City of Covington
Grant No. G0800106

SHORELINE ANALYSIS REPORT
Including Shoreline Inventory and Characterization for City of Covington's Shorelines: Big Soos Creek, Jenkins Creek and Pipe Lake

Project: Shoreline Master Program Update
Task 1.3: Complete Shoreline Inventory
Task 2.1: Complete Preliminary Shoreline Analysis

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TABLE OF CONTENTS

Section ..... Page No.

1.0 INTRODUCTION 1

1.1 Background and Purpose 1
1.2 Shoreline Jurisdiction 1
1.3 Study Area 2
1.4.1 Geographic Context 2
1.4.2 Historic Geology, Topography, and Drainage Patterns 3
1.4.3 Major Land Use Changes and Current Shoreline Condition 4
1.4.4 ESA Listings 6

2.0 CURRENT REGULATORY FRAMEWORK SUMMARY 7

2.1 City of Covington 7
2.2 State and Federal Regulations 7

3.0 ELEMENTS OF THE SHORELINE INVENTORY 9

3.1 Land Use Patterns 9
3.2 Transportation 11
3.3 Wastewater and Stormwater Utilities 11
3.3.1 Wastewater Utilities 11
3.3.2 Stormwater Utilities 12
3.4 Impervious Surfaces 13
3.5 Shoreline Modifications 14
3.6 Existing and Potential Public Access Sites 14
3.7 Critical Areas 15
3.7.1 Geologically Hazardous Areas 15
3.7.2 Flood Hazard Areas 17
3.7.3 Wetlands 18
3.7.4 Streams 19
3.7.5 Other Fish and Wildlife Habitat Conservation Areas 19
3.7.6 Critical Aquifer Recharge Areas 20
3.8 Floodplain and Channel Migration Zone 20
3.8.1 Floodplain 20
3.8.2 Channel Migration Zone 20
3.9 Historical or Archaeological Sites 21
3.10 Other Areas of Special Interest 22
3.10.1 Water-Oriented Uses 22
3.10.2 Toxic or Hazardous Waste Sites 22
3.11 Opportunity Areas 22

4.0 SHORELINE-SPECIFIC CONDITIONS 24

4.1 BIG SOOS CREEK 24
4.1.1 Land Use Patterns 25
4.1.2 Transportation 25
4.1.3 Wastewater and Stormwater Utilities 25
4.1.4 Shoreline Modifications 25
4.1.5 Existing and Potential Public Access Sites 26
4.1.6 Critical Areas 26

4.1.7 Floodplain and Channel Migration Zone 27
4.1.8 Opportunity Areas 27
4.2 JENKINS CREEK 28
4.2.1 Land Use Patterns....28
4.2.2 Transportation 28
4.2.3 Wastewater and Stormwater Utilities 29
4.2.4 Shoreline Modifications 29
4.2.5 Existing and Potential Public Access Sites 30
4.2.6 Critical Areas....30
4.2.7 Floodplain and Channel Migration Zone 32
4.2.8 Opportunity Areas 32
4.3 PIPE LAKE 32
4.3.1 Land Use Patterns....33
4.3.2 Transportation 33
4.3.3 Wastewater and Stormwater Utilities 33
4.3.4 Shoreline Modifications 34
4.3.5 Existing and Potential Public Access Sites 34
4.3.6 Critical Areas....35
4.3.7 Lake Aquatic Invasive Species 36
4.3.9 Opportunity Areas 39

5.0 ANALYSIS of ECOLOGICAL FUNCTIONS and ECOSYSTEM WIDE PROCESSES 39

5.1 Big Soos Creek....40
5.1.1 Hydrologic 43
5.1.2 Shoreline Vegetation 44
5.1.3 Hyporheic Functions....44
5.1.4 Habitat....45
5.2 Pipe Lake....45
5.3 Jenkins Creek 51

6.0 LAND USE ANALYSIS 58

6.1 Big Soos Creek....59
6.1.1 Likely Changes in Land Uses 59
6.1.2 Implications for Shoreline Management....59
6.2 Pipe Lake....59
6.2.1 Likely Changes in Land Uses 59
6.2.2 Implications for Shoreline Management....60
6.3 Jenkins Creek 60
6.3.1 Likely Changes in Land Uses 60
6.3.2 Implications for Shoreline Management....61

7.0 SHORELINE MANAGEMENT RECOMMENDATIONS 61

7.1 Shoreline Master Program 61
7.1.1 Environment Designation Provisions 61
7.1.2 General Policies and Regulations....62
7.1.3 Shoreline Modification Provisions 66
7.1.4 Shoreline Uses....67
7.2 Restoration Plan 68

8.0 REPORT REFERENCES AND BIBLIOGRAPHY 70

9.0 LIST OF ACRONYMS and ABBREVIATIONS..... 73

Appendices

Appendix A: Information Request Letter and Distribution List
Appendix B: Shoreline Jurisdiction Assessment
Appendix C: Photographs
Appendix D: Map Folio
Figure 1a ..... Current Shoreline Management Area: City Map
Figure 1b ..... Current Shoreline Management Area: Detail Map
Figure 1c ..... Proposed Shoreline Management Area: City Map
Figure 1d ..... Proposed Shoreline Management Area: Detail Map
Figure 2 ..... Current Shoreline Management Area Designations
Figure 3 ..... Existing Land Use
Figure 4 ..... Zoning Classifications
Figure 5 ..... Comprehensive Plan Land Use Designations
Figure 6 ..... Sewer and Water Districts
Figure 7 ..... Existing and Proposed Sewerage Facilities
Figure 8 ..... Aquifer Recharge Potential
Figure 9 ..... Stormwater Drainage
Figure 10 ..... Surface Water System with Outfalls
Figure 11 ..... Impervious Surface
Figure 12 ..... Public Access Areas – Existing and Proposed
Figure 13 ..... Natural Resource Conservation Service Soils
Figure 14 ..... Floodplain and Wetland Areas
Figure 15 ..... Geologically Hazardous Areas
Figure 16 ..... WDFW Priority Habitats
Figure 17 ..... Types of Vegetation
Figure 18…… Shoreline Modifications
Figure 19 ..... Ecological Function Assessment

List of Tables Page No.

Table 1. Shoreline Planning Segments. 9
Table 2. Land Use, Zoning, and Shoreline Environments 9
Table 3. Impervious Surfaces 14
Table 4. Big Soos Creek Land Use, Zoning, and Shoreline Environments.....25
Table 5. Jenkins Creek Land Use, Zoning, and Shoreline Environments.....28
Table 6. Pipe Lake Land Use, Zoning, and Shoreline Environments.....33
Table 7. Aquatic herbicides approved for use in lakes requiring NPDES permit coverage through the Washington Department of Ecology. 37
Table 8. Process and Ecological Function Summary for Big Soos Creek in Covington. ...40
Table 9. Ecological Function Summary for Pipe Lake in the City of Covington.....45
Table 10. Ecological Function Summary for Jenkins Creek in the City of Covington. 51

1.0 INTRODUCTION

1.1 BACKGROUND AND PURPOSE

The City of Covington (City) obtained a grant from the Washington Department of Ecology (Ecology) in 2007 to conduct a comprehensive Shoreline Master Program (SMP) update. The first step of the update process is to inventory the City's shorelines as defined by the state's Shoreline Management Act (SMA) (RCW 90.58). The inventory was conducted according to direction provided in the Shoreline Master Program Guidelines and project Scope of Work promulgated by Ecology, and includes areas within current City limits. The shoreline inventory included in this Report describes existing biological and physical conditions. This Report also includes an analysis and characterization of the inventory information, which will serve as the baseline from which future development actions in the shoreline will be measured. The Guidelines require that the City demonstrate that its updated SMP yields "no net loss" in shoreline ecological functions relative to the baseline due to its implementation. Ideally, the SMP in combination with other City and regional efforts will ultimately produce a net improvement in shoreline ecological functions.

A list of potential information sources was compiled and an information request letter was distributed to potential interested parties and agencies that may have relevant information (Appendix A). Collected information was supplemented with other resources such as City documents, scientific literature, personal communications, aerial photographs, internet data, and a brief physical inventory of the City's shorelines.

1.2 SHORELINE JURISDICTION

As defined by the Shoreline Management Act of 1971, shorelines include certain waters of the state plus their associated "shorelands." At a minimum, the waterbodies designated as shorelines of the state are streams whose mean annual flow is 20 cubic feet per second (cfs) or greater and lakes whose area is greater than 20 acres. Shorelands are defined as:

> "those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters which are subject to the provisions of this chapter…Any county or city may determine that portion of a one-hundred-year-floodplain to be included in its master program as long as such portion includes, as a minimum, the floodway and the adjacent land extending landward two hundred feet therefrom… Any city or county may also include in its master program land necessary for buffers for critical areas (RCW 90.58.030)"

In addition, rivers with a mean annual flow of 1,000 cfs or more are considered shorelines of statewide significance.

The City's Shoreline Master Program was first adopted in 1978 (King County Shoreline Master Program), when Covington was located within King County jurisdiction and prior to the City's incorporation. All of Covington's shorelines were designated as Rural Environment.

The City's shoreline boundary has been updated (subject to City Council and Ecology approval) concurrent with this assessment (Figures 1a[1] through 1d). Several changes have been made to the maps based on new information regarding associated wetlands and waterbody size. The most significant change affecting Covington is the extension of Jenkins Creek shoreline jurisdiction farther upstream based on recent United States Geological Survey (USGS) modeling of the upstream limit of mean annual stream flow of 20 cfs.

1.3 STUDY AREA

The City of Covington is located in south King County, and has been incorporated since August 31, 1997. The City is bordered by Kent to the west, Maple Valley to the east, and King County to the north and south. State Route 18 (SR 18) passes through the City from southwest to northeast, and a number of other major arterials criss-cross the City. The City encompasses approximately 5.6 square miles. The City's Potential Annexation Areas (PAAs), all of which do not include any shoreline area, encompass another 0.4 square miles.

The study area for this report includes all land currently within the City's proposed shoreline jurisdiction (Figure 1b), including Big Soos Creek, Jenkins Creek, Pipe Lake, and their associated shorelands. The total area subject to the City's updated SMP is approximately 104.03 acres (0.16 square miles), and encompasses 12,934 lineal feet (2.45 miles) of stream and lakeshore.

1.4 Duwamish/Green River Watershed (WRIA 9)

1.4.1 Geographic Context

Located within Water Resource Inventory Area (WRIA) 9, the Duwamish/Green River is 93 miles long with a drainage area of 566 square miles in King and Pierce Counties. The river headwaters in the Cascade Mountains about 30 miles northeast of Mount Rainier and flows north and west into the Duwamish River before entering Puget Sound at Elliott Bay in Seattle. The Green River watershed is further divided into five discrete sub-watersheds (Exhibit 1). The entire City of Covington is located within the Middle Green River Subwatershed, which includes the Soos Creek basin.

The Soos Creek basin lies in south King County, north and east of the Green River. All of the City of Covington lies within the basin, as well as portions of the Cities of Renton, Maple Valley, and Black Diamond. Portions of unincorporated King County also lie in the basin. The Soos Creek basin consists of the mainstem Big Soos Creek (WRIA #09.0072) with approximately 25 identified tributary streams totaling over 60 lineal miles. The shoreline waters in or bordering the City of Covington include sections of Big Soos Creek, one of its major tributaries, Jenkins Creek (WRIA #09.0087), and Pipe Lake. The subbasin drains an area of approximately 44,800 acres (70 square miles) (Kerwin and Nelson 2000).

[1] **All figures are included in Appendix D at the end of this report.**

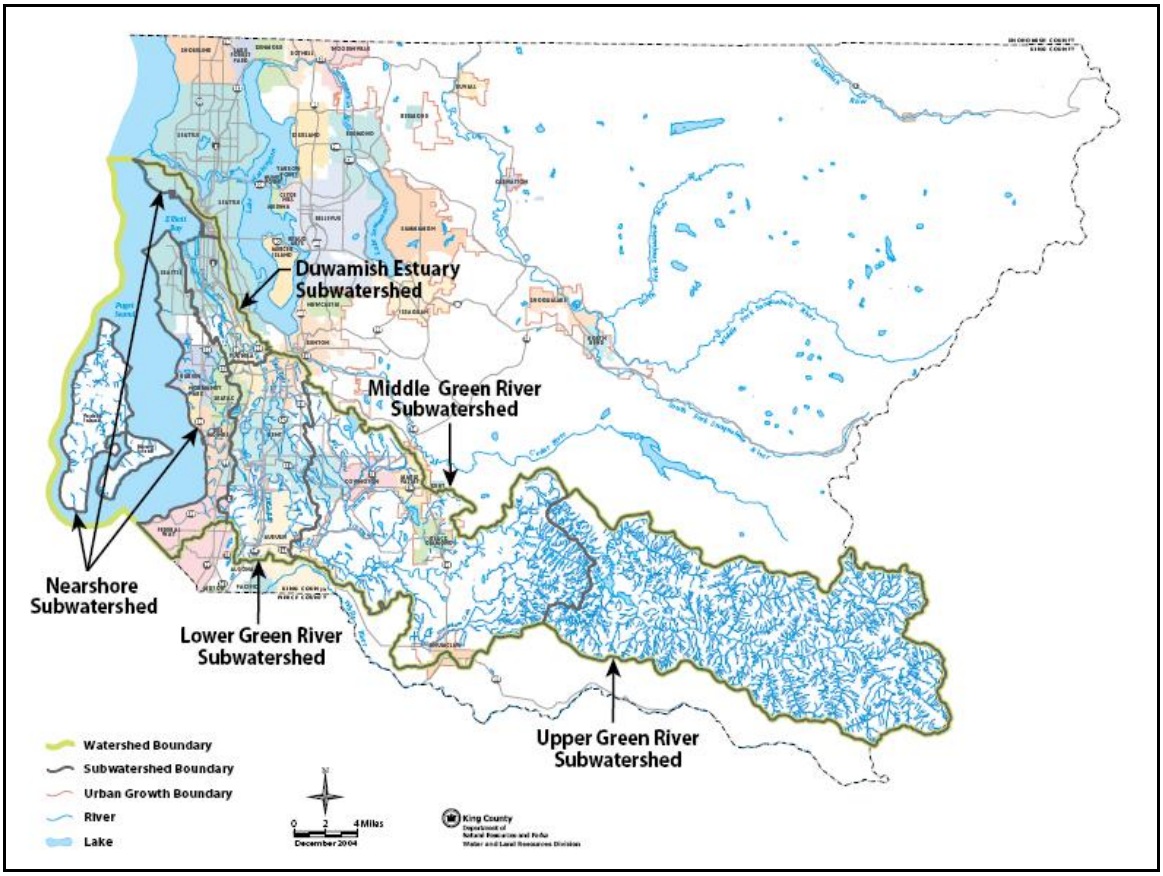

Exhibit 1. Overview of the Green River watershed and its subwatershed boundaries. (http://dnr.metrokc.gov/wlr/watersheds/green/pdf/green-river-watershed-map.pdf)

1.4.2 Historic Geology, Topography, and Drainage Patterns

The underlying geology of the Middle Green River Subwatershed is characterized by Puget Group hard rock (Furstenberg et al. 1996). Landscape characteristics in the Green River basin were heavily influenced by glacial erosion that occurred during the Pleistocene Epoch, from about 1 million years to approximately 12,000 years ago) (Booth 1994; Collins et al. 2003; Collins and Sheikh 2005). During this glaciation, the Puget Lobe of the Cordilleran ice sheet created a number of north-south trending trough-like valleys that are prominent landscape features throughout the Puget Sound region today (Booth 1994, Booth et al. 2003). In lower valley segments of the Puget Lowland (such as in the Lower Green River Subwatershed), these troughs typically have a low gradient with valley bottom widths that are quite broad (3-5 km).

Following the Pleistocene Epoch glacial erosion described above, the Green River valley floor at Kent was part of the prehistoric Duwamish Embayment, an inlet of Puget Sound. Then, around 5,000 years ago, the valley was subjected to the Osceola Mudflow, which swept down from the slopes of Mount Rainier through the valley of the White River. This major geological event covered the lowlands from Enumclaw to approximately 4 miles north of Auburn with mudflow deposits up to 75 feet thick, well into the present Lower Green River sub-watershed (Mullineaux 1970). The lower Green River valley has also been affected by a subsequent series of mid-

Holocene lahars emanating from Mt. Rainier (Dragovich et al. 1994; Zehfuss et al. 2003). The combined effect of these events was that enormous volumes of sediment were deposited in the lower Duwamish River valley, eventually filling in the prehistoric Duwamish Embayment to form a broad lowland valley characterized by meandering river channels and extensive wetlands. The overall length of the valley increased as a consequence, shifting the shoreline approximately 50 km northward from approximately 25 km upstream of Kent to its present location approximately 25 km downstream.

These geologic events and processes affecting the mainstem Green River valley were not prevalent in the tributary Soos Creek basin, however, including those areas now within the City of Covington. The headwaters of Soos Creek originate on a rolling glacial outwash plain, which is high enough above the Green River valley and separated laterally from it sufficiently not to have been particularly affected by the mudflows off of Mount Rainier. The Soos Creek channel along its upper and middle portions is unconfined, has a gradient of less than 0.1 percent, and flows through extensive wetland complexes. Stream flows are generally stable, with little erosive energy, and the channel is described as alternating between "sections of good gravel and sections of swampy channel splits with mud bottoms" (Williams 1975), characteristic of a Palustrine channel type. However, at approximately RM 4.75 (just downstream of Covington), Soos Creek enters a narrow, steep-sided ravine containing long riffles with pools. The channel becomes a moderate gradient, mixed control type, with a gradient of approximately 1.4 percent. Major lakes in the Soos Creek basin include Lake Youngs (a domestic water supply for the City of Seattle), Shadow Lake, Lake Meridian, Lake Sawyer, Lake Morton, Pipe/Lucerne Lake, and Wilderness Lake. These lakes have a combined surface area of approximately 1,370 acres (Wolcott 1973). Downstream of RM 2, the channel gradient decreases again to around 0.5 percent, and Soos Creek has a floodplain channel type that occupies a steep-sided valley. The City of Covington sections of Soos Creek are between approximately river miles 5 and 6).

