography provides that list and is organized to correspond with the sections of the report that were informed by each source.

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A.0 Glossary of Terms

As used in this report, the words and acronyms below have the meaning given here unless the context clearly dictates otherwise. When words or phrases are not specifically defined below, they shall be interpreted so as to give them the meaning they have in common usage and to give this report its most reasonable interpretation and application.

A.1 Abbreviations and Acronyms

- BPA** – Bonneville Power Administration
- cfs** – cubic feet per second
- City** – City of Stevenson
- County** – Skamania County
- CWA** – Clean Water Act
- DNR** – Washington State Department of Natural Resources
- Ecology** – Washington State Department of Ecology
- EPA** – Environmental Protection Agency
- ESA** – Endangered Species Act
- FEMA** – Federal Emergency Management Agency
- FIRM** – Flood Insurance Rate Maps
- GMA** – Growth Management Act
- LWM** – Large Woody Material
- MS4s** – municipal separate storm sewer systems
- NMFS** – National Marine Fisheries Service
- NSA** – National Scenic Area
- NWI** – National Wetland Inventory
- NPDES** – National Pollutant Discharge Elimination System
- OHWM** – ordinary high water mark
- PCE** – primary constituent element
- PHS** – Priority Habitats and Species
- RCW** – Revised Code of Washington
- SMA** – Shoreline Management Act
- SMP** – Shoreline Management Program
- USACE** – U.S. Army Corps of Engineers
- USFWS** – U.S. Fish and Wildlife Service
- USGS** – U.S. Geological Survey
- WAC** – Washington Administrative Code
- WRIA** – Water Resource Inventory Area

A.2 Words and Phrases

Allotchnous Inputs—The organic matter (large woody material, leaf litter, and insects) and nutrients that are imported to the aquatic ecosystem from terrestrial sources.

Cumulative Impact—The impact on the environment that results from the incremental impact of a development or use of a shoreline area when added to impacts from other past, present, and reasonably foreseeable developments and uses of that shoreline area. For the purposes of Stevenson’s Shoreline Management Program, cumulative impacts do not include impacts from development and uses outside of shoreline jurisdiction.

Lacustrine Wetland—A wetland or deepwater habitat with all of the following characteristics: 1) situated in a topographic depression or a dammed river channel; 2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and 3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling less than 8 ha are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet) at low water. Lacustrine waters may be tidal or nontidal, but oceanderived salinity is always less than 0.5 ‰. Lacustrine wetlands include Limnetic (deepwater) and Littoral (nearshore) subsystems.

Liquefaction— A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.

Palustrine Wetland—All nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ‰. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m at low water; and (4) salinity due to ocean-derived salts less than 0.5 ‰.

Shoreline Environment Designation—Analogous to zoning districts in a conventional zoning ordinance, shoreline environment designations divide shoreline jurisdiction into distinct areas where different sets of allowable use provisions, environmental protection measures, and different development standards apply,

B.0 Interrelated Comprehensive Plan Policies

As the City's primary advisory planning document, the comprehensive plan serves as an "umbrella plan" for further planning endeavors, including the SMP. This appendix catalogues the statements, policies, objectives, and tactics of the 2013 Stevenson Comprehensive Plan in an effort to ensure that the comprehensive plan and its update provide consistent direction for the use of land within Stevenson. This catalogue includes only direct references to shorelines and waterfronts in Stevenson and should not be taken as a substitute for the full plan or its general policy statements.

B.1 Explanatory Statements

The first two chapters of the comprehensive plan contain the following statements related to the SMP. At the conclusion of the SMP update, some of these statements may need to be amended as anticipated in Recommendation 1-4 of this report.

B.1.1 Chapter 1

Page 1

Vision Statement. "Stevenson is a friendly, welcoming community that values excellent schools and a small town atmosphere. The natural beauty is enjoyed by residents and visitors through a network of recreational opportunities. The strength of Stevenson's economy is built upon high quality infrastructure and a vibrant downtown that provides for resident's daily needs. Stevenson takes advantage of our unique location on the Columbia River by balancing jobs, commerce, housing, and recreation along the waterfront."

Page 3

Cornerstone Principle. "Active Waterfront represents Stevenson's utilization of its waterfront assets. This includes use, restoration, and harmonization of the wide-ranging economic, scenic, recreational, ecological, and residential resource potentials of the Columbia River, Rock Cove, and Rock Creek areas."

B.1.2 Chapter 2

Pages 7-8

Area Plans. "Area Plans include goals and objectives for those areas that are not specifically addressed in detail in the current comprehensive plan. For this reason area plans can also be viewed as 'supplements' to the existing comprehensive plan. With Stevenson's 2013 comprehensive plan, the 1975 Skamania County Shoreline Management [Master] Program is folded into the Comprehensive Plan and will no longer be used as a stand-alone document."

B.2 Goals, Objectives, and Tactics

The third chapter of the comprehensive plan contains the following aspirations and action items related to the SMP. In order to help prioritize actions, each objective highlights which of the plan's four cornerstone principles it advances. All objectives and tactics related to Active Waterfront are listed below. At the conclusion of the SMP update, some of these statements may need to be amended as anticipated in Recommendation 1-4 of this report.

B.2.1 Goal 1 – Community and Schools

Page 14

"1.3 - Ensure that the monitoring reports contained in Appendix D are submitted to the Council annually prior to budget adoption."

"1.4 - Develop a high level of coordination among all levels of government"

"1.5 - Ensure that the plans and actions related to land use by special districts, County, State, and federal agencies are consistent with the Stevenson Comprehensive Plan."

Page 15

"1.11 - Support the Columbia Gorge Interpretive Center, especially in their educational and children's programming efforts."

"1.12 - Develop and enhance cultural opportunities."

"1.12-1 - Facilitate and support development of a bricks-and-mortar performing arts center."

"1.12-2 - Develop a public art plan."

"1.12-3 - Install public art in key locations throughout the City, especially along the Columbia River waterfront."

"1.12-4 - Install interpretive signs in key locations through the City, especially highlighting Stevenson's unique relationship with the Columbia River."

Page 16

"1.17 - Provide a clean, visually attractive community."

"1.17-1 - Facilitate and support activities to beautify the community, such as a Community Beautification Day."

"1.17-2 - Establish a high enforcement area for nuisances in highly visited areas of the city, such as along Second and First streets, Cascade Avenue, and Rock Creek Drive."

"1.17-3 - Establish strategies to reduce noise and light pollution."

B.2.2 Goal 2 – Urban Development

Page 18

"2.2 - Preserve, protect, and enhance the functions and values of ecologically sensitive areas (habitat areas, wetlands) with special consideration given to anadromous fisheries, as required by the Growth Management Act."

"2.2-1 - Regulate land use within and adjacent to ecologically sensitive areas while allowing for the reasonable use of private property."

"2.2-2 - Consider establishing a funding source to acquire ecologically sensitive areas."

"2.2-3 - Conduct an Urban Area-wide inventory of ecologically sensitive areas."

"2.2-4 - Encourage agreements that will preserve ecologically sensitive areas in appropriate proportions consistent with available resources. Provision of such open spaces should not reduce the density which can be achieved on the site."

"2.2-5 - Establish a stream corridor management plan and program."

"2.2-6 - Consider stream corridors for multiple use in conformance with other plans."

"2.2-7 - Regulate the use of fill in stream corridors."

"Maintain stream corridors in a natural state, preserving tree lines and vegetation wherever possible."

Page 20

"2.7 - Periodically review and revise the Future Land Use and Zoning maps to accommodate changes in community needs."

"2.7-1 - Consider designating areas not served by the public sewer and/or water systems as an "urban reserve" until such systems are made available."

"2.7-2 - Balance the availability of sufficient land for various uses when designating Future Land Use and Zoning districts."

"2.7-3 - Consider infill potential when designating Future Land Use and Zoning districts, especially with regard to multi-family housing."

"2.7-4 - Consider redesignating lands currently designated for industrial use which are unlikely or undesirable to be developed for such uses."

"2.7-5 - Consider location and suitability of land for urban uses and established need when designating Future Land Uses and Zoning districts."

"2.8- Establish policies to review annexation proposals."

"2.8-1 - Prefer annexation of developed areas abutting the city."

Page 21

"2.9 - Encourage the establishment of a subarea plan and land use regulations within the unincorporated Urban Area."

"2.9-1 - Encourage maintaining existing forest and farm uses within the unincorporated Urban Area."

"2.9-2 - Discourage development within the unincorporated Urban Area until suitable land within the City has been developed."

"2.9-3 - Ensure the highest and best use of riverfront properties within the unincorporated Urban Area by protecting them from development and redevelopment until urban utilities and services can be provided."

"2.13 - Establish standards for urban development that encourages mixtures of land uses and intensities."

"2.13-1 - Consider establishing incentives and/or special standards for infill projects."

B.2.3 Goal 4 – Downtown and Waterfront

Page 27

"The waterfront is an extension of the downtown core and a place where people live, work, and play."

The Columbia River, Rock Creek, and Rock Cove waterfronts are key components to improving the look and function of downtown Stevenson and are acknowledged here as a Sub-Goal. The availability of land on Stevenson's Columbia River waterfront is unique within the Gorge where railroads and highways either form barriers to waterfront property access or are the waterfront property owners themselves. The scenic assets of Rock Creek and Rock Cove add additional growth potential for development and redevelopment on their abutting lands. This growth, development, and change can be managed to benefit current and future residents and visitors. The Objectives and Tactics selected to achieve this Goal and Sub-Goal focus on developing Area Plans, improving the appeal of the area through public and private activities, and ensuring the functionality of the area through property infrastructure and uses."

Page 28

"4.2 - Periodically review and revise the downtown commercial area boundary, basing the location, type and amount of commercial activity on community need."

"4.2-1 - Ensure the commercial area boundary encourages compactness and is pedestrian-oriented."

Page 29

"4.10 - Provide better connections between downtown and the waterfront."

"4.10-1 - Consider converting Russell Street into a pedestrian mall between Second and First streets."

"4.10-2 - Consider improving sidewalks and street crossings and installing public art and seating areas on Russell Street from downtown to the waterfront."

"4.11 - Consider establishing a Parking and Business Improvement Area to support downtown improvements, such as a rehabilitation grant or loan program for downtown buildings or provision of visitor amenities."

"4A.1 - Support development of improved river access in the Stevenson area."

"4A.1-1 - Improve waterfront access and control erosion through coordinated stabilization programs."

Page 30

"4A.2 - Establish a Shorelines Master Program to guide the balanced development of industrial, commercial, residential, recreational, and natural uses."

"4A.2-1 - Encourage the use of the riverfront for commercial, residential, recreation, and open space purposes consistent with the Shorelines Management Act."

"4A.2-2 - Protect, enhance, and maintain the natural, scenic, historic, architectural, and recreational qualities along the River."

"4A.2-3 - Support recreational activities on the public lands and waters of the Columbia River, Rock Cove, and Rock Creek."

"4A.3 - Manage lands abutting the Columbia River and Rock Creek for the benefit of the community."

"4A.3-1 - Review all proposals for shoreline use for compatibility with the goals and policies of the Skamania County Shoreline Management Master Program."

"4A.3-2 - Review development proposals located on or near banks and floodway of the River and creeks to maintain the recreation and open space potential while promoting healthy and visually attractive environments."

"4A.3-3 - Review land use policies to ensure compliance with the Shorelines Management Master Program."

"4A.4 - Reduce impediments to attracting waterfront investors."

"4A.4-1 - Enhance Cascade Avenue as the main waterfront street."

"4A.4-2 - Use various marketing techniques to attract waterfront investors, such as a "Come on in, the water's fine" slogan.

Page 31

"4A.5 - Consider repurposing the Tichenor Building for retail and lodging purposes."

"4A.6 - Encourage development of a landscaping plan for the fairgrounds."

"4A.7 - Support development of a large waterfront gathering place, such as a[n] amphitheater for community events."

B.2.4 Goal 6 – Tourism

Page 38

"6.3 - Facilitate and encourage Stevenson to become the year-round recreation and tourist destination center of the County and Central Gorge."

"6.3-1 - Provide visitor amenities such as long-term parking and restrooms."

"6.3-2 - Facilitate and encourage visitor amenities such as affordable and upscale overnight lodging (campsites, yurts, youth and adult hostels, boutique hotels, etc.), convention centers, a marina, and visitor oriented shops."

"6.3-3 - Facilitate and encourage visitor-oriented businesses such as kayak and bike rentals and guided activities."

"6.3-4 - Facilitate and support hospitality training as an economic benefit."

"6.4 - Encourage cross-promotion of visitor-oriented businesses and services."

"6.4-1 - Support establishment of incentive for tour boats that visit Stevenson's visitor attractions such as the Columbia Gorge Interpretive Center."

"6.6 - Provide access from the waterfront to other parts of town via safe, attractive, and convenient walkways."

Page 39

"6.8 - Establish a quiet zone at railroad crossings within the city."

B.2.5 Goal 7 – Transportation and Circulation

Page 41

"Multi-modal transportation options provide people and goods with safe, efficient, and convenient options."

"...Stevenson's existing transportation and circulation system has shifted modes and focuses over its long history.

The original plat of Stevenson was a gridiron pattern that enabled easy internal circulation for pedestrian and horse traffic and focused on the Columbia River and Stevenson Landing as the primary mode of external transportation.

When the railroad came through town, the focus shifted from the river uphill to where the rail line met dirt streets and boardwalks. As automobile use grew and the city expanded away from its riverside terrace, this gridiron

pattern had to be altered to accommodate the steep Gorge slopes, the many creekside canyons and ravines

cutting through these slopes, and the existing oddly intersecting logging roads on the then-periphery. With the

continued dominance of the automobile, the focus again shifted uphill to the new paved state highway, cul-de-sacs and dead-ends became commonplace methods for dealing with the creekside ravines and canyons, and sidewalks waned in importance.”

Page 43

“7.6 - Reduce the effects of through traffic in the downtown commercial area while minimizing any negative impact on local businesses.”

“7.6-1 - Manage road construction projects to minimize construction-related impacts on local businesses.”

“7.6-2 - Facilitate and encourage alternative routing and/or usage of Highway 14 by truck traffic.”

“7.9 - Establish a quiet zone at railroad crossings within the city.”

“7.10 - Facilitate and support rail service for future transportation and commerce needs.”

“7.11 -Manage on-street parking to permit the safe and efficient operation of the transportation system.”

“7.13 - Provide wayfinding signage to aid traveler navigation and guide visitors to Stevenson attractions and amenities, especially east- and west-bound travelers on I-84.”

B.2.6 Goal 8 – Utilities and Services

Page 46

“8.3 - Periodically review and revise the capital facilities plan.”

“8.4 - Identify and correct health and safety hazards within the Stevenson Urban Area.”

“8.8 - Base the provision for future public facilities and utilities upon financial cost and adequacy of desired levels of service.”

“8.8-1 - Consider providing public facilities and utilities in advance of need.”

“8.8-2 - Coordinate urban development with private utility agencies to ensure the availability of services when needed.”