1.4.3 Major Land Use Changes and Current Shoreline Condition

Overall, the Green River basin has undergone extensive development and numerous hydromodifications. It is one of the most hydrologically altered large river systems in the Puget Sound ecosystem. A combination of historic events has dramatically affected the hydrology of the Duwamish/Green River basin. Foremost among these events were the diversion of the White River in 1906 into the Puyallup River for flood control purposes, followed in 1916 by diversion of the Cedar/Black River into Lake Washington to facilitate navigation through the Ship Canal (Exhibit 2). The Green/Duwamish estuary has been largely eliminated over time with the growth of the City of Seattle and associated waterfront development activities. Over 97 percent of the historic estuary area has been either filled, armored, or dredged, and the lower Duwamish River is now a highly industrial area with few natural habitat features (Kerwin and Nelson 2000). Construction of Tacoma Water's Headworks Diversion Dam in 1911 and the Howard A. Hanson Dam in 1962 have also resulted in major hydrologic flow modifications and water withdrawals in the watershed (Grette and Salo 1986).

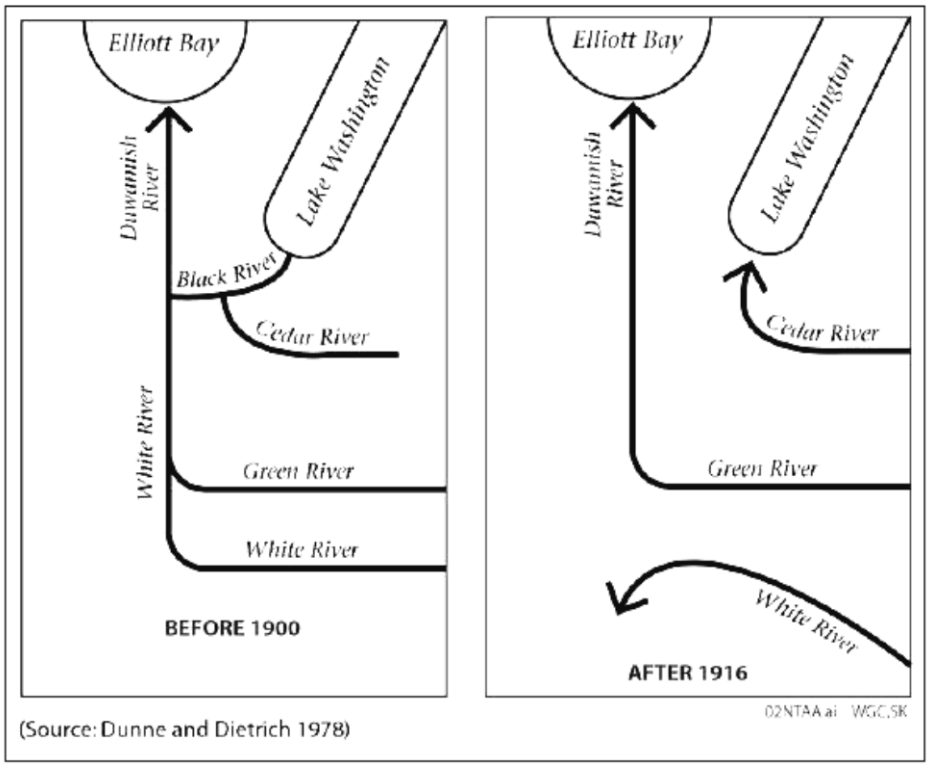

Exhibit 2. Duwamish drainage, before 1900 and after 1916.

In addition to these major events, construction of flood control levees, agricultural development, and urbanization along the Green/Duwamish River valley between Seattle and Auburn has also had a cumulative effect on the flow regime in the Duwamish/Green River watershed. As a result of these alterations, approximately 70 percent of the historic watershed has been diverted out of the Duwamish/Green River basin, and over 90 percent of the historic floodplain has been isolated from the river ecosystem by flood control structures (Kerwin and Nelson 2000). Though these changes related particularly to the diversion of the White River and Green River flow regulation due to Howard A. Hanson Dam are quite striking and have had a significant and marked effect on the basin as a whole, their effects within the Soos Creek basin have been somewhat muted, since these changes have not affected flows in Soos Creek.

Basin-wide changes which have directly and significantly affected the Soos Creek subbasin include the clearing of mature forest vegetation over large areas of the watershed, and increasing amounts of impervious and compacted or hardened surfaces. These have reduced the infiltration capacity of the landscape, thereby increasing total runoff rates and the magnitude and frequency of peak flows in the major tributaries, including Soos Creek. Such peak flow increases have <u>not</u> generally occurred along the Green River mainstem, however, due, again to the construction and operation of Howard A. Hanson Dam and the diversion of the entire White River out of the watershed.

The Soos Creek subbasin is in the process of changing from having a forested, rural character to one which is more heavy urbanized, particularly in those areas within Kent and Covington. Land within in this subbasin has generally been successively converted from old-growth forest to commercial timber production, then to agricultural uses, and more recently to hobby farms and

urban uses. These cumulative changes have had significant and adverse effects with the land along the Kent-Kangley Road becoming the most urbanized. Though the increase in impervious surfaces throughout the basin has contributed somewhat to decreases in summertime low flows and increases in winter flows, the subbasin has an extensive system of interacting lakes, wetlands and infiltrating soils that collectively tend to mute these effects and attenuate peak stream flows (Kerwin and Nelson 2000).

Within the floodplain, the Soos Creek subbasin has one of the largest wetland areas in the Green River basin. Wetland complexes are common throughout the upper plateau of Soos Creek and include open-water, scrub-shrub, forested, emergent marsh, wet meadow and bog wetlands. King County Wetland surveys (King County 1986, 1987a, 1987b) listed over 225 individual wetlands in the Soos Creek subbasin covering approximately 2,076 acres or 4.8 percent of the subbasin area. When combined with the lakes in the system, over 3,436 acres, or 7.7 percent, of the subbasin area are covered with water (Kerwin and Nelson 2000).

1.4.4 ESA Listings

The Green River Watershed is inhabited by three federally listed species of salmonids: 1) chinook salmon of the Puget Sound Evolutionary Significant Unit (ESU), (Reaffirmed as Threatened, U.S. Federal Register, 28 June 2005), 2) bull trout of the Coastal-Puget Sound Distinct Population Segment (DPS), (threatened, U.S. Federal Register, 1 November 1999), and 3) steelhead of the Puget Sound DPS (U.S. Federal Register, 11 May 2007). Puget Sound-Strait of Georgia coho salmon also occur in the basin and are listed as a Species of Concern (U.S. Federal Register, 15 April 2004), indicating that they are under less active consideration for formal listing. An ESU of Pacific salmon is considered to be a distinct population segment (DPS) and thus a “species” under the Endangered Species Act. These three species may occur in City of Covington shoreline areas within the Soos Creek basin portion of the Green River Watershed, though less so for bull trout. Bull trout typically require colder, higher-elevation waters for spawning, but could feed and rear opportunistically in Soos Creek and its tributaries. A single bull trout was reported captured at the Soos Creek State Fish Hatchery (SFH) in 1956 (Beak Consultants 1996).

The Green River Watershed also contains formally designated critical habitat for Puget Sound chinook salmon and Coastal-Puget Sound bull trout. Critical habitat has not yet been proposed or designated for Puget Sound steelhead. Critical habitat for chinook salmon includes the Upper, Middle, and Lower Green River Subwatersheds (Watershed Codes 17110013, 01-03) of the Puget Sound ESU (U.S. Federal Register, 2 September 2005). Specifically included are Big Soos, Jenkins, and Covington Creeks, including those portions within the City. Critical habitat for bull trout includes the Green River mainstem from the mouth to the vicinity of Auburn, but not including the Soos Creek basin or therefore any City of Covington streams (U.S. Federal Register, 26 September 2005). No other federally listed fish species are designated for the Green River Watershed, including the City of Covington or its PAA.

2.0 CURRENT REGULATORY FRAMEWORK SUMMARY

2.1 CITY OF COVINGTON

Upon incorporation, the City of Covington adopted by reference King County's Title 25 Shoreline Master Program to regulate shoreline development in an ecologically sensitive manner (Ordinance No. 32-97). Most of the uses, developments, and activities regulated in the City's SMP are also subject to the City's Comprehensive Plan, the Covington Zoning Code, the International Building Code and various other provisions of city, state and federal laws. An applicant must comply with all applicable laws prior to commencing any use, development, or activity. Covington ensures consistency between the SMP and other City codes, plans and programs by reviewing each for consistency during periodic updates of the City's Comprehensive Plan as required by State statute.

Upon incorporation, Covington also adopted regulations to designate and protect critical areas pursuant to the Washington State Growth Management Act (GMA) (RCW 36.70A). In response to later GMA amendments, the City adopted a revised Critical Areas Code (CAC) in August 2005 consistent with best available science and all other requirements of the GMA. All activities which fall within critical areas and their buffers in the SMA are reviewed under the City's CAO for consistency. If there is a conflict between the CAO and SMP, the regulations that offer the greatest environmental protection apply. After the SMP is updated with appropriate inclusion of SMP-specific critical areas regulations, critical areas within shoreline jurisdiction will be reviewed only under the updated SMP.

In 1997, the City adopted its first Comprehensive Plan pursuant to Growth Management Act requirements and completed a major update of the Covington Comprehensive Plan in 2003. Minor updates to the Comprehensive Plan are made annually through the comprehensive plan amendment process. Major amendments were adopted in the Downtown Plan and Implementation Zoning in 2005. The most recent Comprehensive Plan amendments went into effect in 2007.

No record exists of any shoreline permits being issued since incorporation.

2.2 STATE AND FEDERAL REGULATIONS

State and federal regulations most pertinent to development in the City's shorelines include the federal Endangered Species Act, the federal Clean Water Act, the state Shoreline Management Act, and the State Hydraulic Code. Other relevant federal laws include the National Environmental Policy Act, Anadromous Fish Conservation Act, Clean Air Act, and the Migratory Bird Treaty Act. Other relevant state laws include the Growth Management Act, State Environmental Policy Act, tribal agreements and case law, Watershed Planning Act, Water Resources Act, Salmon Recovery Act, and the Water Quality Protection Act. A variety of agencies (e.g., U.S. Army Corps of Engineers, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, Washington Department of Fish and Wildlife) are involved in implementing these regulations, but review by these agencies of shoreline development in most cases would be triggered by in- or over-water work, discharges of fill or pollutants into the water, or substantial land clearing. Depending on the nature of the

proposed development, state and federal regulations can play an important role in the design and implementation of a shoreline project, ensuring that impacts to shoreline functions and values are avoided, minimized, and/or mitigated. With the comprehensive SMP update, the City will strive to ensure that Covington's SMP regulations are consistent with other agencies' requirements and explore ways to streamline the shoreline permitting process. A summary of some of the key regulations and agency responsibilities follows.

Section 404: Section 404 of the federal Clean Water Act provides the Corps, under the oversight of the U.S. Environmental Protection Agency, with authority to regulate "discharge of dredged or fill material into waters of the United States, including wetlands" (http://www.epa.gov/owow/wetlands/pdf/reg_authority_pr.pdf). The extent of the Corps' authority and the definition of fill have been the subject of considerable legal activity. As applicable to the City of Covington's shoreline jurisdiction, however, it generally means that the Corps must review and approve most activities in streams, Pipe Lake, and wetlands. These activities may include wetland fills, stream and wetland restoration, and culvert installation or replacement, among others. Similar to SEPA requirements, the Corps is interested in avoidance, minimization, restoration, and compensation of impacts.

Federal Endangered Species Act (ESA): Section 9 of the ESA prohibits "take" of listed species. Take has been defined in Section 3 as: "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." The take prohibitions of the ESA apply to everyone, so any action of the City that results in a take of listed fish or wildlife would be a violation of the ESA and exposes the City to risk of lawsuit. Per Section 7 of the ESA, activities with potential to affect federally listed or proposed species and that either require federal approval, receive federal funding, or occur on federal land must be reviewed by the National Marine Fisheries Service (NOAA Fisheries) and/or U.S. Fish and Wildlife Service (USFWS) via a process called "consultation."

Section 401 Water Quality Certification: Section 401 of the federal Clean Water Act allows states to review, condition, and approve or deny certain federal permitted actions that result in discharges to state waters, including wetlands. In Washington, the Department of Ecology is the state agency responsible for conducting that review, with their primary review criteria of ensuring that state water quality standards are met. Actions within streams, lakes or wetlands within the shoreline zone that require a Section 404 permit (see above), will also need to be reviewed by Ecology.

Hydraulic Code: Chapter 77.55 RCW (the Hydraulic Code) gives the Washington Department of Fish and Wildlife (WDFW) the authority to review, condition, and approve or deny "any construction activity that will use, divert, obstruct, or change the bed or flow of state waters." As applicable to the City of Covington's shoreline jurisdiction, however, it generally means that WDFW must review and approve most activities in streams and lakes. These activities may include stream alteration, culvert installation or replacement, pier and bulkhead repair or construction, among others. WDFW can condition projects to avoid, minimize, restore, and compensate adverse impacts.

3.0 ELEMENTS OF THE SHORELINE INVENTORY

For each shoreline (Table 1), the following discussion identifies each of the required inventory elements, sources of information for each element, and provides a City-wide narrative for each element. Shoreline-specific discussions, as needed, are found in Chapter 4.0. Photographs of the various shorelines are included in Appendix C.

Table 1. Shoreline Planning Segments.

Segment	Approximate Length (feet)	Approximate Area (acres)
Big Soos Creek	3,777 feet	53.01 acre
Jenkins Creek	5,321 feet	32.23 acre
Pipe Lake	3,836 feet	18.77 acre
TOTAL	**12,934 feet**	**104.02 acre**

3.1 LAND USE PATTERNS

Land use patterns were derived from GIS mapping of assessor land use data, City zoning classifications, future land use designations from the City's most recent Comprehensive Plan (City of Covington 2003), and from review of aerial photography from 2005 (Figures 3, 4, and 5). Table 2 identifies the relative percentages of existing land uses, zoning classifications, and future land use designations within each planning segment, based on assessor land use codes, current zoning maps, and the future land use map in the City's Comprehensive Plan.

Table 2. Land Use, Zoning, and Shoreline Environments

Shoreline Area	Existing Land Use		Zoning Classification		Comprehensive Plan Designation	
Big Soos Creek	IND MQO SF VAC	4.9% 0.4% 67.6% 27.2%	CD US(R-1)	12.8% 87.2%	I US	13.3% 86.7%
Jenkins Creek	SF UTIL VAC UKN	52.6% 41.6% 2.2% 3.5%	CD I	54.8% 45.2%	CD UTIL R-4	17.1% 45.1% 37.8%
Pipe Lake	CHRC SF VAC UKN	31.8% 55.2% 5.8% 7.2%	R-4	100.0%	OS PUB R-4	4.0% 33.5% 62.5%

Shoreline Area	Existing Land Use		Zoning Classification		Comprehensive Plan Designation	
Total SMA	IND MQO SF VAC UTIL UKN CHRC	2.3% 0.2% 60.2% 24.8% 13.8% 1.9% 6.1%	CD US(R-1) I R-4	24.6% 41.8% 15.2% 18.4%	I US CD UTIL R-4 OS PUB	6.5% 41.9% 5.7% 15.0% 24.0% 0.7% 6.1%

Key:
Existing Land Use
IND = Industrial;
MQO = Mining/Quarry/Ore Processing
SF = Single Family
VAC = Vacant land
UTIL = Public Utility
UKN = Unknown
CHRC = Church/Welfare/Religious Services

Zoning Classifications / Comprehensive Plan Designations
CD = Downtown Commercial Zones (includes)
US (R-1) = Urban Separator
I = Industrial
R-4 = Low Density Residential 4du/acre
OS = Open Space
PUB = Public
UTIL = Public Utility

Existing Land Use

The majority of land use within Covington's three shoreland areas is single-family housing. Each shoreland area, however, differs in the intensity of housing development. For instance, single-family development along Big Soos Creek is very low density with an average density of 0.16 units per acre. One parcel includes a house on 49 acres of land, 25 acres of which falls within shoreline jurisdiction. Housing densities along Jenkins Creek and Pipe Lake are progressively higher with average densities of 1.1 and 2.8 units per acre, respectively. Other types of land uses present within the three shoreland areas differ as well. Approximately 27 percent of Big Soos Creek's shoreland area is undeveloped vacant land. In contrast, 42 percent of Jenkins Creek's shoreland area is occupied by Bonneville Power Administration's Covington substation, and 32 percent of Pipe Lake's shoreland area is located on property containing Camp McCullough, a campground and conference center owned by First Presbyterian Church of Tacoma.

Zoning Classifications and Comprehensive Plan Land Use Designations

Zoning classifications in portions of the shoreline jurisdiction were updated in 2005 with the adoption of the Downtown Plan and Implementation Zoning. Particularly along the eastern banks of Big Soos Creek and the northwestern bank of Jenkins Creek, zoning classifications, rather than Comprehensive Plan Land Use Designations, more specifically reflect the City's current vision for these areas. Forty-two percent of the City's shoreline jurisdiction is comprised of properties zoned as Urban Separator (1 dwelling unit per acre), which run along Big Soos Creek. Downtown Commercial (25 percent) and Industrial zoned properties (15 percent) exist largely along Jenkins Creek. Specifically, the Downtown Commercial area along Jenkins Creek north of Covington Way SE is classified as DN-7B, a sub-district that allows single family residential, townhomes, cottage housing, and small professional medical offices. The City is currently considering a proposal to expand the allowed uses in the DN-7B sub-district to include other types of professional offices with increased height limits. Low Density Residential (4 dwelling units per acre) zoned properties (18 percent) surround Pipe Lake.

Lands along the eastern edge of the Big Soos Creek shoreline jurisdiction are designated for Industrial use in the City's Comprehensive Plan Land Use Map. Along Jenkins Creek, land within the shoreline jurisdiction is designated for Public Utility use southwest of Covington Way SE, and Low Density Residential use, northwest of Covington Way SE. Finally, along Pipe Lake, Camp McCullough is designated as Public Use, the private shoreline tract belonging to homeowner's in the Aqua Vista Estates is designated as Open Space, and the remainder of the Pipe Lake Shoreline in Covington is designated Low Density Residential.

3.2 TRANSPORTATION

Specific transportation facilities are described in greater detail for each shoreline in Chapter 4.0. In general, information about transportation facilities was derived from maps and aerial photographs.

3.3 WASTEWATER AND STORMWATER UTILITIES

There are two primary utilities with the ability to directly and indirectly impact jurisdictional shorelines: wastewater and stormwater. Information about existing and proposed wastewater facilities was drawn from Soos Creek Water and Sewer District's *2005 Sewer Comprehensive Plan*, and district staff. Information about existing and proposed surface water facilities was drawn from the City's stormwater GIS layers, Covington's City Code, and from the City's Public Works department staff. Additional utility information is described in greater detail for each shoreline in Chapter 4.0 and illustrated on Figures 6, 9 and 10.

3.3.1 Wastewater Utilities

Soos Creek Water and Sewer District provides sewer services to the majority of the City of Covington. This includes the southern portion of the Pipe Lake shoreline jurisdiction area, and the northern tip of the Jenkins Creek shoreline jurisdiction area. The Big Soos Creek shoreline jurisdiction area is not located within the mapped Soos Creek Water and Sewer District boundary currently. Existing developed residential areas not served by sewer currently are presumed to have on-site sewage systems, which are regulated by Public Health – Seattle and King County. Excess nutrients can result in algal blooms that use of available oxygen in the water during decomposition, harming fish and other aquatic life. Surface water contamination by microbes also presents a human health hazard if it reaches drinking water and can cause closure of swimming areas.

The District's wastewater is treated by King County Department of Natural Resources and Parks Wastewater Treatment Division's treatment plant in Renton, with deep-water disposal in Puget Sound. Discharges from these plants are regulated by the Washington Department of Ecology under National Pollutant Discharge Elimination System (NPDES) permits, which includes performance standards and monitoring requirements.

Existing and proposed sewerage facilities are illustrated in Figure 7. Shoreline modification projects and any upland development project should locate all lines prior to construction to avoid damaging the lines, incurring biological impacts, during construction. The potential exists for routine repair and maintenance or line failures to result in short-term discharges of sewage into the waterbodies. In addition, any existing failing septic systems can result in groundwater and

surface water degradation through excessive inputs of nutrients (nitrogen and phosphorus) and hazardous microbes.

3.3.2 Stormwater Utilities

The City of Covington adopted surface water regulations "to promote public health, safety and welfare by establishing and operating a comprehensive approach to surface and storm water problems which would reduce flooding, erosion and sedimentation, prevent and mitigate habitat loss, enhance ground water recharge and prevent water quality degradation" (CDC 13.30.030).

Within Covington's shoreline jurisdiction area, two known stormwater outfalls empty directly into Pipe Lake from stormwater pipes running along SE 268th Street and 210th Avenue SE (see Figure 10). The City's Comprehensive Plan (2003) identifies the Camp McCullough property as a possible site for a regional detention and infiltration facility. No known stormwater outfalls empty directly into Big Soos Creek or Jenkins Creek within the shoreline jurisdiction areas. However, several outfalls do exist along these watercourses farther upstream.

The City received its final National Pollutant Discharge Elimination System (NPDES) Phase II permit in January 2007 from Ecology. The NPDES Phase II permit is required to cover the City's stormwater discharges into regulated lakes and streams. Under the conditions of the permit, the City must protect and improve water quality through public education and outreach, detection and elimination of illicit non-stormwater discharges (e.g., spills, illegal dumping, wastewater), management and regulation of construction site runoff, management and regulation of runoff from new development and redevelopment, and pollution prevention and maintenance for municipal operations.

Compliance with the terms of the permit is phased over five years, with full compliance required by 2012. The City currently has various programs to control stormwater pollution through maintenance of public facilities, inspection of private facilities, water quality treatment requirements for new development, source control work with businesses and residents, and spill control and response. Monitoring may be required as part of an illicit discharge detection and elimination program, for certain construction sites, or in waterbodies with a Total Maximum Daily Load (TMDL) Plan for particular pollutants. General water quality monitoring was not required in the first five-year term of the permit; however, the permit asks municipalities to assist in development of a monitoring program that will be implemented during the second five-year permit term. General water quality monitoring concerns include a) stormwater quality, b) effectiveness of best management practices, and c) effectiveness of the stormwater management program.

To date, the City is engaged in planning its strategy for compliance by 2012, and issued a first draft of its *Stormwater Management Plan* in March 2008 (http://www.ci.covington.wa.us/documents/SWMP_First_Draft.pdf). Informational postings have been added to the City's website, and the City conducted an Open House during Public Works Week in 2007. Education and planning efforts will continue in 2008. In 2009, the City will be updating various ordinances to require use of certain practices and stormwater management strategies by new development. In 2010, the City will aggressively review their operations and maintenance practices, and must address any identified problems within one year (Parrish, pers. comm., 5 February 2008).

The City has adopted the *1998 King County Surface Water Design Manual* (KCSWDM), and is working currently with DOE to determine what amendments or revisions may be required to the adopted KCSWDM as part of the NPDES requirements. The purpose of stormwater detention is to reduce flooding of roads and structures, and to reduce damage to stream channels (and associated fish habitat) that results from the more frequent and longer duration peak flows that come from developed watersheds. Discharges into streams can have a significant impact on in-stream habitat complexity, peak flow magnitude and duration, bank stability, substrate composition, and a number of other parameters. The water quality impact of stormwater inputs is also significant. Stormwater runoff carries pesticides, herbicides and fertilizers applied to lawns and sports fields; hydrocarbons and metals from vehicles; and sediments from construction sites, among other things. All of these things can harm fish and wildlife, their habitats, and humans. Per current standards, water quality treatment is required when proposed projects would result in 5,000 square feet or more of new pollution-generating impervious surface (PGIS), or 5,000 square feet or more of contiguous PGIS created through any combination of new and/or replaced impervious surface as part of a redevelopment project, or 43,560 square feet or more of contiguous pollution-generating pervious surface, regardless of whether the system drains to a lake or a stream.

Existing and proposed stormwater facilities are illustrated in Figures 9 and 10.

3.4 IMPERVIOUS SURFACES

Impervious surface is relevant to shoreline functions because of the relationship between impervious surfaces and stormwater runoff. In a number of ways, vegetated areas slow the movement and reduce the quantity of runoff that makes its way into streams and other waterbodies. Increases in impervious surface coverage, and the consequent reduction in soil infiltration, have been correlated with increased velocity, volume and frequency of surface water flows. This hydrologic shift alters sediment and pollutant delivery to streams and other receiving bodies (Booth 1998; Arnold and Gibbons 1996). Increased surface water flows associated with impervious surface coverage of suburban areas has been linked to decreased bank stability and increased erosion (May et al. 1997a). Stream research generally indicates that certain zones of stream quality exist, most notably at about 10% impervious cover, where sensitive stream elements are lost from the system (e.g. Booth, 1991). A second threshold appears to exist at around 20 to 30% impervious cover, where most indicators of stream quality consistently shift to a poor condition, for example, diminished aquatic diversity, water quality, and habitat scores (e.g. May et al 1997a). Rainwater can evaporate off of vegetation without ever reaching the ground, infiltrate into the soils where it is taken up by vegetation and evapotranspirated, infiltrate into the soils to recharge groundwater, or move slowly over the surface or subsurface into a waterbody. Impervious surfaces replace vegetation and speed the movement of runoff into waterbodies while increasing the volume of the runoff, and may pick up pollutants in the process.

Impervious surface data was taken from King County's GIS impervious surface layer created in 2000 and a review of 2005 aerial photographs. Figures below most likely underestimate total impervious surface within the City and shoreline jurisdiction due to the age of the data and limited examination of aerial photos. Impervious surface area is relatively low in the shoreline jurisdictional areas compared to impervious areas in other urban shorelines areas of King County

and the City of Covington as a whole. Approximately 19 percent of the shoreline jurisdictional area is covered with impervious surface compared to 37 percent citywide. The Big Soos Creek shoreline area is largely protected by wetlands and their buffers, and much of the Pipe Lake shoreline area is occupied by a large forested lot with very little development (Camp McCullough). The Jenkins Creek shoreline has the highest level of impervious surface as a result of a Bonneville Power Administration substation along the right bank (facing downstream). Although the shoreline areas within Covington generally have a lower percentage of impervious surfaces (with the exception of the BPA site), development in the larger basins that contribute stormwater runoff to these systems will continue to affect the hydrology and habitat of these waterbodies.

Impervious surfaces within each shoreline area are shown in Table 3 below and illustrated in Figure 11.

Table 3. Impervious Surfaces

Shoreline	Impervious Surface Area (acres)	Total Area	Percent Impervious
Big Soos Creek	6.8	53.0	12.8%
Jenkins Creek	8.3	32.2	25.8%
Pipe Lake	4.7	18.8	24.8%
Total	**19.8**	**104.0**	**19.0%**

3.5 SHORELINE MODIFICATIONS

Shoreline modifications are anthropogenic alterations to natural lake shores, stream and river banks, and nearshore environments, and may include such features as levees, dikes, bridges, road embankments, utility crossings, bulkheads, docks or piers, a variety of armoring types (some associated with fill), and other in-water structures such as boatlifts, boathouses, and moorage covers. These sorts of modifications alter the functions of lake and stream channel edges; change erosion, sediment movement, and channel migration patterns; affect the distribution of aquatic vegetation; alter flow dynamics; impact floodplain processes; and are often accompanied by upland vegetation loss. Information about shoreline modifications was derived from aerial photographs and brief site visits.

In the City of Covington, known shoreline modifications on the two stream systems are associated with road crossings (bridges, culverts), often with armoring just upstream, downstream and below the culvert or bridge. The modifications in Pipe Lake and at the edge of the lake include piers and bulkheading. Known shoreline modifications are described in greater detail for each shoreline in Chapter 4.0.

3.6 EXISTING AND POTENTIAL PUBLIC ACCESS SITES

Information about public shoreline access in the City was drawn from the City's Parks and Recreation and Community Development departments' staff and websites.

Existing public access to shorelines within the shoreline jurisdiction is limited to one open space parcel within the Big Soos Creek shoreline jurisdictional area. Farther upstream, outside of shoreline jurisdiction, Big Soos Creek and Jenkins Creek have major public parks and/or trails that provide physical access to the water for passive enjoyment of the shoreline. Pipe Lake has Camp McCullough and a private park for homeowners in Aqua Vista Estates, both of which provide private access to the lake for boating and swimming. However, public access to Pipe Lake does not exist currently.

Plans for future public shoreline access exist along all three water features in the form of proposed parks, trails, and open space. Existing and potential public access opportunities are described in greater detail for each shoreline in Chapter 4.0 and illustrated on Figure 12.

3.7 CRITICAL AREAS

The inventory of critical areas was based on a wide range of information sources. A complete listing of citations used to compile information on critical areas is included in Section 5.0, References at the end of this study. The City does not have internal critical area data. Therefore, King County GIS data was extracted for this portion of the inventory. Critical areas mapping includes geologically hazardous areas (landslide, erosion and seismic hazards), wetlands, streams, and critical aquifer recharge areas. This information was supplemented with maps or reports obtained from the Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (DNR), Ecology, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. Soils mapped by the Natural Resource Conservation Service (NRCS) are shown on Figures 13. Soil types classified as “hydric” are indicative of wetland soils. The City’s aquifer recharge areas (Figure 8) were identified based largely on NRCS soil information.

Critical areas are described in greater detail for each shoreline in Chapter 4.0 and illustrated on Figures 8, 14, 15 and 16.

3.7.1 Geologically Hazardous Areas

The City of Covington regulations address three types of hazards: landslide, erosion and seismic. They are defined as follows:

> Landslide Hazard Areas: An area subject to severe risk of landslide, such as: (1) An area with a combination of: (a) Slopes steeper than 15 percent of inclination; (b) Impermeable soils, such as silt and clay, frequently interbedded with granular soils, such as sand and gravel; and (c) Springs or ground water seepage; (2) An area that has shown movement during the Holocene epoch, which is from 10,000 years ago to the present, or that is underlain by mass wastage debris from that epoch; (3) An area potentially unstable as a result of rapid stream incision, stream bank erosion or undercutting by wave action; (4) An area that shows evidence of or is at risk from snow avalanches; or (5) An area located on an alluvial fan, presently or potentially subject to inundation by debris flows or deposition of stream-transported sediments (CMC 18.20.680).
>
> Erosion Hazard Areas: An area underlain by soils that is subject to severe erosion when disturbed. These soils include, but are not limited to, those classified as having a severe to very severe erosion hazard according to the United States Department of Agriculture Soil

Conservation Service, the 1973 King County Soils Survey or any subsequent revisions or addition by or to these sources such as any occurrence of river wash ("Rh") and any of the following when the soils occur on slopes inclined at 15 percent or more:

- The Alderwood gravelly sandy loam ("AgD");
- The Alderwood and Kitsap soils ("AkF");
- The Beausite gravelly sandy loam ("BeD" and "BeF");
- The Kitsap silt loam ("KpD");
- The Ovall gravelly loam ("OvD" and "OvF");
- The Ragnar fine sandy loam ("RaD"); and
- The Ragnar-Indianola Association ("RdE"). (CMC 18.20.415)

Seismic Hazard Areas: Those areas in City of Covington subject to severe risk of earthquake damage as a result of soil liquefaction in areas underlain by cohesionless soils of low density and usually in association with a shallow ground water table or of other seismically induced settlement (CMC 18.20.1045).

The following summaries of basic geologic hazard history and risk in the region are excerpted from the King County Office of Emergency Management website: http://www.metrokc.gov/prepare/preparerespond/hazardsdisasters/default.aspx.

Landslides. Although landslides can and do occur in almost any part of the state, geographic King County and the Puget Sound Basin are especially vulnerable due to our urban environment and unique geological conditions. Because of our high population density and the fact that many structures are built either on top of or below bluffs and slopes subject to landslides, more lives are endangered during these land movements and there is a greater potential for damage or destruction to private and public property. Many of the major valleys and shoreline bluffs of Puget Sound are bordered by steeply sloping unconsolidated glacial deposits that are highly susceptible to landslides.

Earthquakes: Earthquakes are described as the sudden release of energy occurring from the collision of crustal plates on the earth's surface or from the fracture of stressed rock formations in that crust. Though it can be said that there are many technical differences in the rocking, rolling, jarring and jolting felt during an earthquake, they can be devastatingly damaging and seriously unnerving.

King County is geographically located in an area known as the Pacific Ring of Fire, a distinctive zone marked by the prevalence of earthquake and volcanic activity. Washington State is framed by the Pacific, North American, and Juan de Fuca plates, which are segments of the earth's crust. A significant number of active fault lines or cracks in the crust have been identified in the central Puget Sound area including Seattle and King County. On an annual

basis, thousands of minor earthquake events occur in the greater Puget Sound region. Most of these earthquakes go unnoticed by local residents since it usually requires a magnitude of 2.5 to 3.0 for a local trembler to be noticed.

Volcanic Eruption. A volcano is a vent through which molten rock escapes to the earth's surface. When pressure from gases within the molten rock becomes too great, an eruption occurs. Eruptions can be quiet or explosive. There may be lava flows, flattened landscapes, poisonous gases, and flying rock and ash. Fresh volcanic ash, made of pulverized rock, can be abrasive, acidic, gritty, gassy and odorous. The acidic gas and ash can cause lung problems for some people and can also damage machinery, including engines and electrical equipment. Volcanic eruptions can be accompanied by other natural hazards, including earthquakes, mudflows (lahars), flash floods, rock falls and landslides, acid rain, fire, and (under special conditions) tsunamis.

Washington state is home to five major active volcanoes: Mount Baker, Glacier Peak, Mount Rainier, Mount St. Helens and Mount Adams. Both Mount Rainier and Mount St. Helens pose potential danger for those living the in the King County region. Residents living on or near the mountain, or in nearby valleys, can be affected by lahars (or mudflows) if an eruption should occur as well as ashfall that could also impact a larger area, depending on wind speed and direction.

The City has mapped landslide, erosion and seismic hazard areas based on King County GIS data. These maps are currently found in Chapter 7, Environmental Element of the Comprehensive Plan. Geologically hazardous areas for each shoreline are discussed further in Chapter 4.0 and identified on Figure 15.

3.7.2 Flood Hazard Areas

"Frequently flooded areas" are those areas within the 100-year floodplain and any other areas subject to flooding (WAC 365-195-090(4)). The City of Covington regulates these areas via its Flood Hazard Area regulations (CMC 18.65.230-275), which are part of Chapter 18.65 Critical Areas.

The City's three flood-prone areas as mapped by the Federal Emergency Management Agency (FEMA) are along Big Soos, Little Soos and Jenkins Creeks. These creeks may, during significant rainfall events, overflow their banks and potentially flood adjacent properties. No reports of Pipe Lake flooding were located, although King County has record of two drainage complaints on waterfront properties. It is likely that these were related to erosion problems occurring during site development or flooding of the cul-de-sac from overwhelmed storm drains.

The following assessment of flood hazards in Covington was excerpted from the Natural Hazard Mitigation Element chapter of the City of Covington Comprehensive Plan (2003).

A large portion of Covington is area that lies in the Soos, Little Soos or Jenkins Creek drainage areas. The broad floodplain of the plateau can be easily inundated by floodwaters. The surface material includes poorly drained, unconsolidated, fine-grained deposits, sand, and gravel. Torrential flood events can introduce large deposits of sand and gravel that assist in the drainage of the otherwise poorly drained soils. The City was most recently affected by

the seasonal flooding of the Soos and Jenkins Creeks in January 1997. However, the devastation brought about by the regional floods of February and November 1996 far surpassed the city's (then County's) normal seasonal flood events, such as that in 1997.

In February 1996, prolonged precipitation accompanied by an early snowmelt caused many rivers and creeks throughout King County watersheds to rise to 100-year flood levels. The Soos and Jenkins Creeks and their tributaries were filled beyond capacity, causing flooding in both rural and urban areas. The confluence of these two streams occurs just South of Covington, where the floodwaters caused significant damage to a large portion of the rural area in unincorporated King County.