“8.8-3- Continue to provide water and sewer services within the Urban Area.”

B.2.7 Goal 9 – Parks and Recreation

Page 49

“As a Gorge town, some of the country’s premier hiking, hunting, mountain climbing, fishing, kayaking, and wind sports surround Stevenson on all sides. Many residents enjoy these activities, and many more visitors are drawn to the area for these relatively solitary activities. Inside Stevenson, a different, more gregarious variety of recreational opportunities exists, including festivals, fairs, and organized or pick-up sporting events. Balancing and connecting these gregarious and solitary varieties of recreation are of special importance to Stevenson. The Objectives and Tactics of this Goal seek to do so by ensuring the facilities we already have are properly maintained, that new lands, facilities, and funding are available, and that trails or pathways are developed as part of the park system.”

Page 50

“9.2 - Preserve open space and recreational resources.”

“9.2-1 - Establish cooperative agreements to ensure that recreation and open space lands and facilities will be provided.”

“9.2-2 - Establish cooperative agreements to ensure that recreation and open space lands and facilities will be provided.”

“9.2-3 - Encourage private enterprise and intergovernmental agreements that will provide open space for recreational lands and facilities. Provision of such open spaces should not reduce the density which can be achieved on the site.”

“9.3 - Maintain parks and recreational lands and facilities.”

“9.4 - Consider establishing a permanent funding source for the acquisition, development, and maintenance of park and recreation lands and facilities.”

"9.5 - Develop a pathways and trails plan to highlight Stevenson's recreational, historical, and commercial sites."

"9.5-1 - Consider using stream corridors as part of a parkway or greenway concept."

"9.5-2 - Include connections among the parks and trails of the City, its partner agencies, and private entities."

"9.5-3 - Include nature walks, scenic vistas, and connections to forests in the plan."

Page 51

"9.6 - Provide pathways and trails that highlight Stevenson's recreational, historical, and commercial sites."

"9.6-1 - Use stream corridors as part of a parkway or greenway concept."

"9.6-2 - Connect the parks and trails of the City, its partner agencies, and private entities."

"9.6-3 - Include nature walks, scenic vistas, and connections to forests in the system of pathways."

"9.7 - Develop a balanced system of recreation facilities, lands and programs that meets the recreation needs of residents and visitors alike."

"9.7-1- Develop small parcels of land resulting from urbanization as mini-parks or landscaped areas."

"9.7-2 - Facilitate and encourage the installation of lights and other improvements at the Hegewald Skateboard Park."

"9.7-3 - Facilitate and support the development of major community recreation facilities for citizens, such as expanding the pool activity center, providing covered pavilion spaces, developing a youth center, and other spaces for recreation, physical fitness, and wellness classes."

"9.8 - Promote Stevenson's recreational opportunities through media such as websites, brochures, and signage."

"9.9 - Protect Rock Cove to improve habitat, water quality and ambiance."

Page 52

"9.10 - Facilitate and support appropriate development and services for the Rock Creek and Rock Cove lands."

"9.10-1 - Facilitate and encourage recreational activities in the Rock Creek and Rock Cove area, such as access for small watercraft."

"9.10-2 - Encourage relocation of the County shops at Rock Creek."

"9.10.3 - Encourage rehabilitation and/or repurposing of the Grange."

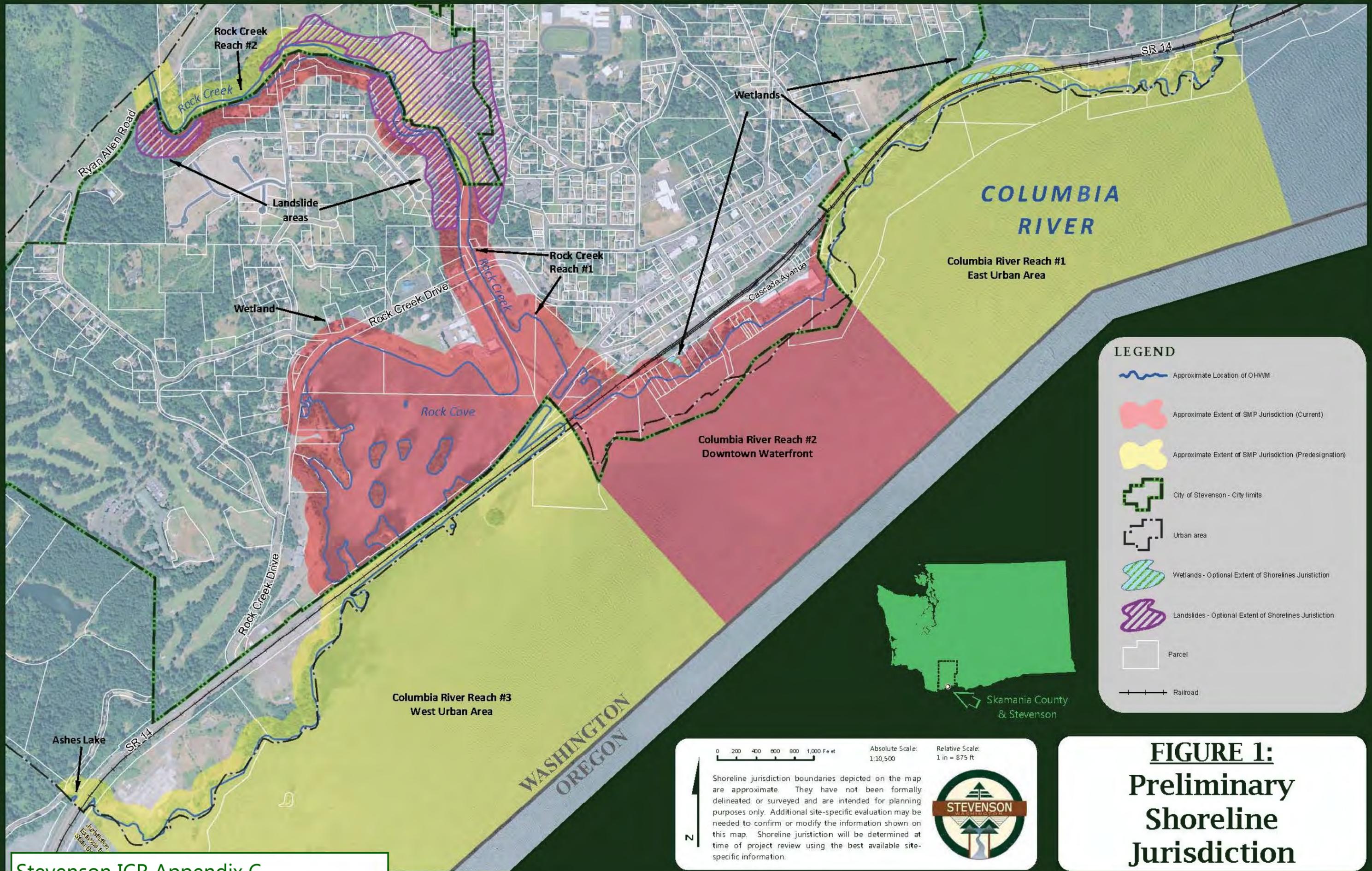
"9.10-4 - Facilitate and encourage enhancement of Rock Cove's habitat, water quality, and ambiance."

Appendix C Map Portfolio

This appendix includes the following figures:

Reach-scale Attribute	Description	Map Number
Preliminary Shoreline Jurisdiction	Approximate extent of SMP jurisdiction (current), approximate extent of SMP jurisdiction (predesignation), approximate extent of landslide hazard areas considered for optional jurisdiction.	1
Physical Environment		
Land Cover	USGS gap analysis program (GAP) data showing forested, shrub-covered, grass-covered, non-vegetated, and water areas. Includes tabular summary of vegetation/land cover.	2
Soil	USGS Soil Survey Geographic Database (SSURGO) and US Forest Service data.	3
Contours	LiDAR-derived 10- and 100-foot contours provided by Skamania County GIS.	4
Liquefaction Hazards	Displays hazard categories for land movement during earthquakes.	5
Geologic Hazards	Stevenson Critical Areas Hazard Map showing potentially unstable slopes, landslide hazard areas, scarps, and unstable soils. Includes memo from PBS Engineering, 2007.	5A
Floodplains	FEMA FIRM, Zone A on Map 530161 A, Panels 01-02 (Red) and Map 530160, Panel 425 (Yellow).	6
Channel Migration Zones	Department of Ecology Map and coarse-scale analysis of likely Channel Migration Zones (CMZs) in Skamania County. Includes memo.	6A
Flowage Easements	Based on County easements records and shows vertical elevation of all flowage easements maintained by the Corps of Engineers for the Bonneville Dam Project.	6B
Biological Resources		
PHS Data	WDFW Priority Habitat and Species (PHS) Wildlife GIS data. Includes species list by reach.	7
Wetlands	USFWS National Wetlands Inventory and Stevenson Critical Areas Wetland Map showing potential wetlands as identified by JD White and Associates in 2007. Includes acreage of wetlands.	8
Land Use & Altered Conditions		
Existing Land Use	County parcel data using Department of Revenue (DOR) codes (derived and categorized from Skamania County Assessor's database).	9
Future Land Use	Map from 2013 Stevenson Comprehensive Plan designating areas for different types of residential and trade uses.	9A
Zoning	Map developed by Skamania County GIS using County and City maps.	10
Archeology/Historic Resources	Washington State Department of Archaeology and Historic Preservation (DAHP), includes publicly available information, excludes sensitive information.	14
Public Access		
Public Ownership	Public land includes all land owned by federal, state, or local government agencies. "Rights-of-way" were not classified as "Public". Areas not covered by parcel dataset (i.e., large portion of the Columbia River) were classified as "Public". Data for length and area in public ownership included and specific recreation areas also noted.	11
Restoration Opportunities		
Impervious Surfaces	County data was used to calculate impervious area (square feet) and linear distance of impervious surface (feet). Includes tabular data for impervious surface types.	12
Rooftops	County data on rooftops within shoreline area and measuring rooftop distance to OHWM. Includes tabular data for building number and size.	13
Shoreline Modifications	Aerial photo-derived data by Skamania County GIS. Includes tabular data on armoring length, island dimensions, and size of docks/piers.	15
Fish Passage Barriers	WDFW Fish Passage and Diversion Screening Inventory Database. Includes reports for identified barriers.	16







Quantities by type*:

Type	Acres	% of Total
Forest	89.7	43.9%
Shrub	25.0	12.3%
Grass	39.5	19.4%
NonVeg	49.8	24.4%
Total:	204.0	100.0%

* Water area is not included in the above quantities and percentages. The total acreage of water in the preliminary jurisdiction area is 858.2 acres, which is 80.8% of the total area.

Heritage tree note:
A review of WA Natural Heritage Program public GIS data (Feb, 2015) did not indicate the presence of any heritage species in the shoreline jurisdiction area.



0 200 400 600 800 1,000 Feet

Absolute Scale: 1:10,500 Relative Scale: 1 in = 875 ft

Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.

LEGEND

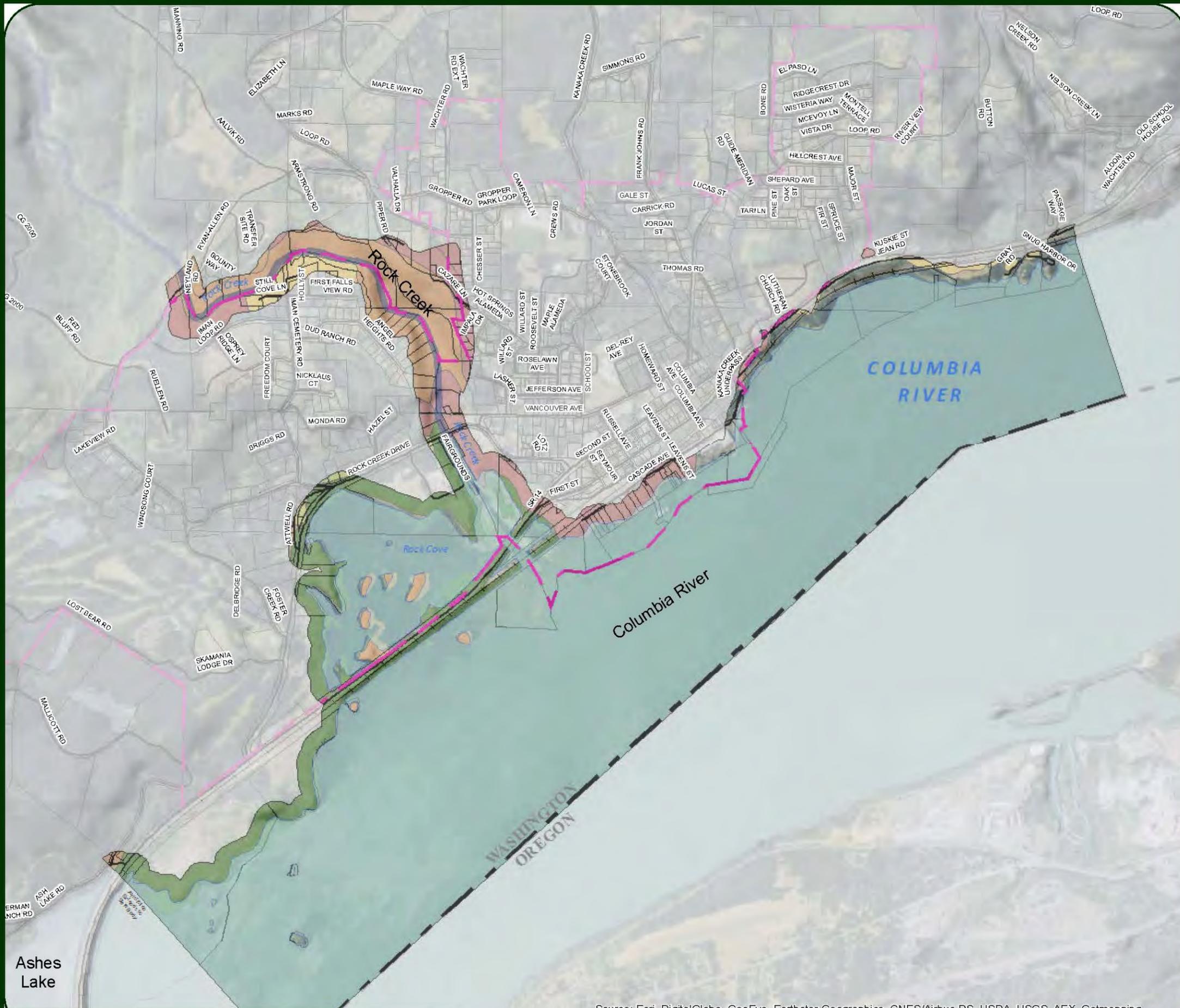
Landcover Type

- Forest
- Shrub
- Grass
- NonVeg
- Water

Approximate Location of OHWM

FIGURE 2:
Land Cover

FIGURE 3: Soils



LEGEND

- Stevenson City Limits
- Public Roads
- State Border
- Rail Road
- Parcel

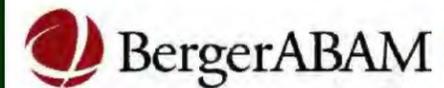
Skamania / Stevenson Soils

- ARENTS
- STEEVER
- BONNEVILLE
- STEVENSON
- SKAMANIA

0 200 400 600 800 1,000 Feet

Absolute Scale: 1:15,000 Relative Scale: 1 inch = 1,250 feet

Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.



BergerABAM, 6/5/2015



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

FIGURE 4: Contours



LEGEND

- River Miles
- Stevenson City Limits
- State Border
- Parcel
- Rail Road
- Public Roads
- Contours**
 - 100 Foot Contours
 - 10 Foot Contours

0 200 400 600 800 1,000 Feet

Absolute Scale: 1:15,000
Relative Scale: 1 inch = 1,250 feet

Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.



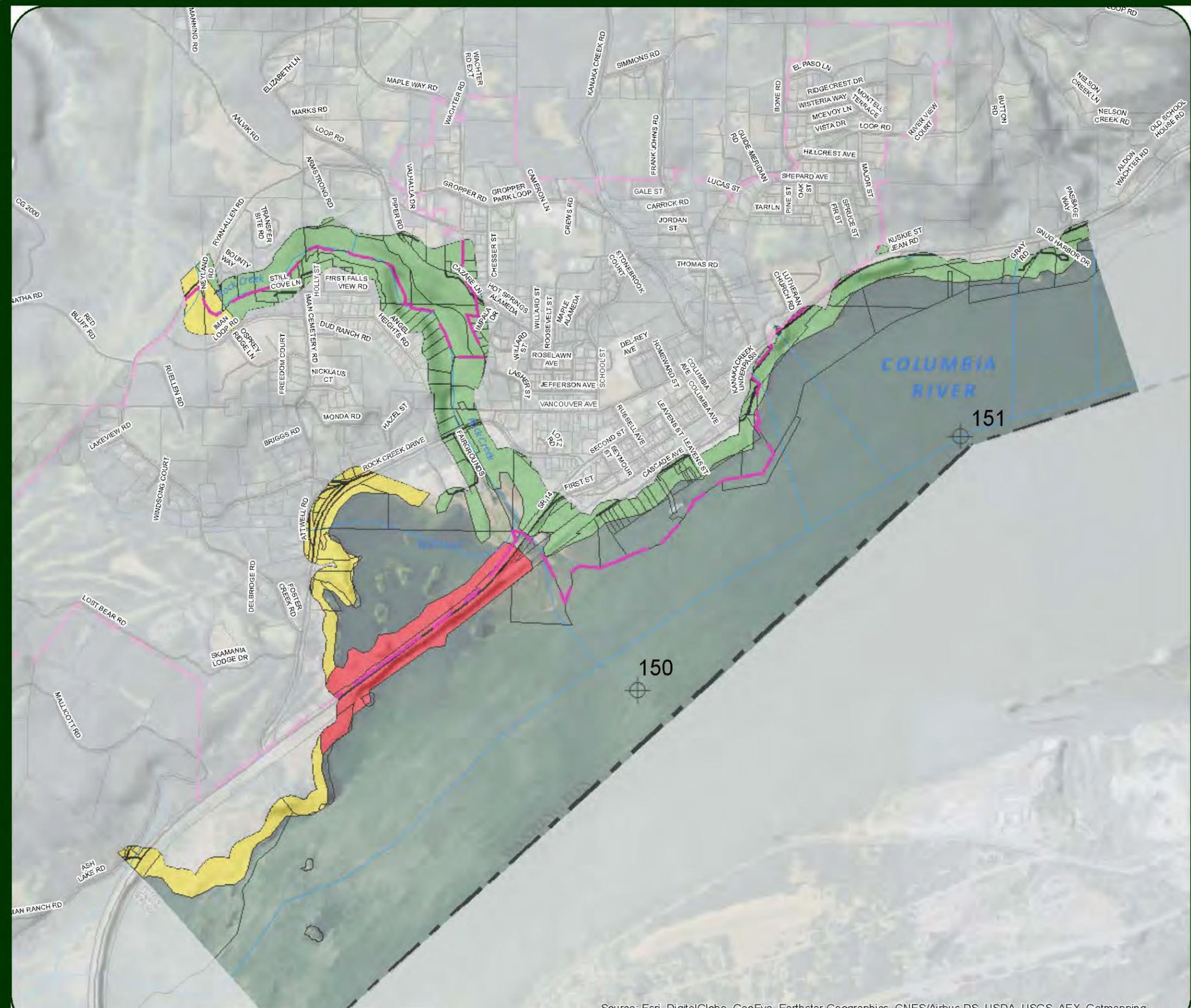
BergerABAM; 8/5/2015



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

FIGURE 5

Liquefaction Hazards



LEGEND

- Stevenson City Limits
 - State Border
 - Parcel
 - River Miles
 - Public Roads
- Liquefaction Potential**
- High
 - Low to moderate
 - Bedrock

0 200 400 600 800 1,000 Feet

Absolute Scale: 1:15,000 Relative Scale: 1 inch = 1,250 feet

Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.



BergerABAM; 6/5/2015



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Stevenson, Washington

Critical Areas & Geologic Hazards Map



800 400 0 800 Feet
1 inch equals 400 feet

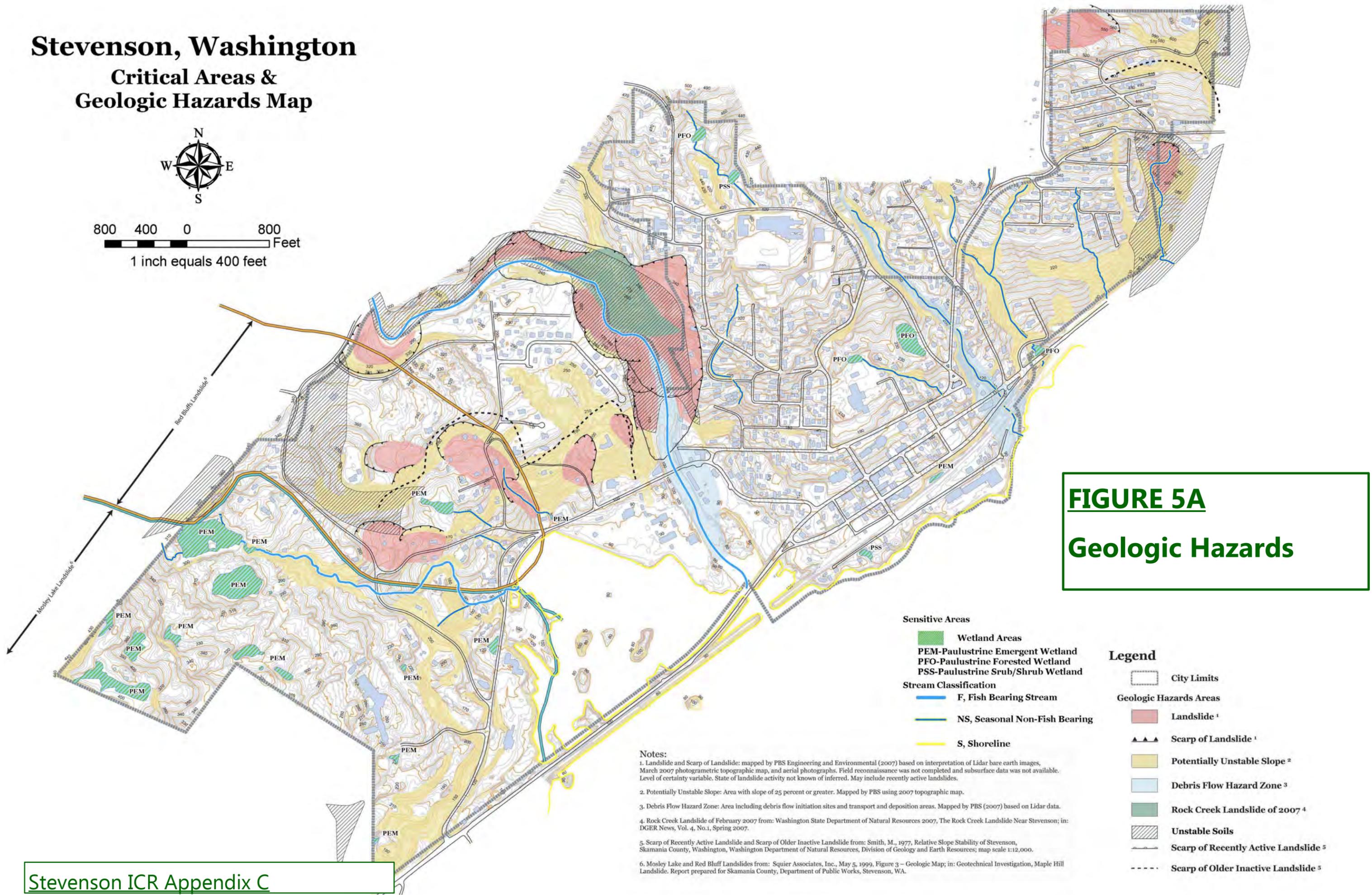


FIGURE 5A
Geologic Hazards

Sensitive Areas

- Wetland Areas
- PEM-Paulustrine Emergent Wetland
- PFO-Paulustrine Forested Wetland
- PSS-Paulustrine Shrub/Shrub Wetland

Stream Classification

- F, Fish Bearing Stream
- NS, Seasonal Non-Fish Bearing
- S, Shoreline

Legend

- City Limits
- Landslide ¹
- Scarp of Landslide ¹
- Potentially Unstable Slope ²
- Debris Flow Hazard Zone ³
- Rock Creek Landslide of 2007 ⁴
- Unstable Soils
- Scarp of Recently Active Landslide ⁵
- Scarp of Older Inactive Landslide ⁵

Notes:

1. Landslide and Scarp of Landslide: mapped by PBS Engineering and Environmental (2007) based on interpretation of Lidar bare earth images, March 2007 photogrammetric topographic map, and aerial photographs. Field reconnaissance was not completed and subsurface data was not available. Level of certainty variable. State of landslide activity not known or inferred. May include recently active landslides.
2. Potentially Unstable Slope: Area with slope of 25 percent or greater. Mapped by PBS using 2007 topographic map.
3. Debris Flow Hazard Zone: Area including debris flow initiation sites and transport and deposition areas. Mapped by PBS (2007) based on Lidar data.
4. Rock Creek Landslide of February 2007 from: Washington State Department of Natural Resources 2007, The Rock Creek Landslide Near Stevenson; in: DGER News, Vol. 4, No.1, Spring 2007.
5. Scarp of Recently Active Landslide and Scarp of Older Inactive Landslide from: Smith, M., 1977, Relative Slope Stability of Stevenson, Skamania County, Washington, Washington Department of Natural Resources, Division of Geology and Earth Resources; map scale 1:12,000.
6. Mosley Lake and Red Bluff Landslides from: Squier Associates, Inc., May 5, 1999, Figure 3 – Geologic Map; in: Geotechnical Investigation, Maple Hill Landslide. Report prepared for Skamania County, Department of Public Works, Stevenson, WA.



MEMORANDUM

DATE: August 13, 2007

TO: Mr. Dan Cary
Natural Resources Team Leader
J.D. White, Division of BERGER/ABAM Engineers Inc.
1111 Main Street, Suite 300
Vancouver, Washington 98660

FROM: John Jenkins and Rick Thrall

PROJECT NO: 72390.001

RE: Landslide Hazard Mapping for Geologic Hazards Area portion of City of Stevenson CAO

INTRODUCTION

PBS Engineering and Environmental (PBS) is contributing the Geologic Hazard Areas section to the draft Critical Areas Ordinance (CAO) for the City of Stevenson. We prepared this Technical Memorandum to explain and document the methods we used to prepare the landslide hazards map that is referenced in the ordinance. The map shows known or suspected landslides and potentially unstable ground that is at higher risk of slope failure if disturbed during development activities. The intent of the landslide hazard map is to facilitate implementation of the Critical Areas Ordinance by the City of Stevenson as part of their land use decision process.

Our scope of work addresses landslide hazards only. We have not specifically addressed other geologic hazards typically covered in CAO's such as seismic hazard areas; mine hazard areas; volcanic hazard areas; and erosion hazard areas. We note that the geologic hazards section in the existing CAO indicates that mine hazard and volcanic hazard areas are not applicable within the city. We concur with that typical volcanic hazards (lahars) are not a risk in the city but do not have specific knowledge of whether mine hazard areas exist. We propose to utilize the existing CAO to address erosion hazards, seismic hazards as well as the volcanic and mine hazards.

In order to generate the landslide hazard map for the ordinance we first completed a more detailed map showing our landslide hazard mapping as well as previous landslide and landslide hazard mapping by others. This map is included as Attachment 1. As explained herein our mapping is based chiefly on interpretation of Light Detection and Ranging (LIDAR) images we generated from the LIDAR data supplied by J.D. White. This map also shows the landslide related information we transposed from the hazard map prepared by the Washington Department of Natural Resources¹ (DNR) that is referenced in the current CAO. In addition the map shows the limit of the recent Rock Creek Slide as mapped by the DNR² and the limits of two ancient landslides in the southwestern area of Stevenson taken from the geologic map contained in a report of the Maple Hill/Kanaka Creek Landslide by another consulting firm³.

¹ Smith, M., 1977, Relative Slope Stability of Stevenson, Skamania County, Washington, Washington Department of Natural Resources, Division of Geology and Earth Resources; map scale 1:12,000.

² Washington State Department of Natural Resources, 2007, The Rock Creek Landslide Near Stevenson; in: DGER News, Vol. 4, No.1, Spring 2007.

³ Squier Associates, Inc., May 5, 1999, Figure 3 - Geologic Map; in: Geotechnical Investigation, Maple Hill Landslide. Report prepared for Skamania County, Department of Public Works, Stevenson, WA.

Although our landslide hazard map is a significant contribution and an improvement to the map currently used by the City, the level of certainty is relatively lower than is typical for this type of effort. This is mainly because ground-based confirmation of interpreted landslides was not possible due to the scope and budget of the project.

However, this memorandum includes recommendations to improve the map and ordinance for future updates. Further, due to budget constraints, no subsurface boring information was made available to us and thus was not incorporated as part of this effort.

LANDSLIDE AND LANDSLIDE HAZARD DEFINITIONS

Landslide Definition and Types in the Stevenson Area

Landslide is a general term covering a wide variety of mass movement landforms and processes involving the downslope transport of soil and rock material en masse. The downslope movement of geologic materials may be triggered by a number of natural factors including intense rainfall, rapid snowmelt, water level changes, wave or stream erosion, earthquake shaking, and volcanic eruptions. Human actions such as the rerouting or concentration of water on a slope, placement of nonengineered fill material on the head of a slope, and cutting into the toe of a slope can all increase the likelihood future landslide activity.