Still recovering from the February floods, the City was hit with a major storm on November 10 and 11, 1996. The storm delivered at least 2.8 inches of rain in one night - a weather event that occurs an average of once every 205 years. Many of the rivers and smaller tributaries in the County quickly reached their flood levels, causing both urban and riverine flooding. Although the damage from this event was not as severe as the February floods, it did warrant road closures and the evacuation of homes in the 100-year floodplain. The 1996 floods caused a statewide loss in the millions of dollars.

Major floods have affected the citizens of the City. Although the 1996 floods were devastating to the entire region, the floods of 1861, 1890, and 1964 were larger. All four floods have been estimated to exceed the 100-year or base flood.

The properties in and near the floodplains of Covington are subject to flooding events almost annually. Flooding is most common from November through April, when storms from the Pacific Ocean, 60 miles away, bring intense rainfall to the area. Covington receives about 36 inches of rain on average each year. Most of the rainfall occurs in winter and spring from November to April. This results in high water, particularly in December and January. The larger floods are the result of heavy rains of two-day to five-day durations augmented by snowmelt at a time when the soil is near saturation from previous rains. Frozen topsoil also contributes to the frequency of floods.

Flood hazard areas are discussed further in Chapter 4.0 and identified on Figure 14.

3.7.3 Wetlands

The City's wetlands map was updated in 2002 as part of the 2003 Comprehensive Plan Update, and was based on the King County wetlands inventory, which focuses on larger wetlands within King County. The City conducted a field inventory in 2002 of all wetlands and streams. During that inventory, 32 wetland resources were identified, many of which are associated with Big Soos Creek and Jenkins Creek (Figure 14). It should be noted that wetland boundaries depicted in Figure 14 are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site specific evaluation will be needed to confirm/verify information shown in the figure. Additional wetlands may be found as redevelopment occurs on underdeveloped and undeveloped properties. The vegetation map provided as Figure 17 outlines the wetland vegetation class based on aerial photo interpretation. Soils mapped by the NRCS are shown on Figure 13. Soil types classified as "hydric" are

indicative of wetland soils; two hydric soil types were identified in portions of shoreline jurisdiction in the City limits.

3.7.4 Streams

Information regarding streams tributary to or originating in the shoreline waterbodies was gathered from WDFW's Priority Habitats and Species (PHS) maps and reports (WDFW 2007), WRIA 9 map products (King County DNR 2001), and other agency resources.

3.7.5 Other Fish and Wildlife Habitat Conservation Areas

Fish and Wildlife Habitat

In addition to the shoreline waterbodies themselves, significant fish and wildlife habitats in the City's shorelines are limited to wetlands, riparian areas along the City's small creeks and streams, and within undeveloped or underdeveloped properties adjacent to and within close proximity of Pipe Lake and Urban Separator lands along the western City limits. Otherwise, most of the shoreline areas are altered by residential, public utility, or industrial development. These land uses do provide differing levels of habitat for different species, but those habitat types are not limiting in the watershed and the species served are highly adaptable to urban environments and may be introduced. Mapping of the vegetation types within shoreline jurisdiction provides some indication of the distribution and availability of habitats (Figure 17). Big Soos Creek has the highest percentage of undisturbed vegetation with relatively high wildlife habitat value, followed by Pipe Lake, and finally Jenkins Creek. Habitat conditions of each of the shoreline areas are provided in Chapter 4.0 below.

Special Status Species

Special status species are species that are listed or proposed for listing under the State or Federal Endangered Species Act or that are identified by WDFW as state Priority Species. All game and food fishes, including salmon, trout, and char, are considered to be Priority Species by the WDFW. In addition, Coastal-Puget Sound bull trout are listed as threatened by the USFWS, and Puget Sound chinook salmon and Puget Sound steelhead are listed as threatened by NOAA Fisheries. Specific information on fish occurrence and habitat use within the City was provided by the PHS data (WDFW 2007), *Washington State Salmon and Steelhead Stock Inventory* (SASSI) (WDFW 2002); the *SASSI Bull Trout/Dolly Varden Appendix* (WDFW 1998); the *Catalog of Washington Streams and Salmon Utilization, Volume 1, Puget Sound Region* (Williams et al. 1975); the *Habitat Limiting Factors and Reconnaissance Assessment Report* (Kerwin and Nelson 2000), *The Green/Duwamish and Central Puget Sound Watershed Salmon Habitat Plan* (Green/Duwamish 2005), the *WRIA 9 Strategic Assessment Report – Scientific Foundation for Salmonid Habitat Conservation* (King County 2005), and additional sources as cited in the text.

Although other sensitive species are likely to occur in the City's shoreline areas, according to WDFW, the following special status species are known to occur in one or more of the City of Covington's shorelines:

- Bald Eagles (*Haliaeetus leucocephalus*) (nesting and/or foraging near Jenkins Creek and Pipe Lake)
- Chinook Salmon (*Oncorhynchus tshawytscha*) (Big Soos Creek)

- Coho Salmon (*Oncorhynchus kisutch*) (Big Soos Creek, Jenkins Creek)
- Steelhead (*Oncorhynchus mykiss*) (Big Soos Creek, Jenkins Creek)
- Cutthroat Trout (*Oncorhynchus clarki*) (Big Soos Creek, Jenkins Creek)

Relevant species are described in greater detail for each shoreline in Chapter 4.0. Special status species locations are illustrated in Figure 16.

3.7.6 Critical Aquifer Recharge Areas

The City of Covington has mapped critical aquifer recharge areas (CARAs) and areas of high recharge potential, with data from King County Department of Natural Resources. According to the City's maps (see Figure 8), CARAs or areas of high recharge potential cover virtually the entire City limits. As noted in its critical areas regulations, CARAs are categorized as follows:

1. Category I critical aquifer recharge areas include those mapped areas that Covington has determined are highly susceptible to ground water contamination and that are located within a sole source aquifer or a wellhead protection area;
2. Category II critical aquifer recharge areas include those mapped areas that Covington has determined:
   (a) Have a medium susceptibility to ground water contamination and are located in a sole source aquifer or a wellhead protection area; or
   (b) Are highly susceptible to ground water contamination and are not located in a sole source aquifer or wellhead protection area; and
3. Category III critical aquifer recharge areas include those mapped areas that Covington has determined have low susceptibility to ground water contamination.

3.8 FLOODPLAIN AND CHANNEL MIGRATION ZONE

3.8.1 Floodplain

Floodplains are "synonymous with one hundred-year flood plain and means that land area susceptible to inundation with a one percent chance of being equaled or exceeded in any given year. The limit of this area shall be based upon flood ordinance regulation maps or a reasonable method which meets the objectives of the act" (WAC 173-26-020). The City has mapped the floodplains via data from the Federal Emergency Management Agency (FEMA). Floodplains occur along Big Soos Creek and the southern reaches of Jenkins Creek. Evaluation of aerial photography provided by King County indicates there is minimal development within these floodplain areas, most of which is public utilities, industrial or large-lot single-family land uses.

3.8.2 Channel Migration Zone

According to definitions in Ecology's Shoreline Master Program Guidelines (WAC 173-26-020), "'Channel migration zone (CMZ)' means the area along a river within which the channel(s) can be reasonably predicted to migrate over time as a result of natural and normally occurring hydrological and related processes when considered with the characteristics of the river and its surroundings." In other words, river and stream channels can move, or migrate, laterally across their floodplains. Channel migration can occur gradually, as a river erodes one bank and deposits sediment along a point bar on the other, or can occur as an abrupt shift of the channel to a new location. Such abrupt shifts are called avulsions, which may happen during a single flood

event. The highest rates of channel migration typically occur in zones of rapid sediment deposition, such as where steep rivers flow out of foothills onto flatter floodplains to form an alluvial fan.

Channel migration poses a potential and sometimes underestimated risk to public health and safety. It represents a different type of flood hazard than getting inundated by overbank flow, and can endanger properties and structures located outside of the regulatory floodplain and thus thought to be safe. It may be the least recognized and yet most destructive type of damage that results from flooding. Erosion caused by channel migration can undermine houses, roads, and infrastructure, wash away property, and even threaten lives (http://dnr.metrokc.gov/wlr/flood/migration.html).

In Covington, channel migration zone discussions are relevant for the Shoreline streams, which include only Big Soos and Jenkins Creeks. Channel migration zones do not apply to lakes. No formal channel migration zone study has been done on any of the creeks in the City of Covington. See Chapter 4.0 for a discussion of the channel migration zones of the City's Shoreline streams.

3.9 HISTORICAL OR ARCHAEOLOGICAL SITES

The Washington State Office of Archaeology and Historic Preservation (OAHP) WISAARD website was searched to identify known historical or archaeological features (http://www.oahp.wa.gov/gis/INDEX.CFM). The OAHP does not have record of any historic sites or structures in Covington's shoreline jurisdiction.

Specific accounts and locations of pre-historic resources are more difficult to find, and the sensitivity of such sites to looting and vandalism precludes publication of detailed locations. Internet search results indicate that a village called Soos was located near the confluence of the Green River with Big Soos Creek, outside of City jurisdiction, as recently as the mid-1800s (http://coastsalishmap.org/). The village, which may only have contained two buildings, was occupied during the rainy winter months by a people that called themselves the *skwohp-absh* or Green ('fluctuating') River people (http://coastsalishmap.org/).

Although no other specific records of Native American use of Big Soos Creek, Jenkins Creek, and Pipe Lake were located, the Muckleshoot Indian Tribe's archaeologist is aware of several sites that have been discovered along Big Soos Creek during site development activities (Murphy, pers. comm., 5 February 2008). Anecdotal information from Covington residents provided during the review of this report also indicated that community members may have discovered artifacts of probable Native American origin near shorelines in Covington. Further, there is a moderate to high probability that Big Soos Creek, Jenkins Creek and Pipe Lake were, at a minimum, resource areas for Native American people (Murphy, pers. comm., 5 February 2008). Fish, other wildlife, roots, berries and other foods, some with medicinal value, could have been harvested from the waters and their associated riparian corridors. Marshy areas in associated wetlands and along lake and stream edges could have also been a source of material for basket weaving.

Many projects in Covington's shoreline jurisdiction have the potential to unearth pre-historic artifacts if previously undisturbed soils are graded or excavated. The Shoreline Master Program

should provide clear direction regarding circumstances when a special study may be necessary, and what action to undertake in the event of an unexpected discovery.

3.10 OTHER AREAS OF SPECIAL INTEREST

Areas of special interest not included in the other elements of the inventory, such as rapidly developing waterfronts, eroding shorelines, or other degraded sites with potential for ecological restoration were identified based on the references described above and during the field reconnaissance of the study area.

3.10.1 Water-Oriented Uses

According to Ecology's SMP Guidelines (173-26-020 WAC), "water-oriented use means a use that is water-dependent, water-related, or water-enjoyment, or a combination of such uses." Aside from the one parcel of City owned open space in shoreline jurisdiction, Camp McCullough, and private piers on Pipe Lake, no other water-oriented uses have been identified in shoreline jurisdiction. Park-related water-oriented uses are discussed in Chapter 4.0 under the *Existing and Potential Public Access* headings and private piers are discussed in Chapter 4.0 under the *Shoreline Modifications* headings.

3.10.2 Toxic or Hazardous Waste Sites

Only one hazardous site was identified in Covington on the Washington Department of Ecology's *Hazardous Sites List* (dated February 20, 2008). The site, associated with Northwest Pipeline, has a ranking of 3 on a scale of 1 to 5, with 1 representing the highest risk. The responsible party is performing "independent remedial action," meaning "remedial actions currently underway or completed, but work not verified by Ecology, or sites that have entered Ecology's Voluntary Cleanup Program" (Ecology 2008).

According to the U.S. Environmental Protection Agency's (EPA) Envirofacts Data Warehouse website (http://www.epa.gov/enviro/), four sites (not including the Ecology site discussed above) with a Covington address are listed as being regulated by EPA. None of these sites appear to be in shoreline jurisdiction, and have not been reported as having any toxic discharges. These sites are not authorized to discharge into waters, but they handle hazardous waste.

3.11 OPPORTUNITY AREAS

Ecology's *Shoreline Master Program Guidelines* (173-26 WAC) includes the following definition:

> "Restore," "Restoration" or "ecological restoration" means the reestablishment or upgrading of impaired ecological shoreline processes or functions. This may be accomplished through measures including but not limited to re-vegetation, removal of intrusive shoreline structures and removal or treatment of toxic materials. Restoration does not imply a requirement for returning the shoreline area to aboriginal or pre-European settlement conditions.

Consistent with Ecology's definition, use of the word "restore," or any variations, in this document is not intended to encompass actions that re-establish historic conditions. Instead, it

encompasses a suite of strategies that can be approximately delineated into three categories: creation (of a new resource), restoration (of a converted or substantially degraded resource), and enhancement (of an existing degraded resource).

There is a critical distinction between restoration and mitigation. Mitigation will require applicants whose shoreline proposals will have adverse impacts to complete actions to mitigate those impacts or provide compensation in other ways for losses of ecological function. The City cannot require applicants to go beyond returning the impacted area (or compensating in other ways for lost functions) to the condition it was in at the time of this inventory or as further detailed at the time of application. However, the City can encourage applicants to implement restoration actions that will improve ecological functions relative to the applicant's pre-project condition. As stated in WAC 173-26-201(2)(c):

> It is intended that local government, through the master program, along with other regulatory and nonregulatory programs, contribute to restoration by planning for and fostering restoration and that such restoration occur through a combination of public and private programs and actions. Local government should identify restoration opportunities through the shoreline inventory process and authorize, coordinate and facilitate appropriate publicly and privately initiated restoration projects within their master programs. The goal of this effort is master programs which include planning elements that, when implemented, serve to improve the overall condition of habitat and resources within the shoreline area of each city and county."

The Opportunity Areas discussions in Chapter 4 present options for "restoration" that would improve ecological functions (Figure 19). For example, enhancement of riparian vegetation, reductions or modifications to shoreline hardening, minimization of in- and over-water structures, and improvements to fish passage would each increase one or more ecological parameters of the City's shoreline. These options could be implemented voluntarily by the City or City residents or, depending on specific project details, could be required measures to mitigate adverse impacts of new shoreline projects.

The *Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound Watershed (Water Resource Inventory Area 9)* (Kerwin and Nelson 2000) identifies the following limiting habitat factors and impacts in WRIA 9:

- Dams which block upstream and downstream passage for salmonids, change the natural flow, cause gravel starvation and scouring and reduce amount and size of large woody debris;
- The placement of roads and railroads immediately adjacent to rivers which reduce and degrade riparian habitat and also limit lateral channel migration and new habitat creation
- Reduced spawning habitat and delayed juvenile outmigration in reservoir pools;
- Logging practices which create reduced riparian habitat, fish passage barriers, excessive sedimentation, decreased water quality and altered stream hydrology;
- Reduced forest cover and increased impervious surface from land development which disrupts hydrologic stream flow, decreases water quality and increases sedimentation;

- Urbanization, water diversions, and revetments that are lowering the floodplain and disconnecting off-channel habitats, reducing large woody debris, causing chronic water quality problems and severely reducing riparian habitats and associated functions;
- Introduction of non-native plant and animal species;
- In the Duwamish River portion, dredging, channelization and filling of estuarine mudflats, marshes and swamps and polluted with stormwater and wastewater effluent, and;
- Along Puget Sound, fish passage barriers, reduction of large woody debris, chronic water quality problems, and simplification of the channel and reduction of riparian functions.

Opportunity areas were initially identified during the compilation of the reference materials described above, review of recent aerial photographs, and a brief site visit in December 2007. More detailed descriptions of each segment can be found in Section 4.0 below. Generally, restoration opportunities which have been identified are located outside of areas currently intensively developed for residential use. These include existing City property, portions of Jenkins Creek adjacent to the BPA Substation and Camp McCullough. Many other restoration opportunities exist throughout the City on more intensively developed private property. Opportunities on private property would likely occur only through voluntary means or through re-development proposals.

A Restoration Plan document will be prepared in 2008 as a later phase of the Shoreline Master Program update process, consistent with WAC 173-26-201(2)(f). The Restoration Plan will "include goals, policies and actions for restoration of impaired shoreline ecological functions. These master program provisions should be designed to achieve overall improvements in shoreline ecological functions over time, when compared to the status upon adoption of the master program." The Restoration Plan will mesh the specific potential projects identified in this report, with regional or City-wide efforts and programs of the City, watershed groups, and environmental organizations that contribute or could potentially contribute to improved ecological functions of the shoreline.

4.0 SHORELINE-SPECIFIC CONDITIONS

4.1 BIG SOOS CREEK

The Big Soos Creek basin is approximately 70 square miles and contains three major hydrogeomorphic settings (Kerwin and Nelson 2000). As delineated by Kerwin and Nelson (2000), the City's shoreline segment of Big Soos Creek is in the headwaters on a "on a rolling glacial outwash plain" and has a "very low gradient (>1%) unconfined channel with low velocity flows." Based on a site visit to this segment of Big Soos Creek, the mapping and characterization seem accurate. Big Soos Creek only meets shoreline jurisdictional criteria (minimum 20 cfs mean annual flow) for a short distance (3,755 feet or a little less than ¾ of a mile) within the City limits, ending just upstream of the City limits at SE Kent Kangley Road (SR 516).

4.1.1 Land Use Patterns

Big Soos Creek is surrounded largely by very low-density residential uses and undeveloped lands (Table 4). Other land uses include a small strip of industrial lands along the eastern edge of the shoreline management area and SR 18 bisecting the area roughly in half from northeast to southwest.

Table 4. Big Soos Creek Land Use, Zoning, and Shoreline Environments

Shoreline Area	Existing Land Use		Zoning Classification		Comprehensive Plan Designation		Existing Shoreline Designation
Big Soos Creek	IND MQO SF VAC	4.9% 0.4% 67.6% 27.2%	CD US(R-1)	12.8% 87.2%	I US(R-1)	13.3% 86.7%	Rural

Key:
Existing Land Use
IND = Industrial;
MQO = Mining/Quarry/Ore Processing
SF = Single Family
VAC = Vacant land

Zoning Classifications / Comprehensive Plan Designations
CD = Downtown Commercial
US (R-1) = Urban Separator
I = Industrial

4.1.2 Transportation

SR-18 is the only major highway in shoreline jurisdiction of Big Soos Creek (Figure 1.b). SR-18 crosses Big Soos Creek shoreline jurisdiction south of SE 272nd Street/SR-516 (a principal arterial). The City's *Six Year Transportation Improvement Program 2004-2009* does not identify any transportation projects in the Big Soos Creek shoreline area.