Landslides are broadly characterized as deep-seated or shallow. Deep-seated landslides fail below the rooting depth of vegetation within or below colluvial materials and into stable, in-place sediments or bedrock. They are often large in extent, complex, and once reactivated, by either natural causes or land management practices, are expensive and difficult to mitigate. In many cases mitigation of deep-seated landslides may not be financially possible. Because deep-seated landslides typically move relatively slow the threat of injury or death to humans is normally low. Several terms have been applied to the types of deep-seated landslides based upon their mechanism of failure and type of materials and include: earth and rock falls, topples, slides, and flows (see for example Varnes and Cruden, 1996⁴).

Shallow landslides typically have a shallower depth of failure within the soil and/or colluvium layer above bedrock. These are generally smaller in size than deep-seated landslides but may also be large in surface area. Shallow landslides include debris flows, shallow slumps, and soil creep. Initiation sites of debris flows are at the heads or on the side slopes of creeks and river valleys. Debris flows are commonly caused by the buildup of pore water pressures in the soil mantle during periods of heavy rainfall or rapid snowmelt whereby the water saturated materials partially or fully liquefy, fail and move downslope typically into a confined stream channel or swale. Debris flows typically bulk up, increasing in size during transport as sediments in the pathway are entrained. Deposition of the materials occur when the velocity decreases at the outlet where the channel becomes unconfined and the gradient decreases. The risk is to structures, roads, and people within the pathway or deposition area. There is evidence of shallow, debris flow failures at the heads and side slopes of smaller drainages as well as the larger creeks (Rock Creek and Kanaka Creek). We recommend that a detailed evaluation of the debris flow hazards be completed to better quantify the risk levels.

Soil creep is a slow process that is normally limited to the topsoil zone. Creep is typically a facilities hazard and if recognized in advance, can usually be mitigated during development.

⁴ Varnes, D.J. and D.M Cruden, 1996, Landslide Types and Processes, in: Turner, A.K; Schuster, R.L., editors, Landslides - Investigation and Mitigation: National Academy Press, Transportation Research Board Special Report 247, p.36-75.

Landslide Hazards

It must be emphasized that the City of Stevenson region is characterized as a landslide prone area with widespread and commonly large landslides that may be ancient or historically active as well as steep slopes at risk to failure and referred to as "potentially unstable". The landslides include both deep-seated and shallow, rapidly moving landslides (debris flows). The most recent landslide occurred in Rock Creek this year and resulted in condemnation of a home and significant deposition of sediment at the creek outlet that had to be dredged. For example the southwestern corner of the City overlies the lower portion and toe of two very large ancient landslides that are part of an even larger landslide complex known as the Bonneville slide. A portion of the Kanaka Creek Landslide termed the Maple Hill slide with the toe being about one-mile north of the city limit was reactivated during the large storms in 1996 resulting in significant damage to homes and roads from deep-seated slides and debris flows. Numerous debris flows were triggered by the 1996 rains that affected Highway 14 in the region⁵.

Landslides pose a threat to the health and safety of citizens and infrastructure when incompatible development is sited in areas of significant hazard. Because Stevenson includes significant landslide prone areas it is incumbent upon the City to recognize and control development of those hazards. A good hazard map and ordinance can achieve that purpose. The ordinance establishes a framework to facilitate sound land use decisions in hazardous areas that is largely based on 1) avoidance of landslides (no building), 2) setbacks from landslides, or 3) mitigation of landslide risk through adequate site investigations and engineering.

SOURCES OF INFORMATION AND METHODS

In accordance with our proposal, PBS utilized information provided to us by J.D. White that we understand was obtained from the City. Additionally PBS utilized readily available published geologic and landslide hazards maps for the Stevenson area. Each of these sources of information are discussed in the following subsections:

Geologic Mapping and Summary of Geologic Conditions

Our research indicates that only regional-scale published geologic mapping is currently available for the Stevenson area. The most useful map we found is contained in the previously referenced consultants report (Squier Associates, 1999) containing the results of investigations of the Maple Hill Landslide as prepared for Skamania County (PBS had a copy of this report as a result of work completed for property within the landslide). The geologic map indicates it is based on the regional geologic map by Hammond (1980)⁶; however we did not review the Hammond map. The Squier Associates map indicates two Tertiary-aged bedrock geologic units and two Quaternary-aged units in Stevenson. The bedrock units are the Ohanapecosh formation and the overlying (younger) Eagle Creek Formation. Quaternary units are the Mosley Lake and Red Bluff landslides, mapped in the southwestern portion of Stevenson, and "debris flow deposits" from the Kanaka Creek Landslide and located along Kanaka Creek. The Ohanapecosh formation covers the eastern third of the city and is mapped in the area to the east of Frank Johns Road. The Eagle Creek Formation is mapped in the adjacent area to the west up to the boundary with the Red Bluff and Mosley Lake landslides extending past the city limits on the west side. This area excludes area of debris flows proximal to Kanaka Creek.

The Ohanapecosh Formation formed in the ancient western Cascades volcanic province and it generally consists of bedded mudstone, siltstone, sandstone, and conglomerate with significant volcanic components and andesite lava flows. The overlying Eagle Creek Formation consists of a series of ancient debris flow deposits and fluvial

⁵ Harp, L.E. and others, undated, Landslides and Landslide Hazards in Washington State Due to February 5-9, 1996 Storm, U.S. Geological Survey Administrative Report.

⁶ Hammond, P.E., 1980, Reconnaissance geologic map and cross sections of southern Washington Cascade Range; Department of Earth Sciences, Portland State University, Portland, Oregon, 31 p., 2 sheets.

sediments composed of volcanic conglomerates, sandstones, and tuffs. An angular unconformity separates the units. The Eagle Creek Formation is locally overlain by Middle Miocene-age basalt lava flows of the Columbia River Basalt Group. These rock units are south dipping towards the Columbia River, contain weak, clay rich layers, and are generally prone to landslides. The Kanaka Creek landslide occurs in these geologic units. According to the Squier Associates report, the Maple Hill Landslide is the southwestern portion of the Kanaka Creek landslide that was reactivated in 1996 as a result of the high rainfall and snowmelt in February 1996. The Maple Hill landslide is characterized by deep-seated movements as well as debris flows that originated on steep slump scarps and flowed downslope causing damage to Loop Road.

We transposed the limits of the Mosley Lake and Red Bluffs landslides from the Squier Associates map to our map (Attachment 1). As noted below, landslide topography is clearly indicated by the LIDAR data for this area. The head scarps of these large, complex landslides coincide with the high cliffs and bluffs to the northwest. These landslides involve the Ohanapecosh and Eagle Creek Formations as well as the younger Columbia River Basalt Group lava flows and other units. It is widely interpreted that these landslides were triggered as a result of rapid drawdown (water level change) associated with the Late Pleistocene glacial outburst floods (also known as the "Missoula Floods") that flowed through the Columbia River about 12,000 years ago. The Skamania Lodge property is entirely located on these landslides. The Bonneville Dam is also located on the landslide complex that is sometimes referred to as the Bonneville Landslide.

Reactivated portions of the landslides within the Columbia River Gorge are known and represent a continued risk to major facilities, particularly transportation routes. The margins of ancient landslides are typically at higher risk for renewed activity. We assume that geotechnical investigations were completed for the Skamania Lodge development addressed mitigation of landslide risks however we did not receive copies of those reports. Additionally, the U.S. Corps of Engineers, possibly the Washington State Department of Transportation and the railroad owner have undertaken studies of landslides with regard to their facilities. Those reports could provide useful information but were not available for this project.

Steep Slopes and Slide Areas, Stevenson Washington (City ID # PL 505 D)

PBS received a copy of the map that is referred to in the existing Stevenson CAO. This map is from the previously referenced 1977 published map by Mackey Smith of the DNR. Accompanying explanatory text for this publication, if it exists, was not received. This large-scale map shows the following categories of geologic hazards:

- "Slopes generally greater than 15 percent. May become unstable if existing land use is modified".
- "Unstable areas: displays recently active landsliding"
- "Scarps of older currently inactive landslides"
- "Scarps of recently active landslides"

These features include areas that extend outside of the current city limits to the north and east. We note however that this map did not identify the area of the Mosley Lake or Red Bluffs landslides.

PBS transposed the scarps and the "unstable areas" from the 1977 map to the map in Attachment 1. The "scarps of recently active landslides" and "unstable areas" is limited to the Rock Creek area. The Rock Creek area is high risk area for future slope failures and debris flows in which a large portion failed in February of this year. Landslide features are clearly evident from LIDAR data and the limit of the 2007 failure was delineated by DNR in the referenced 2007 publication.

The "scarps of older currently inactive landslides" shown on the 1977 map does not indicate the extent of landslide masses that occur downslope of the scarps. Landslide features from LIDAR data are associated with the scarp in the area centered on Iman Cemetery Road between Ryan Allen Road and Loop Road in the southwest part of the city. However, landslide features are not clearly evident below the scarp shown in the developed area in the northeast corner of Stevenson east of Bone road and south of El Paso Lane. The only other scarp feature within the City Limits on the 1977 map occurs nearby to the northwest. Our LIDAR mapping indicates a landslide scarp at that location.

Geotechnical Reports

PBS received a limited number of geotechnical reports (three) that we reviewed. However, none of these reports included subsurface explorations. Thus interpretations of geology, landslides, and slope stability were based on reconnaissance combined with literature review and aerial photo analysis in one of the reports. Two reports pertained to a recent developments south and east of Iman Loop Road one of which is bordered by Rock Creek on the northeast side. Landslides were recognized on the steep slopes bordering Rock Creek and setbacks were recommended. According to geographic information systems (GIS) data showing the location of homes, one of the new homes is located less than 50 feet from the top of the slope break. Fresh slumps on the slope and the recent 2007 failure adjacent to the steep slopes on the other side of the creek indicate that the 50-foot setback is inadequate without further stabilization.

Another report is for property located within the area east of Iman Cemetery Road below the 1977-mapped scarp mentioned above. That report included review of aerial photographs that identified landslide features in the area. It included recommendations for subsurface explorations.

A higher level of certainty regarding evaluation of landslide conditions and slope stability are from geotechnical investigations that include subsurface explorations (test pits, borings, borings instrumented with piezometers and inclinometers, laboratory testing, and slope stability modeling) as well as detailed mapping. We suspect that other geotechnical reports with this type of information exist however we did not receive any. We are particularly interested in geotechnical reports associated with the Skamania Lodge development because it occurs on the large ancient landslide complex that may be unstable.

Light Detection and Ranging (LIDAR) Data, Topographic Map and Aerial Photograph

Our landslide hazard mapping relied heavily on digital elevation models (DEM) derived from LIDAR data we received for this project along with the recent (2007) topographic map and aerial photograph. According to a representative of Minister & Glaeser Surveying, the topographic map was derived from traditional photogrammetric methods using ortho-rectified aerial photos flown in March 2007; a two-foot contour interval is used. We understand that the LIDAR data was obtained from Washington DNR and was flown in February – March 2005. In addition, J.D. White provided GIS information showing roads and buildings. This data was used to delineate apparent landslides, debris flow hazard zones, and steeper slopes (equal to or greater than 25 percent) at generally greater risk for slope movements.

DEMs created from LIDAR is a powerful method used to evaluate landslide hazards as it provides a much more accurate representation of the ground surface in forested areas than is possible by photogrammetric methods. For this project we utilized shaded relief maps/images at a scale of 1 inch = 500 feet with two different virtual sunlight orientations. In particular we utilized a constant sun angle of 45 degrees with sun azimuths (direction) of 45 and 315 degrees. The shaded relief maps were analyzed alone and with the topography, roads and buildings superimposed. Additionally we evaluated the topographic map combined with the aerial photograph.

The LIDAR shaded relief images and images combined with the topographic map accurately depict the ground surface and allow overall interpretation of landforms associated with landslides. Landslide related landforms that were observed include scarps, hummocky (irregular) topography, disrupted drainages, and fan deposits associated with debris flows. The images also allow significant fill areas to be recognized. Typically when landslide mapping is performed using LIDAR DEMS, or other methods such as traditional topographic maps or aerial photographs, field reconnaissance of selected features is conducted to evaluate the general age of the landslide. State of activity can be evaluated based on geomorphology.

In order to improve the accuracy of the attached landslide hazard map by PBS, site reconnaissance of the suspected landslides is recommended as well as review of geotechnical reports that include subsurface explorations (if available). Because our scope of work did not include reconnaissance to evaluate the apparent landslide features, the level of certainty of some of the less obvious mapped landslide features is low. During reconnaissance, the age and state of activity should be estimated based on where features associated with active movement are present (e.g. sharp appearing scarps, ground cracks, leaning or pistol butted trees) or whether the landslide features are subdued due to erosion and possible inactive. A commonly used classification of the age and activity of landslides based on geomorphology indicators includes the following categories (Varnes and Cruden, 1996): 1) Active, reactivated, suspended; 2) Dormant – young; 3) Dormant – mature; 4) Dormant – old or relict. Old landslides are often termed ancient that formed hundreds to thousands of years ago. In some cases these ancient landslides are judged to be inactive and stable. However, ancient landslides or portions of large ancient landslide complexes may be reactivated and periodic movement may have occurred for very long periods of time.

The landslide hazards map shows areas where the slope is 25 percent or higher (4H:1V or 14 degrees delineated as a potentially unstable slope in Attachment 1). Steep sloped areas typically include the scarp areas and side slopes to drainage ways.

LANDSLIDE HAZARD MAPPING BY AREA

The following subsections comment on our results by area within the City of Stevenson:

Northeastern Stevenson:

This area encompasses the northeastern portion of Stevenson extending from the north city limits down to the Columbia River on the south. We delineated two landslides and scarps in this area based on LIDAR. The northern-most landslide extends outside of the city limits in an undeveloped area. As shown on Attachment 1, the northern portion includes a landslide head scarp mapped by the Department of Natural Resources (DNR) in 1977 and is designated as "scarps of older inactive landslides". The LIDAR images are inconclusive with respect to features associated with a landslide below the 1977 mapped scarp although it is possible this is a landslide. Other steeper slope areas are delineated in the northern and southern portions of the area including a south-trending drainage way and undeveloped area above the Columbia River.

Rock Creek:

Rock Creek has cut a steep sided canyon through the north-central portion of Stevenson. This area includes "scarps of recently active landslides" and "unstable areas with recently active landslides" mapped by DNR in 1977. That area approximately coincides with landslides and steep slopes we mapped using LIDAR images. The limit of the large landslide that occurred in February 2007 is also shown and is based on the limit shown in the previously referenced DNR paper publication from this year. The LIDAR images clearly show landslide scarps and associated landforms which appear sharp (and thus recent or youthful) indicating that this is a high-risk area for future landslide activity. The Rock Creek area is also subject to debris flows originating from slumps into the creek that are then transported downstream.

Central Stevenson:

Two areas west of Rock Creek in central Stevenson contain landslides based on LIDAR as well as delineated steep slopes. The southeastern slide was also mapped by DNR in 1977. This area appears to be prone to landslides and debris flows that originate from the head and sidewalls of the surface water drainages. Aerial photo analysis (performed for one of the geotechnical reports we reviewed) similarly interpreted landslides in this area.