4.1.3 Wastewater and Stormwater Utilities

Wastewater Utilities

Currently no sewer service is provided within the Big Soos Creek shoreline jurisdiction area. A new 24-inch gravity main along SR 18 is planned in the near future according to Soos Creek Water and Sewer District's *2005 Sewer Comprehensive Plan*. Future gravity lines are also proposed southwest of 162nd Place SE north of SR 18 in line with 156th Avenue SE, and along SE 272nd Street. Existing and proposed sewerage facilities are illustrated in Figure 7.

Stormwater Utilities

No known stormwater outfalls empty into Big Soos Creek directly within Covington's shoreline jurisdiction area. However, stormwater outfalls empty into tributaries of Big Soos Creek farther upstream outside of the shoreline jurisdiction area. Existing and proposed stormwater facilities are illustrated in Figures 9 and 10.

4.1.4 Shoreline Modifications

The two SR 18 bridge spans and associated embankment fill, armoring, footings, and pilings are the only known shoreline modifications in the Big Soos Creek shoreline area within City limits. The south span has no pilings, and the stream banks at that location are armored with quarry

spalls. In contrast, the north span includes some concrete piling supports outside of the active channel and banks are lined only with gravelly soils. The floodplain of the creek has been constricted considerably at the SR 18 crossing location.

4.1.5 Existing and Potential Public Access Sites

Currently the only existing public shoreline access within the Big Soos shoreline jurisdictional area is a parcel of open space the City owns just north of SR 18. Public access to Big Soos Creek also exists within Soos Creek Park, which is located outside of the shoreline jurisdictional area in the northern part of the City. The 701.89-acre park acts as an urban separator between Kent and Covington, providing critical habitat and recreation areas. King County operates the regional trail system through the park.

Plans to expand the Soos Creek trail system along both Big and Little Soos Creeks are listed in the Park CIP. Both of these would provide additional opportunities for public access to the shoreline. However, no funding has been dedicated for their development at this time. Existing and potential public access areas within shoreline jurisdiction are shown in Figure 12.

4.1.6 Critical Areas

Geologically Hazardous Areas

City maps do not show any geologically hazardous areas in the Big Soos Creek shoreline. However, landslide-type soils, steep slopes, and seismic hazards flank the creek farther upstream where the channel is more confined (Figure 15).

Flood Hazard Areas

The Big Soos Creek 100-year floodplain falls entirely within the shoreline jurisdiction (see Figure 14). Based on the maps, no built structures are found within the floodplain in City limits. The north edge of shoreline jurisdiction is just south of SE 272nd Street (SR 516/Kent Kangley Road) where the floodplain narrows underneath the roadway. The floodplain also narrows downstream, under SR-18, expands for a short distance immediately downstream of SR-18, and then narrows once more (due to natural topography) as it exits the City limits.

Wetlands

City, King County, and WDFW PHS (2007) wetland mapping all show that much of the Big Soos Creek shoreline within the City limits is wetland (Figure 14). Based on aerial photos and a brief site visit, the wetland is a mix of forested, scrub-shrub and emergent communities (Figure 17). Forested areas contained willows, red alder, and black cottonwood; shrub areas contained spiraea and rose; and emergent areas were dominated by reed canarygrass. Non-native, invasive species include patches of bittersweet nightshade throughout and Himalayan blackberry around the fringes. According to King County iMAP, the wetland is 62 acres in size and is classified as Category I.

Streams

Little Soos Creek, which headwaters in Lake Youngs, joins Big Soos Creek north of SR 18 from the east. Approximately 1,000 lineal feet of Little Soos Creek is within Covington's shoreline jurisdiction because it is located in shorelands, wetlands and floodplain associated with Big Soos

Creek. According to WDFW (2007), the stream is used by chinook and coho salmon, as well as steelhead and cutthroat trout.

Other Fish and Wildlife Habitat Conservation Areas

Priority Habitats: WDFW mapping of Priority Habitat and Species classifies the riparian wetland as a Priority Habitat and maps it as palustrine (WDFW 2007). To be considered a "Priority" wetland, it must have met the following criteria in WDFW's estimation: "Comparatively high fish and wildlife density, high fish and wildlife species diversity, important fish and wildlife breeding habitat, important fish and wildlife seasonal ranges, limited availability, high vulnerability to habitat alteration."

Vegetation mapping by King County Department of Natural Resources shows the stream to be vegetated with primarily "shrub" and "young deciduous" (Kerwin and Nelson 2000). DNR's vegetation maps do not distinguish between upland and wetland vegetation types. Vegetation mapping conducted as part of this study and based on aerial photograph interpretation shows that the Big Soos Creek shoreline includes relatively large areas of forested and wetland habitats (Figure 17). These habitat types provide a variety of opportunities for foraging, nesting, breeding and denning to a large variety of wildlife, including birds, amphibians, reptiles, and mammals. Some areas identified as "urban landscape" (which includes impervious surfaces and buildings) are present, and a few areas of "residential landscape."

Priority Species: The only Priority species identified in this section of Big Soos Creek are fish, including: chinook and coho salmon, steelhead, and resident cutthroat trout (WDFW 2007). At the time of the December 2007 site visit, coho salmon were observed on redds from the SR 516 crossing just upstream from the City's designated shoreline area. A great blue heron colony is mapped farther upstream outside of shoreline jurisdiction.

4.1.7 Floodplain and Channel Migration Zone

The Big Soos Creek 100-year floodplain and floodway are encompassed by shoreline jurisdiction and extend only a short distance beyond the wetland edge. The floodway is almost completely within the mapped wetland edge. Based on the maps, some industrial and small residential structures are found within the floodplain or floodway between SR 516 and SR 18. The floodplain narrows under SR 18 due to the road embankment fill and then expands again to the south. At present, the channel is free to migrate within the valley bottom, except as constricted and confined downstream by the SR 18 crossing and upstream by the SR 516 crossing.

4.1.8 Opportunity Areas

The only known shoreline modifications along the Big Soos Creek shoreline area within the City limits occur at the SR 18 crossing where the flood plain is constricted by road embankment fill and the streambanks at the south span are armored with quarry spalls (the banks of the north span are lined only with gravelly soils). However, vegetation on private properties east of the stream just south of SR 516, now cleared and used as pasture, could be enhanced primarily with native shrubby vegetation to improve buffer function. It might also be possible to include a limited number of native trees in this area, particularly conifer species such as Douglas-fir and western red cedar, though the presence of a major BPA power transmission line over the area would limit the use and placement of such trees.

Placement of additional in-stream large woody debris would also serve to enhance in-stream fish habitat. In-stream woody debris is present, but is primarily derived from the smaller willow and other deciduous trees which presently predominate within the floodplain. Beavers are active throughout the area and have utilized much of this material to construct a number of dams of various sizes and in various states of repair. Fish habitat along Big Soos Creek in the area would benefit from the placement of various configurations of larger, longer-lasting conifer logs to scour substantive pools and provide complex cover habitat for fish within those pools.

4.2 JENKINS CREEK

4.2.1 Land Use Patterns

Currently, over half of the shoreland area surrounding Jenkins Creek (53 percent) is in low density residential uses averaging 1.2 units per acre (Table 5). Another 42 percent is in public utility use by the Bonneville Power Administration's Covington substation, and the remaining six percent are undeveloped or unknown.

Table 5. Jenkins Creek Land Use, Zoning, and Shoreline Environments

Shoreline Area	Existing Land Use		Zoning Classification		Comprehensive Plan Designation		Existing Shoreline Designation
Jenkins Creek	SF UTIL VAC UKN	52.6% 41.6% 2.2% 3.5%	CD I	54.8% 45.2%	CD UTIL R-4	17.1% 45.1% 37.8%	Rural

Key:
Existing Land Use
SF = Single Family
VAC = Vacant land
UTIL = Public Utility
UKN = Unknown

Zoning Classifications / Comprehensive Plan Designations
CD = Downtown Commercial
I = Industrial
R-4 = Low Density Residential 4du/acre
UTIL = Public Utility

4.2.2 Transportation

Covington Way SE crosses shoreline jurisdiction of Jenkins Creek just southeast of SE Wax Rd outside the City limits (King County jurisdiction), while SE Wax Road runs parallel to Jenkins Creek along 60 percent of the shoreline jurisdiction area just outside it to the north. The current long-range plan includes a project for SE Wax Road between SE 272nd Street and Covington Way in the year 2022. The project would consist of widening the existing 2-lane roadway to urban arterial standards. This would include five vehicle lanes, two 5-foot bike lanes, a landscaped center median, two 8-foot sidewalks, and two 5-foot planter strips for a total right-of-way width of 100 feet. Turn pockets would also be installed for access to side streets, and all overhead utilities would be placed underground. Currently, the City is in the process of evaluating the plan, which may result in a change in the timing of the project.

4.2.3 Wastewater and Stormwater Utilities

Wastewater Utilities

Currently an 18-inch force main runs along SE Wax Road to Covington Elementary School. Some properties south of SE Wax Road adjacent to the line are served by this force main. Future gravity lines are proposed in the near future for properties southwest of Covington Elementary School, as well as a future lift station at the corner of SE Wax Road and Covington Way SE (LS 28C). Existing and proposed sewerage facilities are illustrated in Figure 7.

Stormwater Utilities

Within Covington's shoreline jurisdiction area, no known stormwater outfalls empty into Jenkins Creek directly. However, stormwater outfalls empty into Jenkins Creek further upstream outside of the shoreline jurisdiction. Stormwater discharges to the Creek may occur where SE Covington Way crosses the Creek. Existing and proposed stormwater facilities are illustrated in Figures 9 and 10.

4.2.4 Shoreline Modifications

A review of aerial photography suggests that the Jenkins Creek channel bordering the Bonneville Power Administration (BPA) substation has been straightened. This suspicion is confirmed by a report titled *Lower Jenkins Creek Salmonid Fish Habitat Inventory and Recommended Improvement Projects* (The Watershed Company 1991), prepared in conjunction with the *Covington Master Drainage Plan* (R.W. Beck and Associates 1991). According to that report, the creek was indeed rerouted and narrowed along the border of the substation site, presumably to prevent bank erosion and flooding and to accommodate construction by providing a large contiguous construction area. Jenkins Creek was realigned to flow through a straightened channel paralleling the fence along the southeast substation boundary. The soils at depth as exposed along this alignment are naturally quite gravelly, and it appears that a coarse gravel substrate was provided to the new stream channel simply by exposing these gravelly soils during the course of excavating the new channel. The new channel was cut to a depth of 5 to 7 feet below the Covington Way SE crossing, deepening to 15 to 20 feet extending downstream, and then moderating in depth approaching the railroad crossing just outside of the City limits. Channel widths ranged from approximately 15-35 feet, narrower upstream widening approaching the downstream end. Federal law prohibits access to this site, so current stream conditions along this stretch have not been confirmed.

Just upstream of the Bonneville Power Administration site, the stream passes through a three-bay concrete box culvert under Covington Way SE. A short distance below this crossing is a low, rock-and-mortar weir followed by relatively steep cascades over a cobble and boulder substrate. According to the *Soos Creek Basin Plan Salmonid Habitat Improvement Study* (King County 1990), the weir was constructed to prevent channel downcutting at the bridge site and eliminate the risk of exposing the footings. It was also implied that this weir raised the channel profile at that location and resulted in an enlargement of the riparian wetlands extending upstream of the roadway. The feature was recommended for modification to improve fish passage by the County report, stating that the correction of man-caused fish passage problems were of relative high priority in basin planning and that it would be a high visibility project with significant demonstration project potential. However, The Watershed Company (1991) placed this potential

project at a lower priority since it does not constitute a fish migration barrier. There are no other known shoreline modifications along Jenkins Creek within City limits.

4.2.5 Existing and Potential Public Access Sites

Existing

Public shoreline access to Jenkins Creek exists currently within Jenkins Creek Park and Jenkins Creek trail, both of which are located further upstream outside of the shoreline jurisdictional area. Jenkins Creek Park was transferred from King County to the City in 2003. The 23-acre park features walking trails and natural areas within the park. A portion of Jenkins Creek trail has been developed further upstream north of SE 262nd. When completed, the trail will connect the Soos Creek Trail in the southwest and the Lake Wilderness Trail in the northeast.

Two open space parcels within and adjacent to the City provide additional opportunities for accessing Jenkins Creek. The first is a small parcel located outside the shoreline jurisdiction area to the north. The second is a larger parcel, located in King County, directly adjacent to the city limits.

Potential

Potential future projects that would provide additional opportunities for shoreline access within the SMA of Jenkins Creek are identified in the Park CIP. They include development of South Covington Park, and expansion of Jenkins Creek and 191st Place SE trails. South Covington Park would be located directly adjacent to Jenkins Creek and accessible from SE Wax Road. In addition to featuring playfields for softball and soccer, the park would tie in to the proposed Jenkins Creek Trail. The 191st Place SE trail would cross Jenkins Creek at Covington Way SE. Both of these projects would provide additional opportunities for public access to the shoreline. However, no funding has been dedicated for their development at this time. Existing and potential public access areas within the shoreline jurisdiction area are shown in Figure 12.

4.2.6 Critical Areas

Geologically Hazardous Areas

City maps do not show any geologically hazardous areas in the Jenkins Creek shoreline jurisdiction. However, landslide-type soils and steep slopes are located to the southeast, outside of shoreline jurisdiction (Figure 15).

Flood Hazard Areas

The mapped Jenkins Creek 100-year floodplain is almost fully contained within shoreline jurisdiction, extending beyond shoreline jurisdiction on a portion of the Bonneville Power Administration site and on a few of the residential properties east of Covington Way SE (see Figure 14). In Jenkins Creek shoreline jurisdiction, there are approximately 19 single-family lots within the mapped floodplain, and approximately five of those lots appear to have residences and outbuildings at least partially in the floodplain. There are several structures and facilities associated with the Bonneville Power Administration within shoreline jurisdiction along the north side of the creek. As mentioned above, large floods exceed the mapped floodplain boundary, possibly affecting the additional four single-family lots in shoreline jurisdiction. However, anecdotal information from a shoreline resident provided during the review of this

report indicated that Jenkins Creek seldom overflows its banks on the NW side, and that properties on the NW side of Jenkins Creek did not sustain any appreciable flood damage during the storms of November and February 1996.

Wetlands

City, King County, and WDFW PHS (2007) wetland mapping all show that much of the Jenkins Creek shoreline on the parcels northeast of Covington Way SE and south of Wax Road within the City limits is wetland (Figure 14). Based on aerial photos and a brief site visit, the wetland is forested with red alder, black cottonwood and willow (Figure 17). According to King County iMAP, the wetland is more than 65 acres in size and is classified as Category II.

Streams

No mapped or known streams discharge into the Jenkins Creek shoreline within City limits. There are several small tributaries that feed into the creek farther upstream and one (Cranmar Creek) feeds into the creek just outside jurisdiction from the City of Kent watershed area to the south.

Other Fish and Wildlife Habitat Conservation Areas

Priority Habitats: WDFW mapping of Priority Habitat and Species classifies the riparian wetland upstream of Covington Way SE as a Priority Habitat and maps it as palustrine (WDFW 2007). To be considered a "Priority" wetland, it must have met the following criteria in WDFW's estimation: "Comparatively high fish and wildlife density, high fish and wildlife species diversity, important fish and wildlife breeding habitat, important fish and wildlife seasonal ranges, limited availability, high vulnerability to habitat alteration." This forested wetland provides a variety of opportunities for foraging, nesting, and breeding to a large variety of wildlife, including birds, amphibians, reptiles, and mammals. Outside of this Priority forested wetland upstream of Covington Way SE, the vegetation is characterized by "residential landscape" (Figure 17).

The sideslopes of the relocated Jenkins Creek channel along the BPA substation are well-vegetated with a good variety of native vegetation, but the vegetation does not extend far beyond the top of the cut sideslopes on either side, with the barren substation grounds occupying the northwest side and an area of grasses, Scotch broom, and weeds growing in sandy soils along the railroad tracks to the southeast (Figure 17). Well-vegetated buffers range up to about 30 feet wide on each side. Species include red alder, bigleaf maple, black cottonwood, Douglas-fir, willow, ninebark, salmonberry, rose, red-osier dogwood, ferns, and spiraea. Invasive species include bittersweet nightshade and Himalayan blackberry (The Watershed Company 1991).

Priority Species: The only Priority species identified in this section of Jenkins Creek are fish species, including: chinook and coho salmon, steelhead, and resident cutthroat trout (WDFW 2007). The streambed gravels occurring along the lower portion of the straightened channel bordering the BPA substation are well-suited for the spawning of salmon and trout, with a gradient allowing for the formation of short spawning riffles between longer pools. A bald eagle nest is mapped farther upstream outside of shoreline jurisdiction.

4.2.7 Floodplain and Channel Migration Zone

The Jenkins Creek 100-year floodplain extends beyond shoreline jurisdiction along the Bonneville Power Administration properties and along a few properties just to the northeast of Covington Way SE and south of Wax Road. There is no identified floodway along Jenkins Creek. As previously mentioned, based on the maps there are several structures and facilities associated with the Bonneville Power Administration within the floodplain. In addition, there are a few residential structures as well. The floodplain is generally the same size along the shoreline corridor.

4.2.8 Opportunity Areas

According to The Watershed Company (1991), the primary salmonid fish habitat deficiencies along the straightened Jenkins Creek channel section bordering the BPA substation are its lack of meandering and its lack of large woody in-stream structure. Well-defined, diverse pools are also lacking, but would be formed and maintained by large woody debris placement. Since trees will not be allowed to grow to maturity beneath two power line crossings, precluding the recruitment of large wood naturally at those locations, the benefits of placing such wood are all the more important. Meandering would also assist pool formation, but may not be feasible to reestablish because it would involve a major earth-moving project and disturb existing vegetation. Though native vegetation density and diversity is good along the immediate stream channel, a wider vegetated buffer would also be beneficial. Vegetation along this stretch of the creek on both banks could be supplemented in order to develop such a wider functioning buffer of native trees and shrubs.

Upstream of Covington Way SE, Jenkins Creek is in little need of improvement. The creek there flows through an extensive, forested wetland area, with fairly wide, dense, and functional buffers. Tree species include western red cedar, hemlock, Sitka spruce, cottonwood, and alder. Non-wetland trees survive by growing on relatively well-drained hummocks within the midst of the wetlands. The understory includes ninebark, elderberry, red osier dogwood, devil's club, vine maple, willow, salmonberry, skunk cabbage, horsetail, spiraea, sedges, and various ferns. The stream gradient is low, with typically split or braided channel sections and a substrate of gravel in-filled with sand. In contrast to the reach downstream of Covington Way SE, large woody debris is fairly common in the channel, helping to form split channel sections and braids. It also contributes to pool formation and complexity and provides cover, though scour is limited by low stream gradient and energy. The low gradient and resulting sandy substrate also preclude this reach from functioning as good spawning habitat for salmonid fish. However, the complexity, dense vegetation, and abundance of woody cover make it excellent rearing habitat. (The Watershed Company 1991).

4.3 PIPE LAKE

Pipe Lake is an oligotrophic - mesotrophic (low to moderate productivity) lake in one of the headwater areas of the Jenkins Creek sub basin. Water quality is reportedly excellent (King County 2007). The Pipe Lake watershed area is 313 acres, over half of which is located within the City of Maple Valley, and is connected to Lake Lucerne by a narrow channel on the northeast corner. Pipe Lake feeds into Lake Lucerne, which eventually feeds into a tributary of Jenkins Creek approximately one-half mile to the north of Lake Lucerne. There are no visible inflows

into either lake. Pipe Lake itself is approximately 52 acres and has a maximum depth of approximately 65 feet and a mean depth of 27 feet.

Although there are no public parks or boat launches located on the lake within City limits, there are a number of docks that are owned and maintained by private homeowners associations located along the lake. There is also a boat launch and dock along the western shore of the lake that is associated with Camp McCullough (First Presbyterian Church of Tacoma). This parcel has 800 feet of natural shoreline and is the last remaining underdeveloped site along the Lake. Motorized boats on Pipe Lake are prohibited.

4.3.1 Land Use Patterns

Currently, over half of the shorelands surrounding Pipe Lake (53 percent) are in low-density residential uses (Table 6). Camp McCullough comprises another 32 percent and the remaining 13 percent are undeveloped or unknown.

Table 6. Pipe Lake Land Use, Zoning, and Shoreline Environments

Shoreline Segment	Existing Land Use		Zoning Classification		Comprehensive Plan Designation		Existing Shoreline Designation
Pipe Lake	CHRC SF VAC UKN	31.8% 55.2% 5.8% 7.2%	R-4	100%	OS PUB R-4	4.0% 33.5% 62.5%	Rural

Key:
Existing Land Use
CHRC = Church/Welfare/Religious Services
SF = Single Family
VAC = Vacant land
UKN = Unknown

Zoning Classifications / Comprehensive Plan Designations
OS = Open Space
PUB = Public
R-4 = Low Density Residential 4du/acre

4.3.2 Transportation

Adjacent to Pipe Lake there are a few minor local access roads that are within shoreline jurisdiction; however, these are used primarily by local residents and are not major commuting corridors. Otherwise, roadways are limited to minor drives that each provide access off of these roads to a few homes or businesses.

4.3.3 Wastewater and Stormwater Utilities

Wastewater Utilities

Currently 10-inch and 16-inch gravity and low pressure facilities exist along portions of Pipe Lake. Future gravity facilities along the western shore of Pipe Lake would be installed at time of new development. Existing and proposed sewerage facilities are illustrated in Figure 7.

Stormwater Utilities

Two known stormwater outfalls empty directly into Pipe Lake from stormwater pipes running along SE 268th Street and 210th Avenue SE. Existing and proposed stormwater facilities are illustrated in Figures 9 and 10.

4.3.4 Shoreline Modifications

The most common shoreline modifications on Pipe Lake are anthropogenic alterations to the natural lake edge, and primarily include a variety of armoring types (some associated with fill), piers, and other in-water structures such as boatlifts, boathouses, and moorage covers. These sorts of modifications alter the function of the lake edge, change erosion and sediment movement patterns, affect the distribution of aquatic vegetation, and are often accompanied by upland vegetation loss. Mapping of shoreline armoring and piers was not conducted as part of this study.

Shoreline armoring can have many justifications, but often the intent of bulkheads is to:

- protect shoreline property by reducing wave impacts and decreasing erosion,
- increase or maintain lawn areas, and/or
- coordinate style of neighboring shoreline properties.

According to aerial photos and a brief site visit, there is very minimal shoreline armoring along the lake within City limits. In fact, based on aerial photos and site visits, more than 80 percent of the lake within the City's jurisdiction is natural shoreline. The largest stretch of natural shoreline is located along the western shore (800 feet). This shoreline is owned by Camp McCullough (First Presbyterian Church of Tacoma).

There are approximately 30 piers (some may be obscured by trees in the aerial photo) in Covington's Pipe Lake shoreline, and at least five small swimming platforms. Most of the piers are less than 60 feet long. The longest pier is located at Camp McCullough, and is approximately 100 feet long. There are 34 parcels on Covington's Pipe Lake shoreline, indicating that there is potential for an increase of approximately four more piers. Digital layers of piers in Pipe Lake are not available, so detailed statistical analyses of pier length and area were not generated. Total overwater cover and number of structures are relevant to ecological function assessment. Total overwater cover is an indication of the amount of lake surface that is shaded, which can impact growth of aquatic vegetation and subsequently the food chain as a whole. The number of structures is relevant as it indicates the number of artificial objects that that can alter fish behavior and species interactions.

4.3.5 Existing and Potential Public Access Sites

Existing

Currently public access to Pipe Lake does not exist, neither within the City of Covington, nor within the City of Maple Valley, which contains the other half of Pipe Lake. However, two privately owned areas provide private shoreline access to Pipe Lake. The largest of them is Camp McCullough, a 40-acre campground and conference center owned by First Presbyterian Church (FPC) of Tacoma. It includes cabins, a ballfield, a basketball court, swings, picnic tables, a lodge, a floating dock, and a swimming area. The campground overlooks Pipe Lake. The other private shoreline area is a small parcel located on the south side of Pipe Lake. It provides private access to Pipe Lake on the south shore for homeowners in Aqua Vista Estates.

Potential

The City identified Camp McCullough as a desirable property to acquire for future development of a public park in their Park CIP. However, no funding has been dedicated for acquisition or development at this time**.** Preliminary plans for a park in this location noted in the Park CIP include parking, natural features, an arboretum, restrooms, picnic facilities, multi-use ball fields, concessions, canoe, bike and peddle boat rentals, limited tent and camper camp sites, and a lodge with multi-purpose rooms available for rental functions such as weddings, retreats, and small conferences. At this time, current informal discussions among City staff indicate the desire to potentially acquire a portion of the property near the southwest corner of Pipe Lake at the western terminus of SE 268th Street for public shoreline access.

4.3.6 Critical Areas

Geologically Hazardous Areas

According to GIS data, there are no known erosion, landslide or seismic hazard areas mapped around the lake (see Figure 15). An erosion hazard area is identified just to the east of Lake Lucerne in Maple Valley.

Flood Hazard Areas

Pipe Lake does not have a mapped flood hazard area.

Wetlands

There are no known wetland systems adjacent to Pipe Lake (Figure 14). According to aerial photos, there is one very small Category IV wetland located to the west of the lake (outside of shoreline jurisdiction) on the Camp McCullough property. This has not been field verified.

Streams

There are no streams which flow into or out of Pipe Lake within Covington's shoreline jurisdiction. However, Lake Lucerne in Maple Valley drains northward to Jenkins Creek.

Other Fish and Wildlife Habitat Conservation Areas

Priority Habitats: Land cover mapping by King County Department of Natural Resources (2001) shows the lake to be primarily "mixed forest" along the western shoreline and "mixed urban/low-density" along the south and north shorelines. Vegetation mapping conducted as part of this study and based on aerial photograph interpretation is generally consistent with DNR's 2001 mapping (Figure 17). The western shore is still primarily mixed forest, with a small residential inclusion. The nearshore area on the Camp McCullough parcel includes abundant downed wood in the water, which provides perches for birds, cover for fish, and basking sites for turtles. The remainder of the Pipe Lake shoreline is "residential landscape" (including residences, lawn, ornamental vegetation).

Priority Species: A bald eagle nest is mapped south of Pipe Lake south of Maple Valley's shoreline jurisdiction. No priority fish species are known to occur in Pipe Lake. However, Chad Jackson, a fisheries biologist at WDFW, speculated that cutthroat trout may be present and possibly rainbow trout if stocked by lake residents (pers. comm., 13 March 2008). Based on fish presence in nearby lakes, Pipe Lake is likely to contain "a mixture of warm water species like

bass, panfish (bluegill, pumpkinseed, crappie), perch, and bullhead catfish" (Jackson, pers. comm., 13 March 2008).

4.3.7 Lake Aquatic Invasive Species

Noxious weeds of Washington State are non-native, invasive plants defined by law as a plant that when established is highly destructive, competitive, or difficult to control by cultural or chemical practices (RCW 17.10). These plants have been introduced intentionally and unintentionally by human actions. Most of these species were brought in without any natural enemies, such as insects or diseases, to help keep their populations in check. As a result, these plants can often multiply rapidly (Ecology and Washington State Department of Agriculture 2004). The most common invasive plant to impact Pipe Lake in recent years is hydrilla (*Hydrilla verticillata*). According to reports, fragrant water lily and yellow flag iris also grow in the lake. Eurasian milfoil was found in the lake in 1994, but has since been eradicated due to management activities dedicated to hydrilla infestation (King County DNR 2004).

Impacts: The introduction of any non-native species has an effect on native species and habitats, although it is often difficult to predict those effects. However, there is a growing number of non-native aquatic plant and animal species whose current or potential impacts on native species, and habitats are known to be significant. Potential threats may be evidenced by the degree of negative impact these species have upon the environment, human health, industry and the economy (WDFW 2001). Potential negative impacts related to invasive species investigation include:

- loss of biodiversity;
- threaten ESA-listed species such as salmon;
- alterations in nutrient cycling pathways;
- decreased habitat value of infested waters;
- decreased water quality;
- decreased recreational opportunities;
- increased safety concerns for swimmers; and
- decrease in property values.

Control: The Washington Department of Fish and Wildlife has set guidelines for aquatic plant control and removal in the pamphlet *Aquatic Plants and Fish*.[1] This serves as the Hydraulic Project Approval (HPA) for any project that is conducted solely for the removal or control of such aquatic noxious weeds, provided that the project is carried out as described in the pamphlet. Mechanical and physical means of removal and control of aquatic noxious weeds are discussed in the pamphlet (more information can be found on WDFW's website). Mechanical and physical methods of removal discussed in the *Aquatic Plants and Fish* pamphlet include hand pulling, hand tools, bottom barrier, weed roller, mechanical cutters, and harvesters. Some mechanical methods may require an individual HPA. If the project calls for any use of herbicides, additional permits are required through Ecology.

[1] [1] The online version of the Aquatic Plants and Fish pamphlet is for informational purposes only and copies of it do not satisfy the requirement to have a copy of the Aquatic Plants and Fish pamphlet on the job site when conducting aquatic plant control operations. An official copy must be obtained from WDFW.

Ecology currently issues coverage for aquatic herbicide use under the National Pollutant Discharge Elimination System (NPDES) permit to qualified applicants. The applicant must be a licensed pesticide applicator (WAC 16-228-1545) in the state of Washington and have an aquatic endorsement (WAC 16-228-1545 3[t]). The applicant must agree to comply with all requirements of the permit, including posting public notices, adhering to timing restrictions, complying with the specific application restrictions for each herbicide product, conducting monitoring, performing sampling and analytical procedures, and reporting and recordkeeping (Ecology 2006).

As of 2006, there are seven aquatic herbicides approved for the management of noxious aquatic plants in lakes, rivers, and streams. The characteristics and recommended usage of these herbicides are summarized in Table 7.

Table 7. Aquatic herbicides approved for use in lakes requiring NPDES permit coverage through the Washington Department of Ecology.

Aquatic Herbicide Name	Type of Herbicide	Targeted Species and Recommended Usage
Glyphosate	Systemic broad spectrum, non-selective herbicide	Floating plants, not submerged plants
Fluridone	Broad spectrum, slow-acting systemic herbicide	Eurasian watermilfoil and Brazilian elodea
2,4-Dichlorophenoxyacetic acid, dimethyl-amine salt	Liquid formulation; fast-acting, systemic, selective herbicide	Selective to Eurasian watermilfoil and Brazilian elodea
Endothall - Dipotassium Salt	Fast-acting, non-selective contact herbicide	Short term (one season) control of a variety of aquatic plants
Diquat	Fast-acting, non-selective contact herbicide	Short term (one season) control of a variety of submersed aquatic plants
Triclopyr	Fast-acting, systemic, selective herbicide	Selective to Eurasian watermilfoil
Imazapyr	Systemic broad spectrum, slow-acting herbicide	Floating plants, not submerged plants
All aquatic herbicides may only be used by an approved licensed herbicide applicator (Ecology; http://www.ecy.wa.gov/programs/wq/plants/management/aqua028.html)		

Depending on the herbicide used, it may take several days to weeks or several treatments during a growing season before the herbicide controls or kills treated plants. Rapid-acting herbicides like endothall and diquat may cause low oxygen conditions to develop as plants decompose. Low oxygen can cause fish kills. Additional information about invasive aquatic plants and methods of control can be found in the Water Quality section of Ecology's website.

There is often a fine line between whether or not control is biologically necessary or justifiable. Depending on the method of control chosen, there could be disturbance of the substrate, reduction in benthic invertebrates (which are an important food source), and increased risk of spread of the invasive species to other areas. Depending on the condition of the sediments, substrate disturbance can result in acute, although temporary, increases in turbidity and may re-introduce pollutants bound to the sediments back into the water column. In addition, reductions

in aquatic vegetation, whether native or non-native, reduce primary productivity, which is the foundation of the lake food chain. This could result in reduced fish production at the top of the food chain (Kahler et al. 2000). However, control of invasive aquatic vegetation may be biologically justifiable where the plants are so dense that dissolved oxygen (DO) levels fall to suboptimal or even lethal levels (2-4 mg/L). DO levels drop below dense surface mats because light is blocked to the submerged aquatic vegetation which produces the majority of the oxygen to the water column. Much of the oxygen produced by the surface mats of vegetation is lost to the atmosphere. Decomposition of submerged dead material also depletes the water column of oxygen. In addition, dense vegetation can reduce wave action at the surface, which would otherwise help oxygenate the water. Reduced wave action can also contribute to increased water temperature, as the cooler water from deep areas does not flush the warmer, vegetated shallow areas. Warmer water holds less oxygen than cold water.

Brief History of Hydrilla: Hydrilla, native to Africa, Australia and Asia, is considered to be one of the most invasive aquatic species in the County. First introduced in the 1950s in Florida through the aquarium trade, hydrilla quickly spread throughout the southeastern states and eventually reached the western states and northward to Washington. According to DNA analysis, the hydrilla species in Washington is likely from Korea.

Hydrilla, found primarily in the nearshore zone, spreads through fragmentation, tubers, turions, and seeds and is very difficult to eradicate. The plant forms dense mats that clog lakes, rivers, canals, and chokes native aquatic vegetation. These plants can grow and inch a day and can decrease dissolved oxygen by inhibiting water mixing areas, increasing the water temperature by absorbing sunlight, creating mosquito breeding areas, and negatively affecting recreational activities such as swimming, fishing, and boating. When the plant dies it becomes a food source for bacteria that consume the plant and use oxygen in the process, which reduces dissolved oxygen. The die-off of hydrilla also releases nutrients to the water that can cause algal growth and related water quality problems (King County DNR 2004).

City Conditions: The only known infestation of hydrilla in Washington was found in Pipe and Lucerne Lakes in 1994. Listed as a Class A noxious weed by the Washington State Administrative Code (WAC 16-750), hydrilla requires immediate eradication efforts in order to reduce and eliminate the potential of infestation of other waters of the county and state. Because the two lakes are private, the risk of spreading the species from outside boats is minimal (King County DNR 2004).

Beginning in 1995, King County began an extensive eradication effort to remove the hydrilla infestation. The herbicide Sonar (active ingredient fluridone) was applied at 10 parts per billion in both Pipe and Lucerne Lakes during eight weeks in the summer. This application proved to be successful, although this treatment would not entirely remove the tuber banks. In order to remove the tubers, the project was extended to 2000 (King County DNR 2006).

A slight setback occurred during a legal battle in Oregon (Headwaters Inc. vs. Talent Irrigation District), which questioned whether aquatic herbicides were pollutants. From this case in 2001, it was decided by the Ninth Circuit Court of Appeals that herbicides were, in fact, to be considered as pollutants and be held to standards of the National Pollution Discharge Elimination System (NPDES) permitting requirements, required by the Clean Water Act. Because of this

decision, the County had to temporarily discontinue herbicide treatment during the summer of 2001 while the State drafted appropriate permits (King County DNR 2006).

Hand-pulling was the only method permitted during between the summer of 2001 and 2002 while permits were drafted. Once Ecology had completed drafting the NPDES permits, the County chose to continue hand-pulling plants. However, in the fall of 2002, a large re-growth of hydrilla was found and spot-treated with Endothall granular herbicide. Upon review of California's successful eradication techniques of hydrilla, the County chose to implement their control program. This included treating the areas with fluridone for three years after the first survey that finds no plants in a specific location. Beginning in 2002, a series of granular applications were applied coupled with snorkel surveys. County staff monitored the progress over several years, creating maps that identified where remaining hydrilla stands were located (King County DNR 2006).

As of a press release issued in November 2007, no hydrilla plants were found in Pipe Lake. In 2003, there were 470 plants in both Pipe Lake and Lake Lucerne. It was eradicated in Lake Lucerne in 2004. In Pipe Lake, only two plants were found in 2006 and none in 2007. The County plans to treat the lake with herbicide for two more years and will monitor for another five years beyond the treatment completion (King County DNR 2007).

4.3.9 Opportunity Areas

Based on a November 2007 site visit, most of the lake edge within Covington jurisdiction remains in a "natural" (not armored) state (approximately 80 percent). The largest stretch of natural shoreline is located along the western shore (800 feet) and is owned by Camp McCullough (First Presbyterian Church of Tacoma). Habitat along this stretch of shoreline is primarily mixed upland forest (Douglas fir, sword fern).