Southwestern Stevenson (Red Bluff and Mosley Lake Landslides):

The southwestern Stevenson area is defined by the approximate limit of the Red Bluff and Mosley Lake Landslides, taken from the referenced geologic map in the Squier Associates report, as shown on Attachment 1. The Red Bluff Landslide that comprises the northeastern portion of this area includes individual landslides that are interpreted from LIDAR images as well as adjacent steep slopes. This area also includes a scarp identified by DNR as "scarps of older currently inactive landslides".

The LIDAR images for the area to the southwest (that coincides with the Mosley Lake landslide and includes the Skamania Lodge Resort and golf course property) clearly show landforms characteristic of a large landslide complex. Local areas with steep slopes are delineated.

CONCLUSIONS AND RECOMMENDATIONS

The Landslide Hazard Map is based on the information compiled in the Attachment 1 map and is thus largely based on interpretation of slope hazards from LIDAR images in combination with previous hazard mapping. In order to improve the accuracy of the mapping, site reconnaissance of the mapped landslide features, steep slopes and geologic conditions is strongly recommended. Additionally review of geotechnical reports from the Skamania Lodge development and other developments that include subsurface explorations, should be completed. This could be done for future updates of the geologic hazard map. It is possible that landslide features exist that could become evident with field reconnaissance or further study.

On the basis of the available information used for this report and our professional judgment we have characterized the risk of the identified areas as follows:

HIGH HAZARD:

Rock Creek area. – Landslides and Debris Flows
Delineated Landslides

MEDIUM HAZARD:

Mosley Lake and Red Bluff Landslides
Steep slopes
Debris flows

LOW HAZARD:

None

The draft ordinance includes requirements for detailed geotechnical investigations for these areas.

Attachment 1: Landslide Hazards Map

FIGURE 6: Floodplain

LEGEND

-  Stevenson City Limits
-  State Border
-  Parcel
-  River Miles
-  Public Roads
-  Streams and Rivers

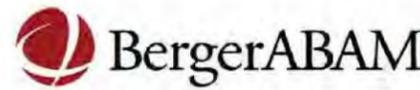
Red areas are designated via FEMA FIRM Map 530161 A Panels 01-02.

Yellow areas are designated via FEMA FIRM Map 530160, Panel 425.

0 200 400 600 800 1,000 Feet

Absolute Scale: 1:15,000 Relative Scale: 1 inch = 1,250 feet

Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.




BergerABAM; 6/5/2015

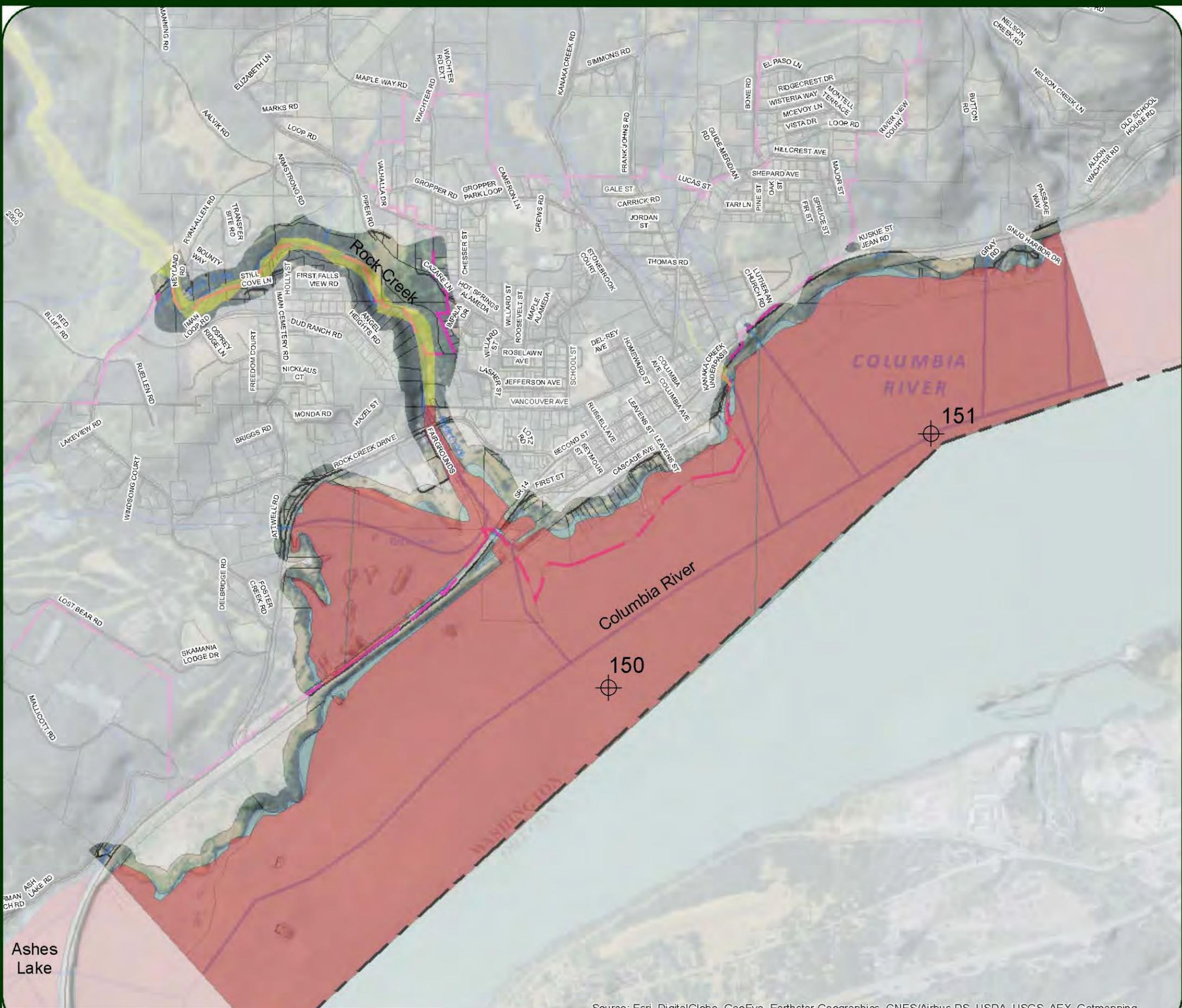


FIGURE 6A Channel Migration Zones

MEMORANDUM

To: Skamania County SMP Update Team
From: Jay Cook, Hydrogeologist, WA Department of Ecology
Date: May 19, 2016
Subject: Channel migration zone analysis for SMA streams in Skamania County

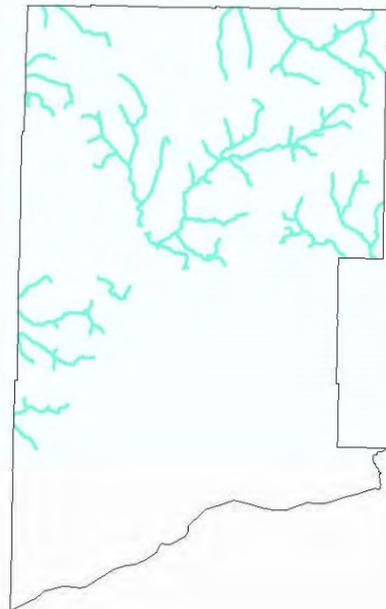
Provided with this memo is a collection of digital data files (ArcGIS map package) that show the results of a planning-level assessment of channel migration zones completed on behalf of the County for the Shoreline Master Program (SMP) Update.

The GIS map data provided by Ecology include two layers. The first is a line layer of the Planning Level Channel Migration Zone (pCMZ) boundaries. The second is a point layer with comments of notable observations, which is not required for the SMP update but hopefully will provide some useful information.

Please note that the pCMZs within the map package are currently drafts. Skamania County, upon review of the pCMZ map data and this document, may contact Ecology to discuss the delineations and the possibility and protocol for adjustments prior to finalizing.

Understanding the low development pressure in the federally owned lands within Skamania County and to expedite the process of generating pCMZs, the county was divided into two parts – low development potential (federally owned land) and higher development potential (privately held land within the National Forest and privately owned land within the rest of the county). In low-development areas, the pCMZ was auto-generated based on channel confinement and valley width. In the higher-development areas, a standard pCMZ analysis was performed.

Low Potential Development Areas



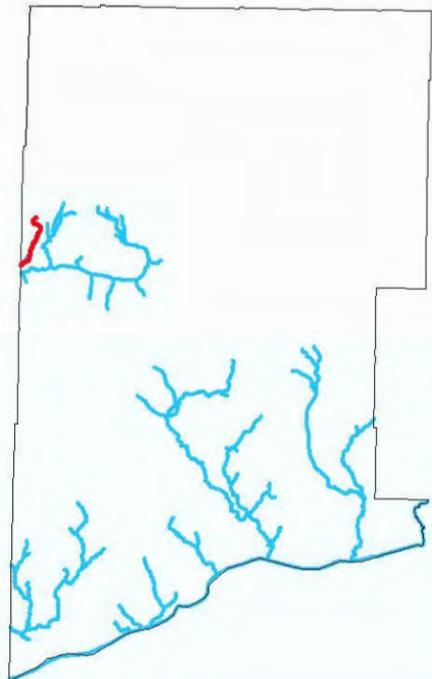
Auto-generated pCMZs

- In GIS, the SMA-jurisdiction streams layer was compared to the CHAMP (Channel Migration Potential) layer. CHAMP layer streams segments, which are present upstream of the 20 cubic feet per second (cfs) regulatory threshold, were trimmed to match the SMA jurisdictional extent. CHAMP data are described in Ecology Publication No. 15-06-003, "Screening Tools for Identifying Migrating Stream Channels in Western Washington" and are available for public use at the Department of Ecology website.
- The relative degree of channel confinement, found in the CHAMP dataset, was selected as the most suitable attribute to categorize stream segments for auto-generating pCMZs. Stream segments were divided into two categories: 1) unconfined, and 2) confined and moderately confined. The Screening Tools publication suggests that in confined and moderately confined stream settings, the valley bottom is a reasonable and conservative approximation of the planning level CMZ. The publication does not offer similar guidance for unconfined settings. Thus, the standard pCMZ methodology, outlined in Ecology's publication No. 14-05-025, "Methodology for Delineating Planning Level Channel Migration Zones", was consulted to aid in appropriately locating pCMZs. The auto-generated pCMZs were assigned as follows:
 - o Confined and moderately confined segments: pCMZ = Valley Bottom Width (attribute within CHAMP data layer).
 - o Unconfined segments: pCMZ = Valley Bottom Width plus 500 feet. Rationale for this approach is as follows: Ecology's pCMZ publication prescribes first delineating the "Modern Valley Bottom" (MVB), followed by situating the pCMZ at some distance relative to the MVB. In settings with very wide valleys relative to the stream, the pCMZ may be placed streamward of the MVB. In settings where the stream is likely to impinge on the valley wall, the pCMZ may be placed outside of the MVB to recognize potential erosion due to undercutting of valley walls. The placement of the pCMZ when outside of the MVB for any segment is controlled by several factors, including the probability of impingement against valley walls, erodibility of valley wall materials, and height of the valley wall. In settings with low erodibility and high valley walls, as generally expected in northern Skamania County, the methodology suggests the pCMZ be placed up to one channel width outside the MVB. In order to assign a common, protective "buffer" distance outside of the valley bottom for all streams in the low-development area, the area stream with the widest active channel, Muddy River, was evaluated. The active channel for Muddy River reaches more than 1,000 feet in width in a few places. While this appears to be atypically wide for streams in the general area, it was a consideration in determining the common pCMZ placement for unconfined stream segments. Considering the Muddy River channel, the hydrologic and geologic setting, and that no migration analysis was performed, it was determined that a reasonable and protective pCMZ for all unconfined stream segments is 500 feet outside of the valley bottom defined in the CHAMP dataset
- It should be noted that pCMZ areas delineated in this fashion are very coarse, and depending on actual stream location versus stream-location data in GIS, the delineated pCMZ area could be significantly misaligned. **Skamania County should narratively explain in their SMP update that**

proposed development near (inside or outside of) these auto-generated pCMZs should first be analyzed on the ground to determine if the project is actually within the valley bottom for confined stream segments or within about 500 feet of the valley bottom for unconfined stream segments. Additionally, the SMP update should note that proposed developments within the physical, on-the-ground boundaries will require a site-specific, detailed CMZ analysis. Ecology Publication #03-06-027 “A Framework for Delineating Channel Migration Zones” provides a methodology for such a detailed analysis that should be conducted by a qualified professional.

- There are 5 streams/stream segments within the Low Development Areas that fall under SMA jurisdiction but are not in the CHAMP stream dataset. Three are in the northwest corner of the county – South Coldwater Creek headwaters, North Fork Toutle River, and Studebaker Creek. Two are in the eastern portion of the county – Trout Lake Creek and the upper White Salmon River. Absent CHAMP data, valley width and confinement information, the valley bottom was hand-digitized using available data (USGS Topographic Information from ESRI, 10-m DEM, and Aerial Photos), and the pCMZ was set back 500 feet from the mapped valley bottom.
 - o The upstream portion of South Coldwater Creek is the outfall of Spirit Lake and appears to travel through a tunnel, thus no pCMZ was generated for that section.
- The pCMZ delineation lines within the GIS package overlap at many stream confluences. Where this occurs, the most protective (i.e., farthest from the stream) should be used.

Higher Potential Development Areas



- Standard pCMZ analyses were performed using available desktop methods.
- Note that all mapped CMZs are “Planning-Level”:
 - o Fairly abbreviated process, relying on visible landforms, channel characteristics, valley characteristics, historic migration, and soils/geology. Channel migration rates were not analyzed. Considering the abbreviated nature of the analysis, the pCMZs are relatively conservative (wide). More precise or narrower CMZs could be generated, but a more detailed analysis would require significantly more time and costs.
 - o In many cases, the pCMZ boundary is above the valley bottom onto valley walls as described in the previous section.
 - o For all streams, the “natural” pCMZ was mapped without regard for man-made structures such as levees and roads that may actually limit migration.
- LIDAR available – Lower White Salmon River – available LIDAR data were utilized to generate the pCMZ following the protocol outlined in Ecology’s Planning Level CMZ publication, referenced above.
- No other streams within the county had significant LIDAR coverage. Absent high-resolution data, ten-meter resolution Digital Elevation Model (DEM) data were used to analyze all other streams. Recognizing coarseness of the data and in order to be protective, the pCMZs were intentionally placed slightly farther from the streams than if LIDAR data were available. Relative Water Surface Elevations (RWSE) were produced for all stream segments using the 10-meter DEM data. The RWSEs were used to aid in visibly locating the preliminary pCMZ or to create a contour (5-10 meters) above the water surface to approximate the valley bottom or a reasonable zone above and outward from the active stream. Once generated, the preliminary pCMZ or the contour was manually adjusted (either streamward or landward) based on historic orthophotos, topographic information, and geologic/soils information. Again, protocol from Ecology’s pCMZ document was followed.
- Note, the unnamed stream in red in the map above was not delineated. It appears to be a mistake within the SMA jurisdiction GIS dataset. The stream is not readily evident in orthophotos or USGS topo maps.

Columbia River

Understanding that the Columbia River has little tendency to migrate and in being consistent with previous CMZ assessments, it was decided to use the existing FEMA 100-year flood zone delineation as the pCMZ. The most current digital flood-zone data available for Skamania County are the FEMA Q3 data, which often do not project well in GIS. This problem, which results in the 100-year flood delineation not aligning properly with the river and adjacent landforms, was noted during assessment of the Q3 data for the Columbia River.

The Columbia River pCMZ delineation presented by Ecology for Skamania County should be recognized in the SMP update as imprecise and should be used only in an advisory capacity. Project-level decisions should utilize existing Flood Insurance Study maps and information and/or more detailed, site-specific delineations.

area and may be the most important layer in terms of understanding the actual locations of encumbered lands. However, all data is retained because it could all be considered valuable for different purposes. Also, when generating the contour line for the purpose of 'cropping' the tract into a specific easement area, it is important to note that the contour line represents only the elevation at the time of the LiDAR data capture (in this case the LiDAR data was collected in 2005-06). Changes to topography (e.g. cut and fill) influence the actual area of easement. Therefore it is important to have the entire area of each tract as well as its specified high elevation information. This data is available in the complete tract (polygon) dataset. Also, the full legal scope of each easement is defined within the original recorded legal document. These should be reviewed prior to making any firm judgment regarding the location of each easement.

In the case of cropping the tracts that had a defined high elevation of 800,000 c.f.s. or where the high elevation was not defined (i.e. entered as 99999 in the data), these tracts were cropped at the 95 foot contour line. While this may not be the legally defined high contour location of the easement, it allows the tracts to be cut to show an estimate of actual easement area.

FIGURE 7: PHS Data



LEGEND

- Stevenson City Limits
- State Border
- Parcel
- River Miles
- Rail Road
- Public Roads
- Streams and Rivers

WDFW PHS Data

- Salmonoid Stock Inventory (SaSI)
- Canada Goose
- Waterfowl Concentrations

0 200 400 600 800 1,000 Feet

Absolute Scale: 1:15,000 Relative Scale: 1 inch = 1,250 feet

N

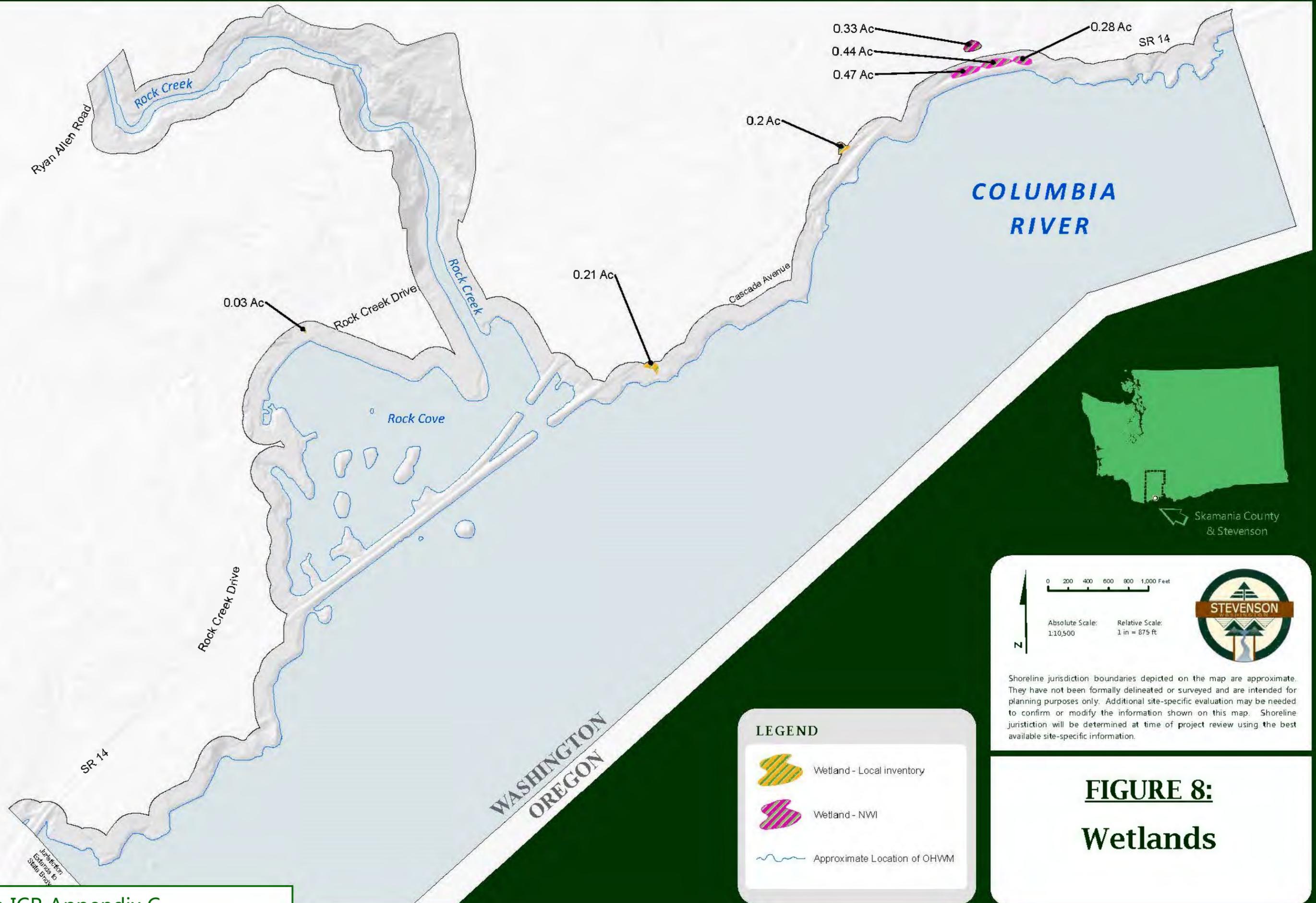
Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.

BergerABAM STEVENSON

BergerABAM: 6/5/2015



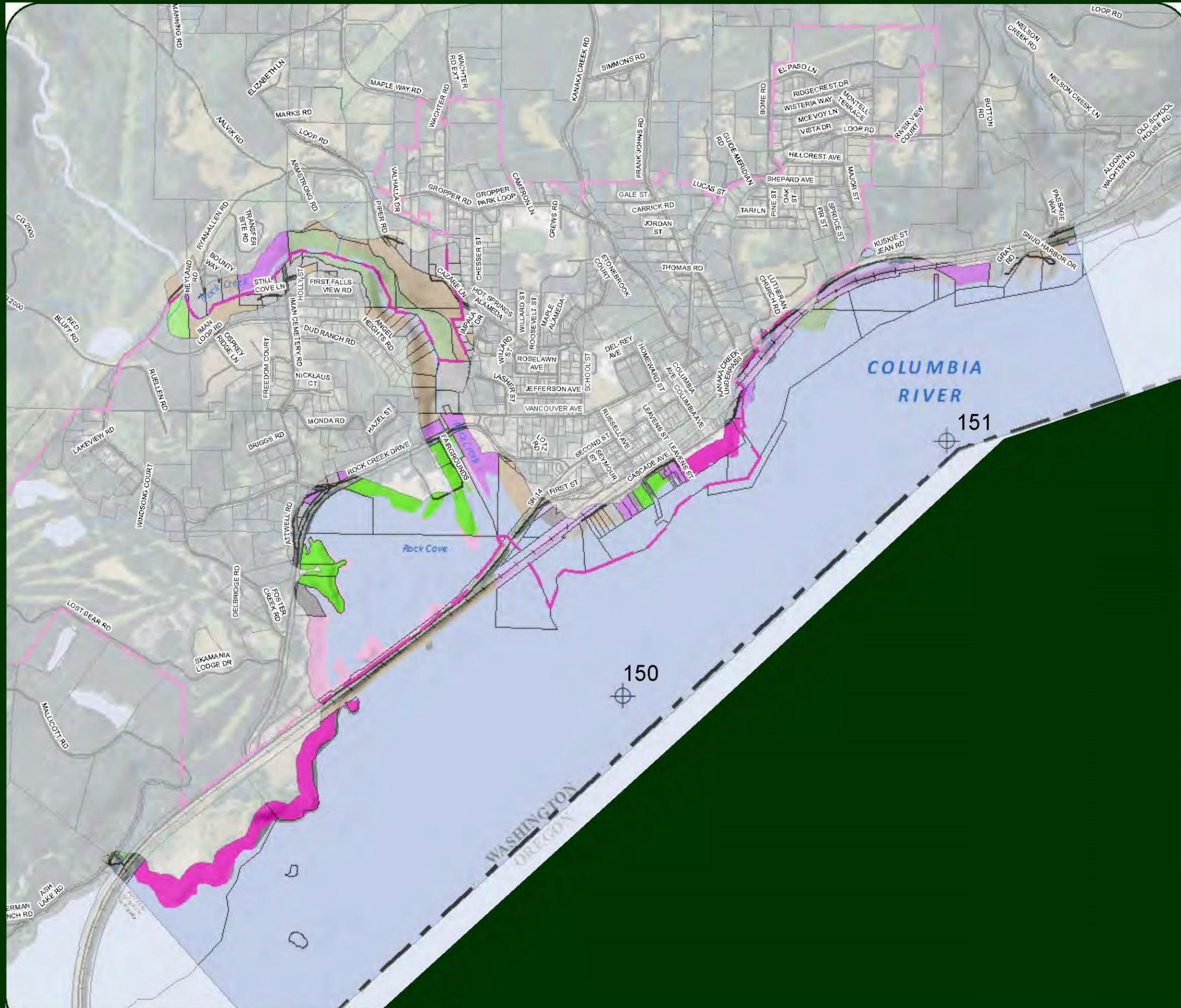
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.

**FIGURE 8:
Wetlands**

FIGURE 9: Existing Land Use



LEGEND

- Stevenson City Limits
- Public Roads
- State Border
- Rail Road
- Parcel
- River Miles

Land Use

- Single Family
- Multi-Family
- Manufacturing
- Utility-Trans
- Services
- Culture-Recreation
- Parks
- Private/Commercial Forest
- Undeveloped
- Open Space

0 200 400 600 800 1,000 Feet

Absolute Scale: 1:15,000 Relative Scale: 1 inch = 1,250 feet

Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.