Single-family residences with either natural shoreline, grass lawns up to the shoreline edge, or small bulkhead armorments and piers, flank the remainder of the shoreline. Some of these areas could be further enhanced by encouraging private homeowners to implement bulkhead removal and shoreline enhancement projects (including installation of native riparian vegetation) and replace deteriorating piers. Most of the single-family residences along the lake are within Maple Valley's shoreline jurisdiction, so efforts should be coordinated with residents of both cities.

5.0 ANALYSIS of ECOLOGICAL FUNCTIONS and ECOSYSTEM WIDE PROCESSES

Ecological processes and functions of the City of Covington's shorelines are summarized in Tables 8 through 10, below, and illustrated on Figure 19. The tables are organized around the Department of Ecology's list of processes and functions for streams and lakes, and qualitatively outline function levels. The level categories are: Low, Low/Moderate, Moderate, Moderate/High, and High. Points are assigned to each level, and then are averaged for each of the four major processes. Finally, the process average scores are averaged to reach a final function score that is identified at the bottom of each table and illustrated on Figure 19. Jenkins Creek and Pipe Lake each have two very distinct conditions which are broken out as "reaches" and described below; Big Soos Creek did not have sufficiently distinct breaks in character to

warrant reach delineation. As appropriate, the reaches are separately analyzed in Tables 14 and 15. As a result of this functions analysis, Big Soos Creek was rated at Moderate (average score of 2.9), Pipe Lake Reach 1 rated as Moderate/High (average score of 3.9), Pipe Lake Reach 2 rated as Low (average score of 1.4), Jenkins Creek Reach 1 rated as Low/Moderate (average score of 2.4), and Jenkins Creek Reach 2 rated as High (average score of 4.6).

5.1 BIG SOOS CREEK

Table 8. Process and Ecological Function Summary for Big Soos Creek in Covington.

Process	Function Performance	Score[1]
Hydrologic		
Storage of water and sediment	MODERATE: The creek still flows through fairly wide wetland flood plain along much of its length in and near the City, typically vegetated with willows and other scrub-shrub vegetation. During high flows, the creek is still able to spread out across its flood plain, and so the flood plain is still able to store and attenuate flood flows and trap and store fine sediments. These fine sediments are incorporated into the flood plain topsoil to nourish vegetative growth, in turn supporting wildlife habitat. Beaver dams at some locations aid in keeping the creek connected with its flood plain. In contrast to the Green River in and near Kent, the flood plain of Big Soos Creek has gone largely un-diked and unconstrained. Wetland and flood plain regulations have helped to keep the flood plain relatively undeveloped, and thus able to better carry out its natural hydrologic and habitat functions.	3
Transport of water and sediment	MODERATE: Deforestation and urbanization throughout the basin have increased stream flows, flow volatility, erosion, and sedimentation. As for most streams in the region, the stream channel and flood plain have formed in response to a lower flow and sediment regime and are not entirely suited to carry the increased flows and sediment loadings experienced. For example, bank erosion is typically a response to higher flows as the channel enlarges and widens to accommodate higher flows.	3
Attenuating flow energy	MODERATE: As mentioned above, some sections of broad floodplain remain which are characterized as scrub-shrub wetlands. These are effective at attenuating streamflow energy during flood events. However, the recruitment of woody debris, especially large woody debris, is impaired due to clearing and the small size of the streambank trees remaining. To its benefit, the basin includes a system of lakes, large wetland areas, and naturally infiltrative recessional outwash soils which all serve to dampen and moderate stream flow fluctuations. Still, the decrease in channel roughness brought on by a reduction in accumulated woody debris and bank vegetation has reduced the stream channel's ability to absorb and dissipate stream flow energy.	3
Developing pools, riffles, and gravel bars	MODERATE: Reduction in roughness elements such as primary log jams and a narrowing of the flood plain in some areas has resulted in a simpler channel form which is less conducive to the formation and maintenance of the basic habitat elements, including pools riffles, and gravel point bars. Some pools have been formed in and near the City by beaver activity.	3

Process	Function Performance	Score[1]
Removing excess nutrients and toxic compounds	MODERATE: Remaining broad floodplain areas provide a competent biofiltration function. However upland shoreline areas and developed, former flood plain areas now functioning essentially as upland are more often a source of nutrients and toxic compounds than a sink, due to lawn and landscaping runoff (pesticides, fertilizers, herbicides) and road runoff (hydrocarbons, metals). Segments of Big Soos Creek are also currently listed on the State's 303(d) list as Category 5 waters for fecal coliform.	3
Recruitment and transport of LWD and other organic material	LOW/MODERATE: Streambank forest vegetation, particularly large trees, has been reduced, reducing the recruitment of large logs and some other vegetative material as well. The size of the remaining trees along the creek are typically small, such as the stands of willow lining the banks even where the floodplain is relatively intact, so opportunities for recruiting really large wood are reduced. Furthermore, channel migration has been curtailed by development in places, primarily the major road crossings of SR 18 and SR 516. Laterally migrating channels recruit the forest materials in their paths and also recruit and recycle riverbank gravels laid down along previous channel alignments. However smaller woody debris such as the smaller trunks, limbs, and leaf litter derived from locally dense stands of streamside and flood plain willows are readily available and recruited in good to moderate quantities.	2
	Average Hydrologic Score	**2.8**
Vegetation		
Temperature regulation	LOW/MODERATE: Well-vegetated banks and buffers improve shading conditions, in turn benefiting both temperature and dissolved oxygen. Segments of Big Soos Creek are currently listed on the State's 303(d) list as Category 5 waters for dissolved oxygen. Low density and small size of shoreline vegetation greatly reduces the level of shading afforded the creek. However, smaller vegetation is needed to provide shade to a narrower creek as opposed to a wider river.	2
Water quality improvement	MODERATE: Where wide flood plain areas remain and are densely vegetated with willows, grasses, emergent vegetation, and other riparian vegetation types, an effective level of biofiltration can still occur. However, urbanizing areas in the basin are dominated by roads and other impervious surfaces, lawns, and landscaping, and lack densely vegetated buffers of sufficient width. These urban areas are sources, rather than sinks, of water quality contaminants such as fertilizers, herbicides, pesticides, hydrocarbons, metals, and eroded soils. Segments of Big Soos Creek are currently listed on the State's 303(d) list as Category 5 waters for fecal coliform.	3
Slowing riverbank erosion; bank stabilization	MODERATE: The dense grasses and shrubby vegetation such as willows that line much of the Soos Creek banks are fairly effective at stabilizing soils and slowing the rate of erosion. However, the function of slowing the rate of bank erosion formerly provided by bank vegetation has now been taken over by artificial armoring in some areas, such as at the road crossings. Prior to settlement and clearing, the creek was lined with mature, mixed-forest communities.	3
Attenuation of flow	LOW/MODERATE: (As stated above), the decrease in channel	2

Process	Function Performance	Score[1]
energy	roughness due to a reduction in accumulated woody debris, and reduction in bank vegetation has reduced the channel's ability to absorb and dissipate stream flow energy.	
Sediment removal	MODERATE: As stated above, remaining densely-vegetated floodplain areas are effective filters for the removal and retention of fine sediments.	3
Provision of LWD and organic matter	LOW/MODERATE: Streambank vegetation now includes primarily only smaller tree sizes, so there is little opportunity for the recruitment of truly large woody debris. There is considerably better opportunity for the recruitment of small woody debris, leaf litter, etc. that would contribute to a decomposition-based food chain.	2
	Average Vegetation Score	**2.5**
Hyporheic		
Removing excess nutrients and toxic compounds	MODERATE/HIGH: The Soos creek basin is dominated by highly infiltrative, glacial outwash soils which provide for a high degree of interaction between ground and surface waters. Stream flows supplement shallow groundwater or hyporheic flows and vice versa, thereby increasing the proportion of flow which routinely flows in and out of the zone to be filtered in the process. Furthermore, the hyporheic zone also provides some nutrient and toxic compound removal when water from the developed floodplain and uplands infiltrates into the permeable soils instead of running off of the surface. Though overall water quality parameters show mixed results and include specific problem areas (see previous discussions), water quality is likely improved due to its filtration as groundwater prior to entering stream flow.	4
Water storage and maintenance of base flows	MODERATE/HIGH: The combined presence of headwater lakes, large wetland areas, and highly infiltrative and interactive soils throughout the Soos Creek basin provides a high level of water storage which is available for the support of stream base flows. Hyporheic zone functioning with respect to water storage is enhanced due to the high degree of interactivity between the creek and its flood plain and supporting aquifers. Such water stored in the hyporheic zone is available to supplement dry season, low stream flows.	4
Support of vegetation	MODERATE: While the interaction between Soos Creek and its hyporheic zone is generally quite good, the gravelly outwash soils that tend to be present in the hyporheic zone and throughout the basin can be so well-draining and poor at wicking water upward that plants growing above these gravelly soils can be deprived of water even when an active water table is only a few feet below the surface. The few prairie areas present in Western Washington tend to form on such gravelly outwash soils, as occurs near Yelm, because these soils are too well-drained to support forest vegetation. However, any landscaping vegetation within the shoreline zone is/would be supported by irrigation water and precipitation rather than by hyporheic water storage.	3
Sediment storage	MODERATE/HIGH: Good interaction between the hyporheic zone and stream flows allows good potential for filtration of interflow and hyporheic flow, and thereby sediment storage. If sediment loading is too high, however, gravels of the hyporheic zone could become clogged, their sediment storage capacity used up, and	4

Process	Function Performance	Score[1]
	the overall functioning of the hyporheic zone impaired.	
	Average Hyporheic Score	**3.75**
Habitat		
Physical space and conditions for life history	LOW/MODERATE: Habitat in and along Soos Creek has been reduced in quality, quantity, and complexity compared to its original condition. The vegetative community is now much sparser and with a much lower level of accumulated downed wood and snags, resulting in fewer places for various wildlife species to find cover or suitable nesting and rearing sites. The diminishment of dense shoreline vegetation is a limiting factor for terrestrial species' (birds, mammals, amphibians) use of the shoreline, since cover, food, nesting sites, travel corridors, etc. are absent. Within the channel itself, fewer log jams and less wood overall similarly results in less available protective cover, and diminishes the creation of pool/riffle sequences as well. Some beaver dams along the course of the creek have helped to maintain the abundance of in-channel wood, however. A reduction in side channels and backwaters has reduced the amount of valuable edge habitat available, and further reduced overall complexity. Shallow, low-energy aquatic areas provide critical rearing, foraging, and refuge habitat for amphibians and juvenile fish, particularly salmonids. Bank armoring has reduced the amount of low-energy shallow-water environment, creating deeper, higher-velocity water that is inhospitable to small fish and amphibians, as well as to emergent vegetation.	2
Food production and delivery	MODERATE: Food production from developed floodplain and upland areas is limited by a reduction in native seed- and fruit-bearing vegetation. Not only does such vegetation provide food directly for terrestrial wildlife, but it is a source of insects and other organic matter that drop into the water and provide food, either directly or indirectly, for fish and other aquatic life. The historic, but now reduced, emergent wetland areas that were associated with side channels, backwaters, and extensive floodplain wetlands also provided productive foraging areas for juvenile fish, small mammals, wading birds, and waterfowl.	3
	Average Habitat Score	**2.5**
AVERAGE BIG SOOS CREEK SCORE	**2.9 (3) = Moderate**	

[1] Low = 1, Low/Moderate = 2, Moderate = 3, Moderate/High = 4, High = 5

5.1.1 Hydrologic

The Soos Creek subbasin is in the process of changing from being rural and forested to being heavily urbanized (particularly in the western areas). The subbasin has an extensive system of interacting lakes, wetlands and gravelly, infiltrating soils that collectively attenuate peak stream flows. In the 1980s, Soos Creek discharged about 8 to10 cfs to the Green River during the summer (Metro 1988) and 400 cfs during one-year event high flows (King County 1990). The Soos Creek Basin Plan provides detailed subcatchment peak flow tables and maps for various future and existing conditions HSPF modeling.

Existing flow-related problems occur in the upper reaches of the creek which are subject to low stream flows, both natural and anthropogenic. In 1990, it was predicted that stream flows would increase by an average factor of 1.8 under build-out conditions. However, some areas were expected to have stream flows increase to 3.5 times the 1985 levels (King County 1990). These higher flow increases would be in areas that have highly infiltratable soils that are converted to urban areas with impervious surfaces (Kerwin and Nelson 2000).

Soos Creek is one of the largest tributaries to the Green River and its hydrologic regime is dominated by winter rain events, with low flows occurring in the late summer. The topography in typified by rolling hills formed on glacial deposits. Lakes and wetlands in the headwaters of the basin help sustain stream flows by slowly releasing groundwater during the summer months. The primary impacts on the hydrology of Soos Creek include stormwater runoff, urban development and consumptive water use. The effects of urbanization and groundwater withdrawals have reduced summer low flows, which may delay the upstream migration of adult chinook salmon (Kerwin and Nelson 2000). The increased sediment delivery to alluvial fans and low gradient reaches of the Green River, in combination with the decrease in low flows impedes adult chinook attempting to migrate upstream into Soos Creek and other tributaries.

Dense stands of young trees or shrubs are sufficient to provide good sediment filtration where the riparian zone is at least 150 feet wide. Approximately 45 percent of the existing riparian zone along Soos Creek provides good sediment filtration. Elsewhere roads, development, or other contributing activities near the stream reduce the ability of riparian area to filter fine sediment (Kerwin and Nelson 2000).

5.1.2 Shoreline Vegetation

Streambank and riparian vegetation is important for maintaining temperature, removing excessive nutrients and toxic compounds, sediment removal, bank and channel stabilization, attenuation of flow energy, and provision of large woody debris and other organic matter. Though shrubby willow and similar types of vegetation occur along the City's shoreline reaches of Soos Creek, little mature native vegetation remains in the riparian zone along the creek. Basin-wide, there is still an intact riparian zone supporting native tree species between RM 1.5 and 2.8, and patches of native deciduous trees also occur elsewhere along the lower six miles of the creek. However, these trees are generally small. The remainder of the riparian zone is composed primarily of shrubs or grass. Development and roads limit the riparian zone width in many cases (Kerwin and Nelson 2000).

5.1.3 Hyporheic Functions

Surface water rights and claims in the Soos Creek basin amount to approximately 27 cfs, and are predominantly for irrigation and small multiple domestic systems (Culhane et al. 1996). Groundwater withdrawals represent the largest water source in the major Green River tributary basins, including Soos Creek. Apparent declines in summer stream flow have been identified for the Soos Creek basin, likely in response to increased urbanization, groundwater withdrawals, and changes in precipitation (WDOE 1995). The average seven-day low flows in Soos Creek have decreased significantly between 1968 and 1993 (Kerwin and Nelson), with declining trends in the average seven-day low flows detected for all years between 1968 to 1993 (Culhane 1995). The likely causes for these instream flow declines include a combination of decreased

precipitation 1993 (Culhane 1995), increases in the percentage of impervious surfaces associated with urbanization, and increased groundwater withdrawal.

Potable water wells that produce less than 5,000 gallons per day do not require a water right. It is not known how many of these wells are present in the subbasin and what their cumulative impacts might be. Information in the Ground Water Management Plan (SKCGWAC 1989) and studies conducted by the USGS indicate that groundwater withdrawals from the Covington Upland have adversely impacted streamflow in Soos Creek. The mean annual streamflow in Soos Creek decreased about 14 percent and the low mean monthly flow decreased about 33 percent during the time period from 1967 to 1992. However, precipitation as measured at Palmer (located in unincorporated King County just east of Covington) decreased only 5 percent during that same period, indicating that the declines cannot be attributed to decreases in precipitation alone. More likely, the decreases are also caused by a combination of ground water removal and increases in the percentage of impervious surfaces (Culhane 1995 in Kerwin and Nelson 2000).

5.1.4 Habitat

Because existing stands of riparian trees (where present) are small, LWD recruitment is currently considered poor all along Soos Creek. Bank stability, shade, and organic matter recruitment are also considered poor along approximately 65 percent to 80 percent of Soos Creek (overall, not just in the City) because of development that extends to within 75 feet of the channel and the small size of trees in the riparian zone. Summer low flow discharges are also decreasing (see *hydrology* above), which limits available rearing production for species of salmonids that require over-summer residency (Kerwin and Nelson 2000).

5.2 PIPE LAKE

Pipe Lake was broken into two major reaches for purposes of the function assessment. Reach 1 consists of the Camp McCullough property on the west shore, which is mostly forested with relatively little shoreline development. Reach 2 consists of the single-family residential areas on the north and south shores, which include varying levels of shoreline armoring, sparse riparian vegetation, and typically a pier.

Table 9. Ecological Function Summary for Pipe Lake in the City of Covington.