BergerABAM; 6/5/2015



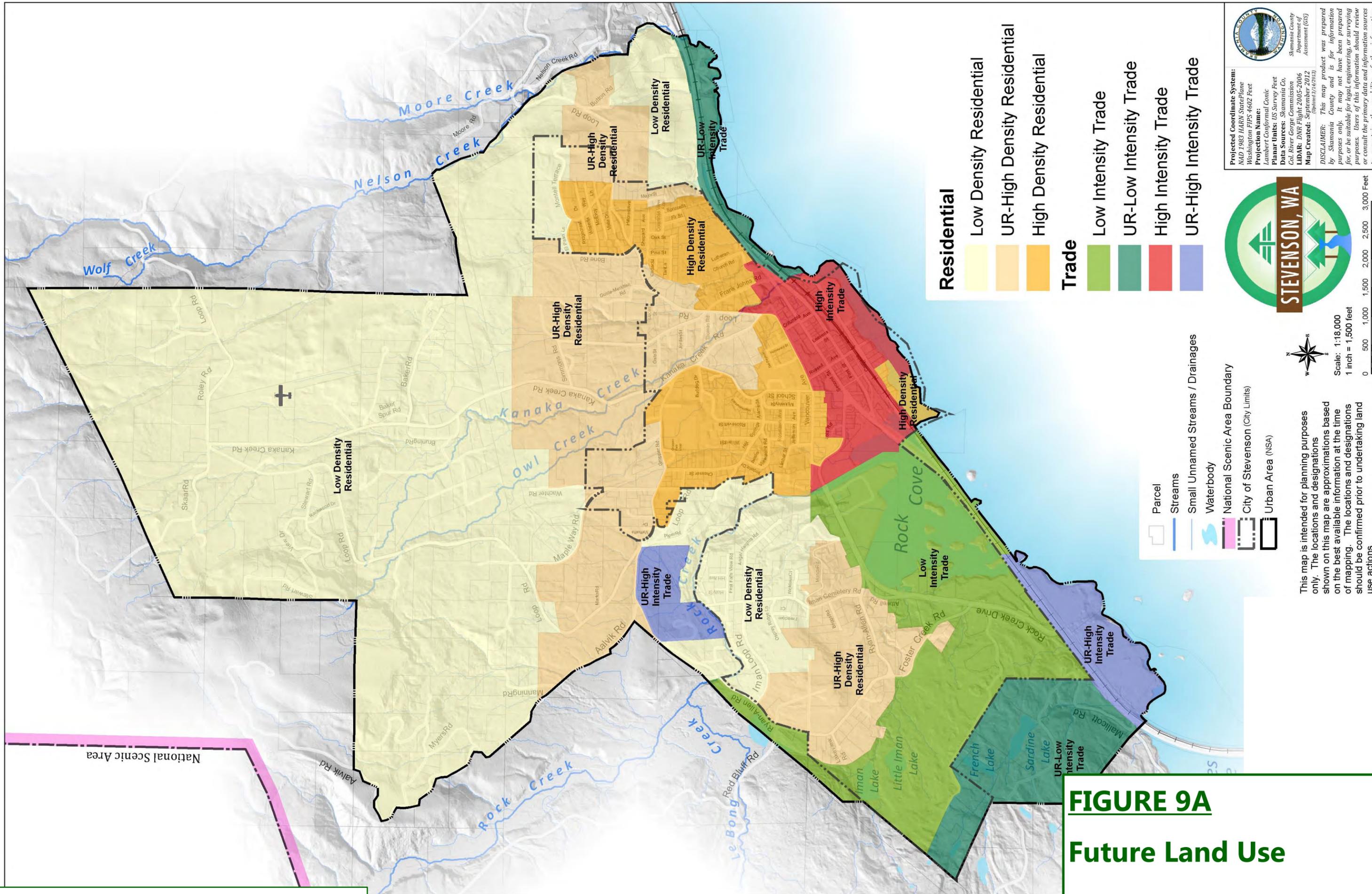


FIGURE 9A
Future Land Use

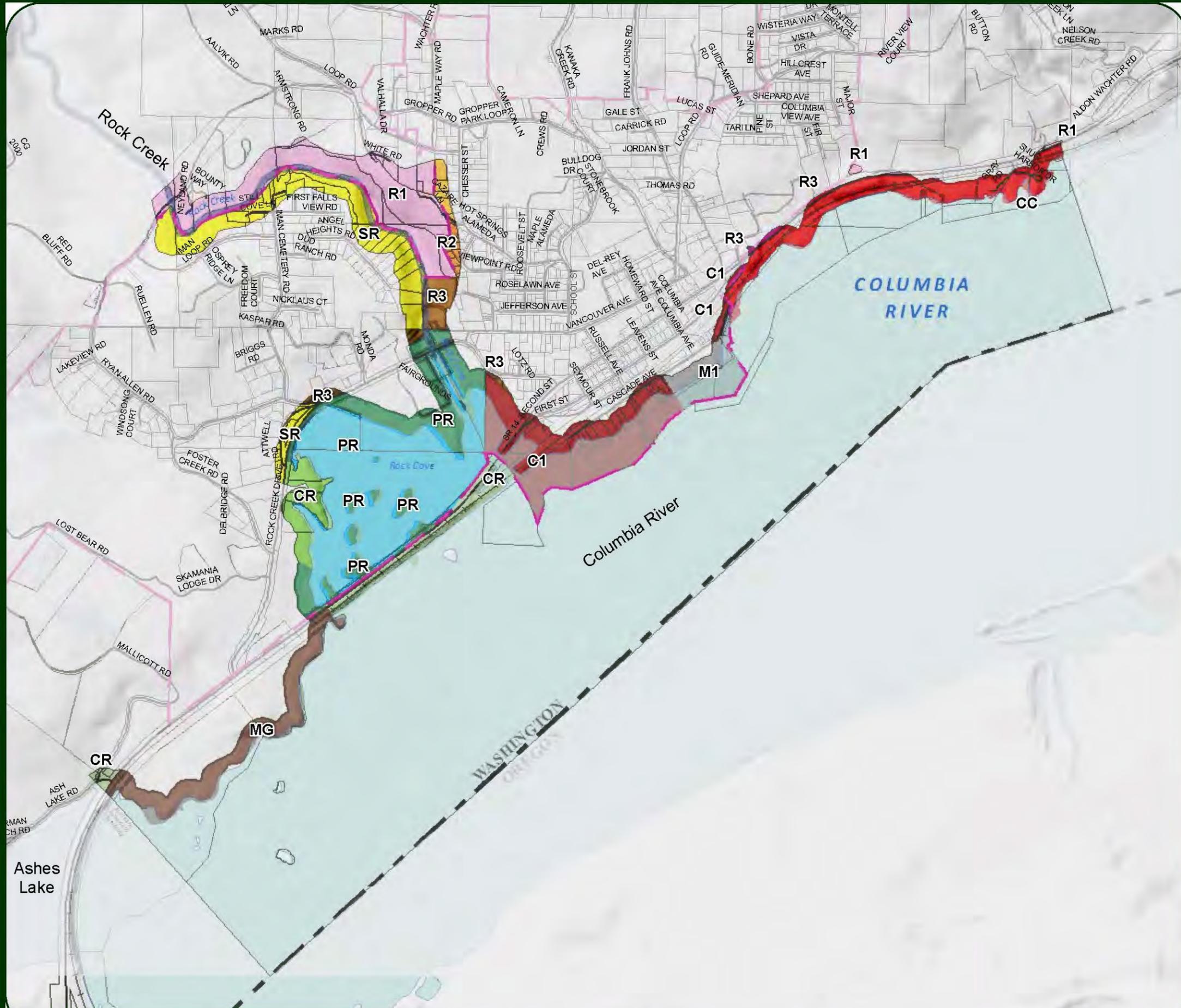
Projected Coordinate System:
NAD 1983 HARN StatePlane
Washington FIPS 4602 Feet
Projection Name:
Lambert Conformal Conic
Planar Units: US Survey Feet
Data Sources: Skamania Co,
Col. River Geologic Commission
LIDAR: DNR Flight 2005-2006
Map Created: September 2012
(09/06/2012/14/09/12)

DISCLAIMER: This map product was prepared by Skamania County and is for information purposes only. It may not have been prepared for, or be suitable for, legal engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.



This map is intended for planning purposes only. The locations and designations shown on this map are approximations based on the best available information at the time of mapping. The locations and designations should be confirmed prior to undertaking land use actions.

FIGURE 10: Zoning



LEGEND

Stevenson City Limits	Public Roads
State Border	Parcel
Rail Road	

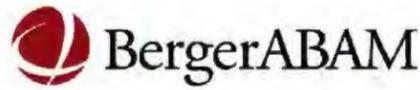
Zoning

Skamania County	City of Stevenson
Residential 1 (R1)	Commercial (C1)
Residential 2 (R2)	Commercial Recreation (CR) (Stev)
Community Commercial (CC)	Light Industrial (M1)
Commercial Rec. (CR) (SkaCo)	Public Use and Recreation (PR)
Industrial (MG)	Rock Cove Public Use & Rec. (PR)
	Single Family Residential (R1)
	Two Family Residential (R2)
	Multi-Family Residential (R3)
	Multi-Family Residential Overlay (R3)
	Suburban Residential (SR)

Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.

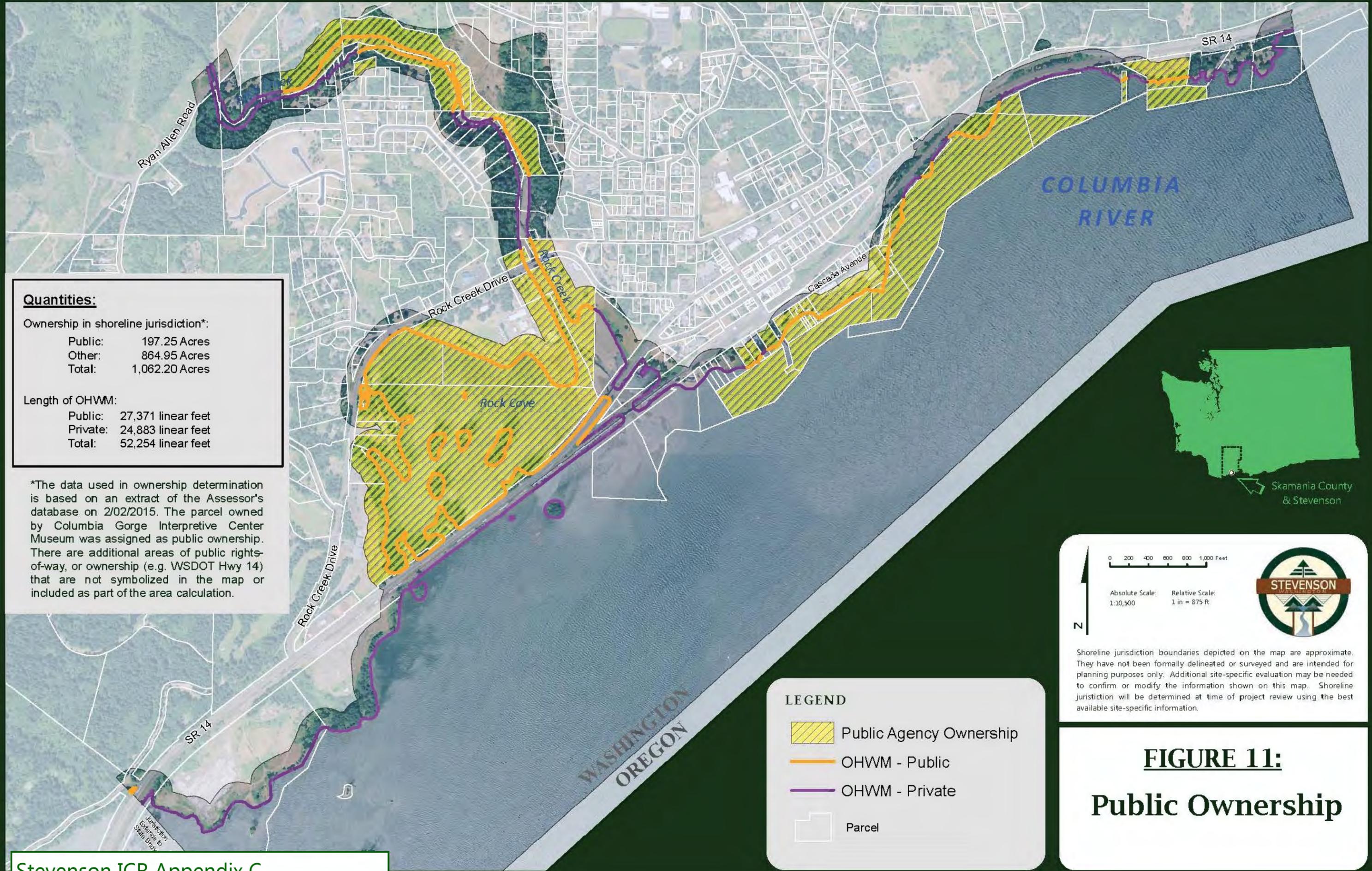
0 200 400 600 800 1,000 Feet

Absolute Scale: 1:15,000 Relative Scale: 1 inch = 1,250 feet




BergerABAM, 6/5/2015





Quantities:

Ownership in shoreline jurisdiction*:

Public:	197.25 Acres
Other:	864.95 Acres
Total:	1,062.20 Acres

Length of OHWM:

Public:	27,371 linear feet
Private:	24,883 linear feet
Total:	52,254 linear feet

*The data used in ownership determination is based on an extract of the Assessor's database on 2/02/2015. The parcel owned by Columbia Gorge Interpretive Center Museum was assigned as public ownership. There are additional areas of public rights-of-way, or ownership (e.g. WSDOT Hwy 14) that are not symbolized in the map or included as part of the area calculation.

LEGEND

-  Public Agency Ownership
-  OHWM - Public
-  OHWM - Private
-  Parcel

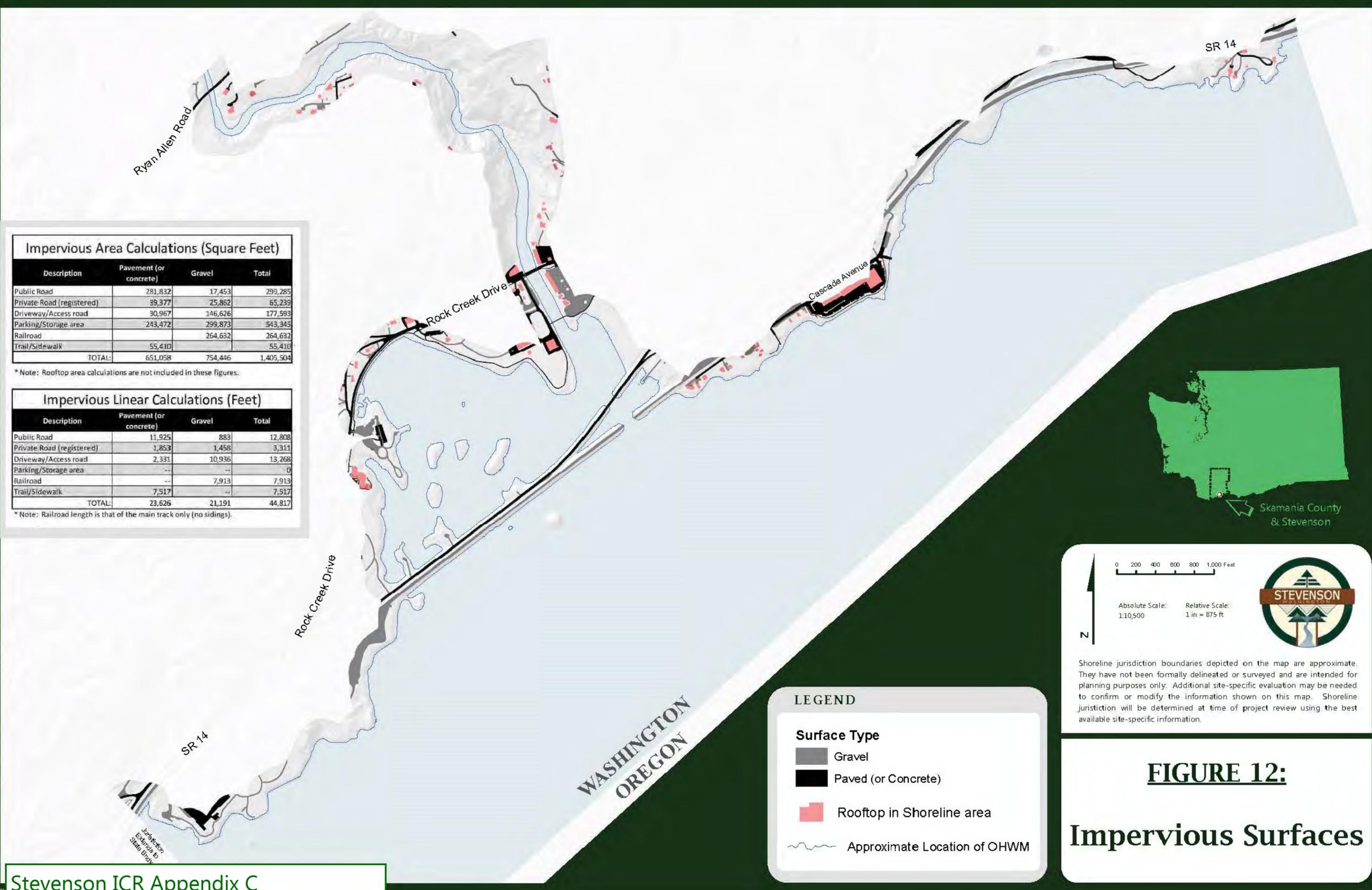
0 200 400 600 800 1,000 Feet

Absolute Scale: 1:10,500 Relative Scale: 1 in = 875 ft



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FIGURE 11:
Public Ownership



Impervious Area Calculations (Square Feet)

Description	Pavement (or concrete)	Gravel	Total
Public Road	281,832	17,453	299,285
Private Road (registered)	39,377	25,862	65,239
Driveway/Access road	30,967	146,626	177,593
Parking/Storage area	243,472	299,873	543,345
Railroad		264,632	264,632
Trail/Sidewalk	55,410		55,410
TOTAL:	651,058	754,446	1,405,504

* Note: Rooftop area calculations are not included in these figures.

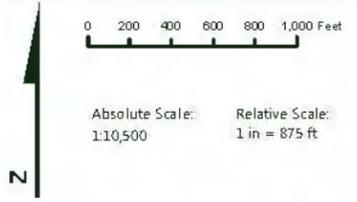
Impervious Linear Calculations (Feet)

Description	Pavement (or concrete)	Gravel	Total
Public Road	11,925	883	12,808
Private Road (registered)	1,853	1,458	3,311
Driveway/Access road	2,331	10,936	13,268
Parking/Storage area	--	--	0
Railroad	--	7,913	7,913
Trail/Sidewalk	7,517	--	7,517
TOTAL:	23,626	21,191	44,817

* Note: Railroad length is that of the main track only (no sidings).



Skamania County & Stevenson



Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.

LEGEND

Surface Type

- Gravel
- Paved (or Concrete)
- Rooftop in Shoreline area
- Approximate Location of OHWM

FIGURE 12:
Impervious Surfaces



Rooftop Statistics:
 Sum of all rooftops = 212,076 Sq Ft
 Largest single structure = 35,425 Sq Ft (the portion falling in Shoreline)
 Average size in Shoreline per structure = 2,020 Sq Ft
 Count of structures = 105 (partially or fully within Shoreline)



0 200 400 600 800 1,000 Feet

Absolute Scale: 1:110,500 Relative Scale: 1 in = 875 ft

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LEGEND

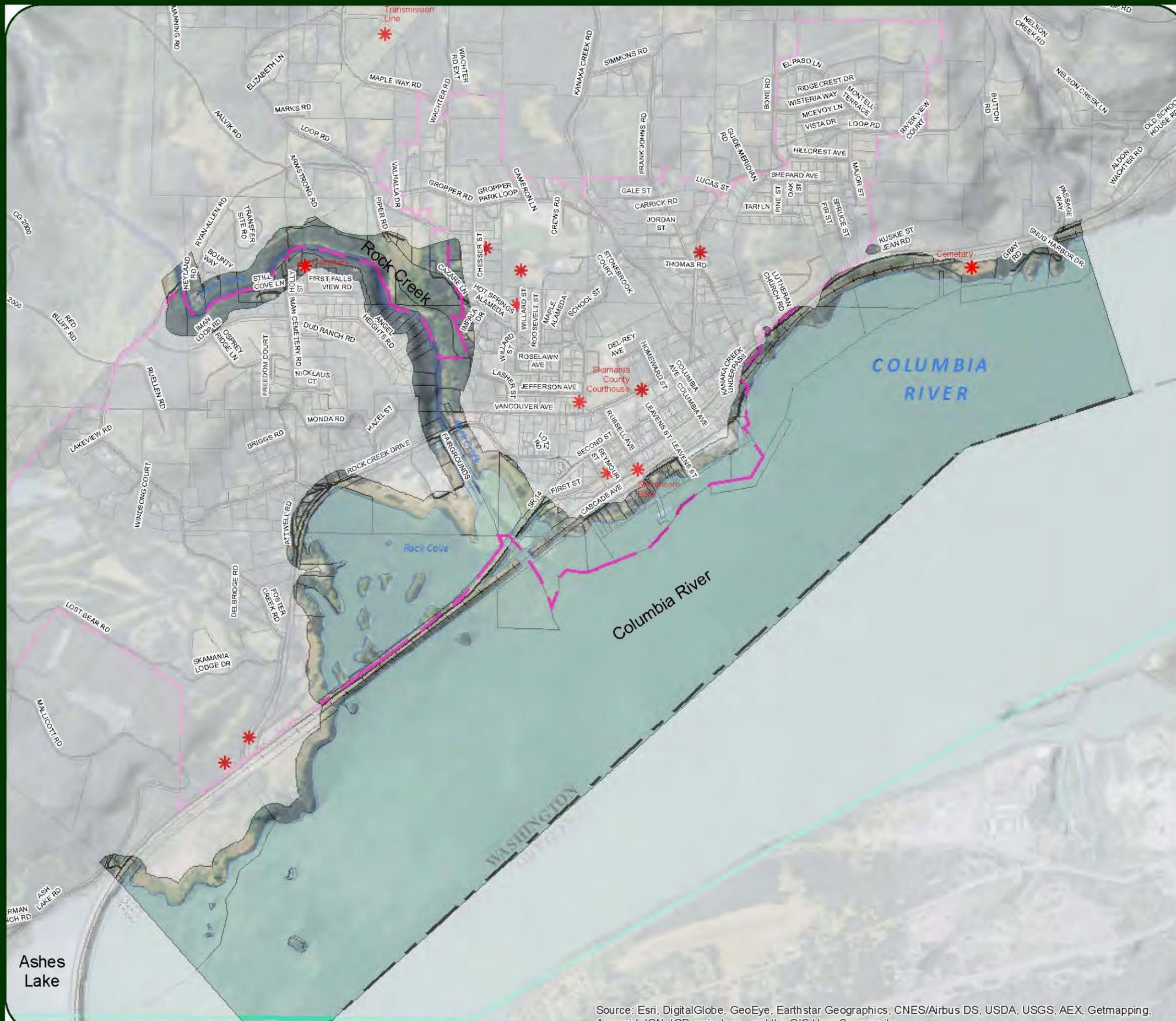
■ Rooftop in Shoreline area

~~~~~ Approximate Location of OHWM

**FIGURE 13:**

**Rooftops**

# FIGURE 14: Archeology / Historic

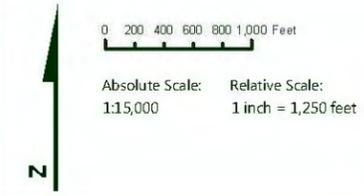


## LEGEND

- Stevenson City Limits
- Rail Road
- State Border
- Public Roads
- Parcel

## Skamania / Stevenson Historic Inventory

- Historic Property Inventory Points
- Washington Register Districts \* (Not on map)
- Washington Register Properties \* (Not on map)



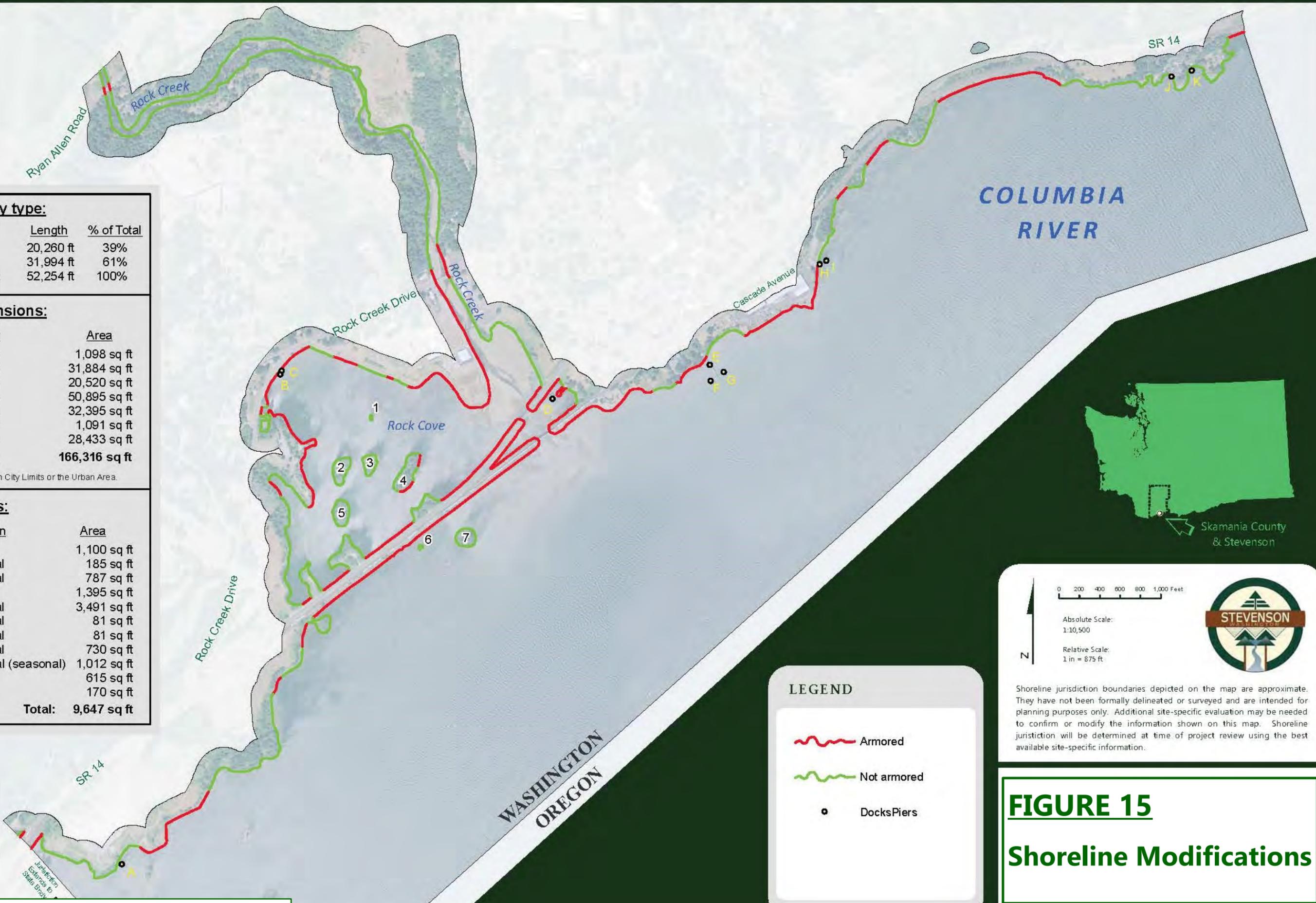
Shoreline jurisdiction boundaries depicted on the map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm or modify the information shown on this map. Shoreline jurisdiction will be determined at time of project review using the best available site-specific information.



BergerABAM; 8/5/2015



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



**Quantities by type:**

| Type                    | Length           | % of Total  |
|-------------------------|------------------|-------------|
| Armored                 | 20,260 ft        | 39%         |
| Not armored             | 31,994 ft        | 61%         |
| <b>Total shoreline:</b> | <b>52,254 ft</b> | <b>100%</b> |

**Island dimensions:**

|               | Perimeter       | Area                 |
|---------------|-----------------|----------------------|
| 1             | 133 ft          | 1,098 sq ft          |
| 2             | 731 ft          | 31,884 sq ft         |
| 3             | 563 ft          | 20,520 sq ft         |
| 4             | 1010 ft         | 50,895 sq ft         |
| 5             | 681 ft          | 32,395 sq ft         |
| 6             | 127 ft          | 1,091 sq ft          |
| 7*            | 606 ft          | 28,433 sq ft         |
| <b>Total:</b> | <b>3,851 ft</b> | <b>166,316 sq ft</b> |

\* Island is not within City Limits or the Urban Area.

**Docks / Piers:**

|   | Description         | Area               |
|---|---------------------|--------------------|
| A | Private             | 1,100 sq ft        |
| B | Communal            | 185 sq ft          |
| C | Communal            | 787 sq ft          |
| D | Private             | 1,395 sq ft        |
| E | Communal            | 3,491 sq ft        |
| F | Communal            | 81 sq ft           |
| G | Communal            | 81 sq ft           |
| H | Communal            | 730 sq ft          |
| I | Communal (seasonal) | 1,012 sq ft        |
| J | Private             | 615 sq ft          |
| K | Private             | 170 sq ft          |
|   | <b>Total:</b>       | <b>9,647 sq ft</b> |

**LEGEND**

-  Armored
-  Not armored
-  Docks/Piers

0 200 400 600 800 1,000 Feet

Absolute Scale:  
1:10,500

Relative Scale:  
1 in = 875 ft.

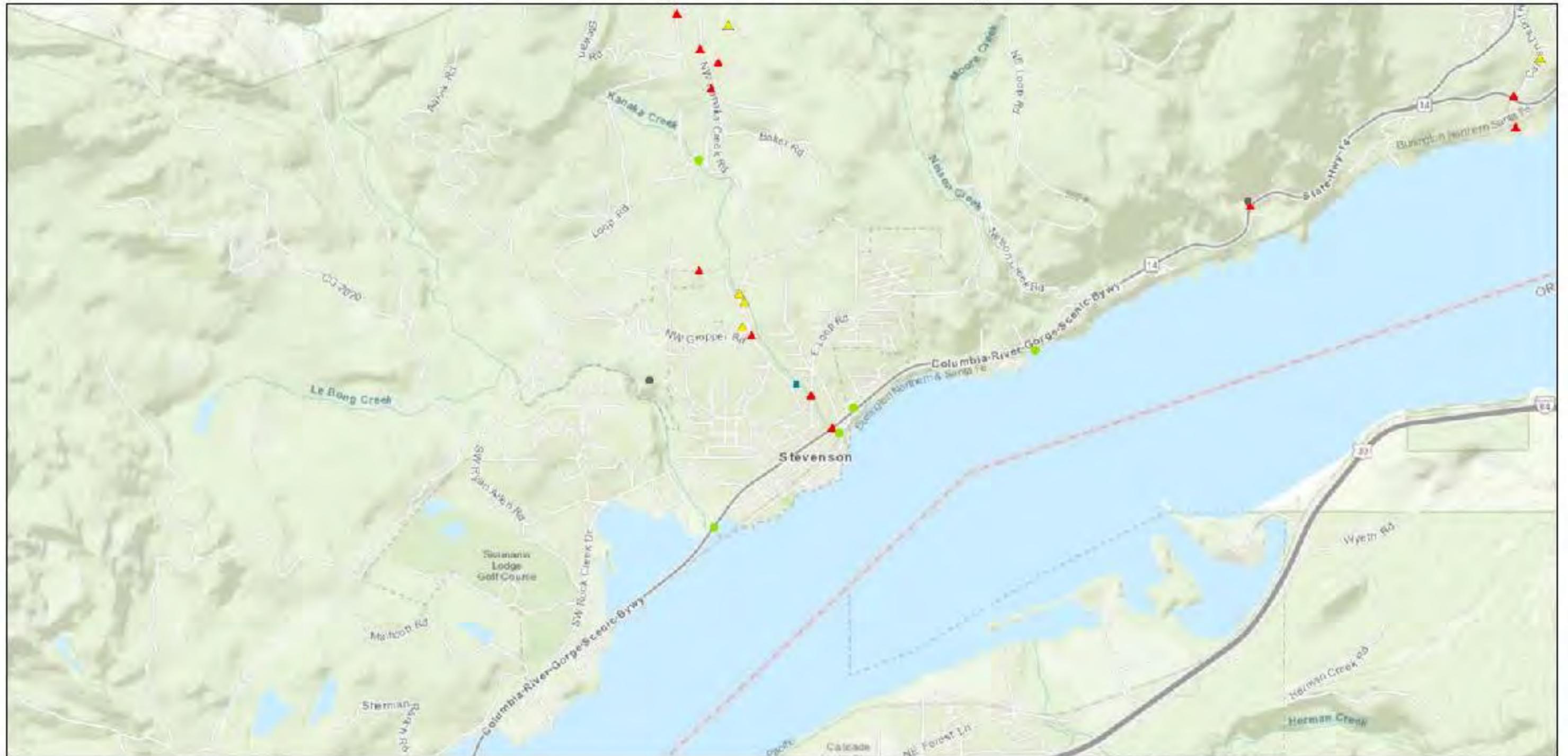


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**FIGURE 15**

**Shoreline Modifications**

# Washington State Fish Passage

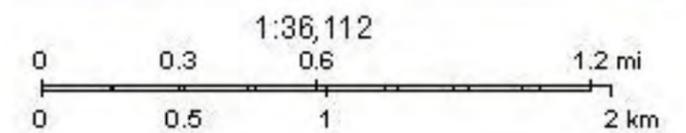


September 10, 2018

- Unknown
- Diversion
- ▲ Barrier, Unknown Percent Passable
- ▲ Total Fish Passage Blockage
- ▲ Partial Fish Passage Blockage
- Not a barrier
- Corrected Barriers

Stevenson ICR Appendix C

**FIGURE 16**  
**Fish Passage Barriers**



Washington Department of Fish and Wildlife, Habitat Program, Restoration Division, Restoration Division of the DFW Habitat Program, Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,





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