Function	Performance	Score[1]
Hydrologic		
Storing water and sediment	The lake itself, of course, provides excellent water and sediment storage functions. By definition, a lake consists of stored water, and sediments tend to settle out and become deposited in such low-energy, quiet-water areas. However, the uplands surrounding the lake within Shoreline jurisdiction can have very different water and sediment storage capacities and functions depending on soils conditions and level of development: **Reach 1:** MODERATE/HIGH: Much of the upland surrounding the lake within the Camp McCullough property within Covington Shoreline jurisdiction is well-	Reach 1: 4 Reach 2: 2

Function	Performance	Score[1]
	vegetated and less intensely undeveloped, resulting in relatively good water and sediment storage functions. There is little impervious surface or landscaped area to interfere with infiltration of precipitation. **Reach 2:** LOW/MODERATE: In contrast, the more highly developed, upland residential areas surrounding the lake within Shoreline jurisdiction have somewhat lower water and sediment storage functionality. Impervious surfaces and compact managed lawns interfere with infiltration of precipitation and rapidly send water "downstream." Wetlands and other natural water and sediment storage features are generally lacking.	
Attenuating wave energy	**Reach 1:** MODERATE/HIGH: The lake is not large enough to generate very large waves. Furthermore, prevailing winds from the south or west would blow generally offshore along Reach 1, and so would have little fetch over which to generate waves. The banks along Reach 1 are heavily vegetated with accumulated overhanging and fallen vegetation which protect the lake somewhat from wind energy. .Boat wakes are not believed to be a major factor, especially since gas-powered engines are prohibited. **Reach 2:** LOW/MODERATE: Bulkheading and other shoreline modifications, have replaced native vegetation and natural woody debris along Reach 2 sections as the features in place to attenuate wave energy. Some of the non-bulkheaded sections have lawn right down to the water's edge. Shoreline erosion is not known to be a serious problem on either the Reach 1 or Reach 2 portions of the lake.	Reach 1: 4 Reach 2: 2
Removing excess nutrients and toxic compounds	**Reach 1:** MODERATE/HIGH Relatively little impervious surface area, including road and roof areas, feeds into the lake from Reach 1. Immediately surrounding areas are not urbanized, so runoff carries less in the way of hydrocarbons, metals, sediments, and other pollutants to the lake than would be the case from roads, parking lots, and other developed areas. **Reach 2:** LOW: The lake is surrounded by intensively landscaped lakefront homes. These upland shoreline areas are more often a source of nutrients and toxic compounds than forested areas, via lawn treatment runoff (pesticides, fertilizers, herbicides) and road runoff (hydrocarbons, metals).	Reach 1: 4 Reach 2: 1
Recruitment of LWD and other organic material	**Reach 1:** LOW/MODERATE: A more actively eroding lakeshore could recruit the large woody debris and other organic materials present along the shore areas to the lake. However, lakeshore erosion along the Reach 1 portion of Pipe Lake is quite slow and does not appear to be a primary factor in the recruitment of wood or other organic materials to the lake. Some wood, however, does fall into the lake as trees die or due to wind, but these are not hydrologic factors. **Reach 2:** LOW: Dense residential development and other	Reach 1: 2 Reach 2: 1

Function	Performance	Score[1]
	upland modifications restrict the ability of the lake to recruit LWD and organic material. Much of the lakeshore forest vegetation has been removed and so is not available for recruitment.	
	Average Hydrologic Score	**Reach 1: 3.5** **Reach 2: 1.5**
Vegetation		
Temperature regulation	**Reach 1:** HIGH: The combination of a forested and east-facing lake shore provides good shading to the lake surface, particularly during the warmer, afternoon hours. As the forest trees mature further, shade may increase somewhat. **Reach 2:** LOW: Sparse shoreline vegetation greatly reduces potential for some shading of the shallow-water nearshore area. Vegetation is less effective at shading south- and west-facing shoreline areas due to midday sun from the south and afternoon sun from the west.	Reach 1: 5 Reach 2: 1
Water quality improvement	**Reach 1:** MODERATE/HIGH: The Reach 1 portion of the lake is generally lined by maturing mixed forest areas. The lake is also shallow in areas with thick beds of macrophytic vegetation which would also tend to retain and/or break down toxics and nutrients. Although the lake is on Ecology's 303d list for total phosphorus and invasive exotic species (Brazilian elodea), neither of these listings is related to the condition of the well-vegetated shorelands. **Reach 2:** LOW: Residential areas surrounding the Reach 2 portions of the lake and are dominated by lawn and landscaping rather than dense buffers of native lakeside vegetation. These residential areas are likely to be sources of water quality contaminants such as fertilizers, herbicides and pesticides. In addition to the typical residential landscaping pollutants, runoff from surrounding urban areas carries hydrocarbons, metals, sediments, and other pollutants to the lake from roads, parking lots, and other developed areas.	Reach 1: 4 Reach 2: 1
Attenuating wave energy	**Reach 1:** HIGH: Native vegetation along the Reach 1 lake shore is relatively intact, and so is available to provide a significant wave attenuation function. Little bulkheading or other shoreline modifications have occurred which would remove native vegetation and natural woody debris, the natural features which attenuate wave energy. **Reach 2:** LOW: In its pre-development condition, the lake is expected to have been ringed with emergent wetlands and mature mixed-forest communities. Those communities are now almost entirely absent around the Reach 2 sections of the lakeshore, so vegetation does not provide any significant wave attenuation function. As mentioned above, bulkheading and other shoreline modifications have replaced native vegetation and natural woody debris as the features in place to attenuate wave	Reach 1: 5 Reach 2: 1

Function	Performance	Score[1]
	energy.	
Sediment removal and bank stabilization	**Reach 1:** HIGH: Much of the lakeshore is lined with native vegetation, so the rate of shoreline erosion is presumably near an underlying, natural, ongoing rate which contributes to maintaining natural lake substrate conditions. This rate is determined and moderated by the presence of the shoreline vegetation whose root systems tend to hold bank material in place. **Reach 2:** LOW: Under natural conditions, there would be an ongoing, underlying rate of shoreline erosion, which would contribute to maintaining substrate conditions. Instead, the lake shore now has little shoreline vegetation and a significant proportion of it is armored. While this "stabilizes" the banks, it limits natural recruitment of lakebed materials.	Reach 1: 5 Reach 2: 1
LWD and organic matter recruitment	**Reach 1:** MODERATE/HIGH: Much of the Reach 1 lake shore is forested with a mixed, maturing forest, providing opportunities for smaller wood, leaves, and some larger wood to enter the lake. However, the trees along the shore are not overly large, being second-growth and some are deciduous, such as alder, which decay much faster than conifer trees, such as cedar. Several large pieces of wood, unknown species, were also noted during site visits. **Reach 2:** LOW: Again, the loss of natural, forested shoreline vegetation and its replacement primarily with lawn and other types of landscaping has nearly eliminated large woody debris and organic matter recruitment potential along the lake shore. Any trees or large woody debris that do enter the lake are likely to be quickly removed out of concern for safety or to reduce the risk of property damage.	Reach 1: 4 Reach 2: 1
	Average Vegetation Score	**Reach 1: 4.6** **Reach 2: 1**
Hyporheic		
Removing excess nutrients and toxic compounds	**Reach 1:** MODERATE/HIGH: The hyporheic zone along this fairly natural section of lake shore likely provides high nutrient and toxic compound removal function, treating water from the uplands as it infiltrates into the hyporheic zone rather than running off to enter the lake directly as surface flow as would occur in more highly–developed areas. Water quality is likely protected in part due to upland runoff moving through the hyporheic zone or moving towards the lake as shallow groundwater flow, or interflow. The lake is oligotrophic-mesotrophic (is low to moderate in primary productivity), which is generally considered to be beneficial, with very good water quality otherwise. Nitrogen to phosphorus ratios in the upper water column are above 20:1, which generally favors other algal species over blue-greens. Besides discouraging the growth of nuisance algal blooms, this condition, increases water clarity, and generally supports beneficial uses including recreational uses such as swimming, boating,	Reach 1: 4 Reach 2: 2

Function	Performance	Score[1]
	and fishing. **Reach 2:** LOW/MODERATE: The hyporheic zone along Reach 2 is more restricted by fairly extensive shoreline armoring, but likely does provide some nutrient and toxic compound removal for water which infiltrates into the hyporheic zone instead of running off to enter the lake directly as surface flow. Water quality is generally very good (see previous discussions), and is likely protected in part due to upland runoff moving through the hyporheic zone.	
Water storage	**Reach 1:** MODERATE/HIGH: Although the water storage function is not of particularly high importance in a lake with a high average retention time (low flow-through) and relatively low fluctuations in water surface elevation, the hyporheic water storage capacity for Reach 1 with its natural vegetation and the presumably granular, permeable soils as found throughout the basin should be relatively high. **Reach 2:** MODERATE: The function of the hyporheic zone along Reach 2 would be restricted, compared to Reach 1, by the shoreline armoring present.	Reach 1: 4 Reach 2: 3
Support of vegetation	**Reach 1:** MODERATE: The granular soils throughout the basin are not conducive to wicking water very far upwards from the static water table, restricting, somewhat, the shoreline areas where the roots of vegetation would be within range of the hyporheic zone. **Reach 2:** LOW: Along Reach 2, much of the shoreline zone within range of the hyporheic zone is vegetated with lawn and other landscaping, which is not generally supported by hyporheic water storage, but instead, by irrigation or precipitation.	Reach 1: 3 Reach 2: 1
Sediment storage and maintenance of base flows	**Reach 1:** MODERATE: Lake levels or base flows may be supported somewhat by the hyporheic zone, given the gravelly, porous soils found throughout the basin. Spaces may be available to store some sediment, though sediment storage and support of base flows (lake level) are somewhat in conflict, since the more the interstitial spaces in the gravelly soils are filled with sediment, the less space is available for the storage of water. **Reach 2:** LOW/MODERATE: The hyporheic zone is restricted by shoreline armoring along Reach 2, which limits movement of fines from the lake into the hyporheic zone.	Reach 1: 3 Reach 2: 2
	Average Hyporheic Score	**Reach 1: 3.5** **Reach 2: 2**
Habitat		
Physical space and conditions for life history	**Reach 1:** MODERATE/HIGH: The shore along Reach 1 is typically lined with native upland vegetation. This dense shoreline vegetation is beneficial for terrestrial species' (birds, mammals, amphibians) and increases their use of the shoreline since cover, food, nesting sites, travel corridors, etc. are more available. Shallow nearshore	Reach 1: 4 Reach 2: 1

Function	Performance	Score[1]
	areas include both emergent and submerged vegetation, which attenuates wave energy and provides a refuge for small fish and amphibians. These shallow nearshore areas provide rearing, foraging and migration habitat for fish. Maturing shoreline vegetation provides large organic debris recruitment to the lake to a moderate degree, which should increase over time as the forest matures. **Reach 2:** LOW: Under natural conditions, the lake bottom would gradually rise in a shallow wedge such that incoming waves would roll up the bottom, and onto the shore, losing energy. This reduced energy environment would be more hospitable to emergent vegetation, which further attenuates wave energy and provides a refuge for small fish and amphibians. Shallow nearshore areas in lakes typically provide rearing, foraging and migration habitat for fish. Shoreline armoring, however, generally reduces this low-energy shallow-water environment, creating a deeper, more turbulent nearshore area that is less hospitable to small fish and amphibians, as well as to emergent vegetation. The deeper water may also allow larger fish predators to prey on small fish. The absence of dense shoreline vegetation is a limiting factor in terrestrial species' (birds, mammals, amphibians) use of the shoreline, since cover, food, nesting sites, travel corridors, etc. are limited or largely absent.	
Food production and delivery	**Reach 1:** MODERATE/HIGH: Food production from the uplands along Reach 1 is available in various forms, including native seed- and fruit-bearing vegetation. Fruit trees and other non-native vegetation in yards may also supply some food for wildlife. Not only does native upland vegetation provide food directly for terrestrial wildlife, but it is a source of insects and other organic matter that drop into the water to provide food for fish and other aquatic life. The emergent wetland areas present along sections of the lakeshore, particularly in the park, provide productive foraging areas for small mammals, wading birds and waterfowl. **Reach 2:** LOW: Food production from the uplands is limited by the lack of native seed- and fruit-bearing vegetation. This may be made up for, in part, by fruit trees and other non-native vegetation in yards which supplies some food for wildlife. Not only does native upland vegetation provide food directly for terrestrial wildlife, but it is a source of insects and other organic matter that drop into the water to provide food for fish and other aquatic life. The historical emergent wetland areas that are now reduced or absent also provided productive foraging areas for small mammals, wading birds and waterfowl.	Reach 1: 4 Reach 2: 1
	Average Habitat Score	**Reach 1: 4** **Reach 2: 1**
AVERAGE PIPE LAKE SCORE	**Reach 1: 3.9 (4) = Moderate/High** **Reach 2: 1.4 (1) = Low**	

[1] Low = 1, Low/Moderate = 2, Moderate = 3, Moderate/High = 4, High = 5

5.3 JENKINS CREEK

Jenkins Creek was broken into two major reaches for purposes of the function assessment. Reach 1 is downstream of the Covington Way SE crossing and includes shoreline area impacted by utilities. Reach 2 upstream of Covington Way SE contains floodplain wetlands and is flanked by single-family residential development.

Table 10. Ecological Function Summary for Jenkins Creek in the City of Covington.

Function	Performance	Score[1]
Hydrologic		
Storage of water and sediment	**Reach 1:** LOW/MODERATE: The channel along the City's Reach 1 section of Jenkins Creek is artificial and was dug in the past to make way for the adjoining BPA substation. As such it has little or no flood plain, till near the downstream end, and so has little capacity for the storage of water and sediment. **Reach 2:** HIGH: Along Covington's shoreline section of Jenkins Creek upstream of Covington Way SE, approaching the upstream shoreline boundary, the stream flows through a densely wooded area, including wooded wetlands. Adjacent areas across and bordering the stream to the southeast are managed as a City of Kent watershed with very restricted access. The soils beneath the floodplain and wetlands within the City's Jenkins Creek shoreline area are sandy, gravelly, and permeable. During high flows, the creek is still able to spread out across its flood plain. As such, there is a high degree of flow interaction between the creek, its flood plain, associated riparian wetlands, and the floodplain/wetland soils. Water spilling over the banks and/or infiltrating through the permeable bank soils during flood events can be stored on the floodplain (including the riparian wetlands) and in the permeable soils below for later release. By this process, the flood plain is able to store and attenuate flood flows and trap and store fine sediments. These fine sediments are incorporated into the flood plain topsoil to nourish vegetative growth, in turn supporting wildlife habitat. The floodplain along the City's portion of Jenkins Creek is largely unconstrained.	Reach 1: 2 Reach 2: 5
Transport of water and sediment	**Reach 1:** MODERATE/HIGH: As an artificial, channelized stream section created to allow space for the adjoining BPA substation, the narrow, straight Reach 1 channel section is fairly efficient at transporting both water and sediment. Vegetation has grown and matured since the channel was originally created, however, roughening the channel and reducing flow capacity and velocities somewhat. **Reach 2:** MODERATE: Flows through the Reach 2 section of Jenkins Creek within the City are somewhat	Reach 1: 4 Reach 2: 3

Function	Performance	Score[1]
	dispersed as they pass through a forested wetland area. While this does not make for the most efficient transport of water and sediment, it is beneficial in terms of fish and wildlife habitat, sediment retention and biofiltration for water quality improvement. However, deforestation and urbanization throughout the basin upstream of the City's Jenkins Creek shoreline area have likely increased streamflows, flow volatility, erosion, and sedimentation to a moderate extent. As for most streams in the region, the stream channel and floodplain have formed in response to a historically lower flow and sediment regime and are not entirely suited to carry the increased flows and sediment loadings experienced. Bank erosion may occur as the channel enlarges and widens to accommodate higher flows.	
Attenuating flow energy	**Reach 1:** MODERATE: Though initially poor at attenuating flow energy following its construction associated with the BPA substation, streambank tree and shrub vegetation has grown considerably since that time, significantly roughening the channel and improving its capacity to attenuate flow energy. **Reach 2:** HIGH: As mentioned above, sections of floodplain remain in the Reach 2 shoreline area which are characterized as forested wetlands. These are effective at attenuating streamflow energy during flood events as flow disperses and follows complex flow pathways. The recruitment of woody debris, including large woody debris, is good, increasing complexity and roughness in the channel as well as throughout the floodplain. To its benefit, the basin includes a system of lakes, large wetland areas, and naturally infiltrative recessional outwash soils which all serve to dampen and moderate stream flow fluctuations.	Reach 1: 3 Reach 2: 5
Developing pools, riffles, and gravel bars	**Reach 1:** LOW/MODERATE: The originally channelized nature of the Reach 1 Jenkins Creek section, along with its lack of large-scale meandering and the low level of size and maturity of its woody debris, have all served to limit the degree to which pools, riffles, and gravel bars have formed. **Reach 2:** MODERATE/HIGH: The naturally forested condition of the channel banks and buffers along Reach 2 provides for adequate large woody debris recruitment and bank protection (will improve further as the forest matures), which is, in turn, conducive to bed scour and pool formation at locations where such debris accumulates. The debris also provides protective cover in the pools for fish, and riffles formed downstream provide spawning habitat. Gravel bars may form on the inside of channel bends where pools form on the outside. Gravel substrate supply and condition are good due to the underlying gravelly soils.	Reach 1: 2 Reach 2: 4

Function	Performance	Score[1]
Removing excess nutrients and toxic compounds	**Reach 1:** LOW/MODERATE: Lack of a very extensive flood plain along the Reach 1 section precludes a very high biofiltration/water quality improvement component of habitat function, though good hyporheic function is a plus (see below). **Reach 2:** MODERATE/HIGH: There is a high degree of interaction between the creek, its flood plain and included riparian wetlands ALONG Reach 2, as well as an extensive hyporheic zone consisting of gravelly glacial outwash soils. These conditions are well-suited to provide for a high degree of biofiltration, removing pollutants entering the stream from portions of the watershed farther upstream. These pollutants may include lawn and landscaping runoff (pesticides, fertilizers, herbicides) and road runoff (hydrocarbons, metals).	Reach 1: 2 Reach 2: 4
Recruitment and transport of LWD and other organic material	**Reach 1:** MODERATE: As stated above, the forested areas along Reach 1 are still fairly young and, in some places, narrow. As such, the potential for the recruitment of really large woody debris still has considerable room for improvement. Potential for the recruitment of smaller organic is better. As a fairly straight, narrow channel section which is somewhat steeper than the section above it, Reach 2, Reach 1 should function fairly well at transporting organic materials. **Reach 2:** MODERATE/HIGH: As a well-forested shoreline area that is partially protected due to its proximity to City of Kent watershed areas, the potential for large woody debris recruitment along Reach 2 is presently good and should increase even further as the forest matures over time. Due to the relatively small size of the stream as far as shoreline streams go (the City's Jenkins Creek shoreline area approaches and ends near the upstream limit of shoreline jurisdiction), it would not transport *large* wood well, but would supply smaller wood and leaf litter to support biological functions downstream.	Reach 1: 3 Reach 2: 4
	Average Hydrologic Score	**Reach 1: 2.7** **Reach 2: 4.2**
Vegetation		
Temperature regulation	**Reach 1:** MODERATE: Though streamside tree and shrub vegetation is maturing well along Reach 1, the vegetated buffer is still fairly narrow, limiting the amount of shading provided to the creek. **Reach 2:** HIGH: The combination of a well-established and maturing forest in the shoreline/buffer areas and a relatively narrow active channel during low-flow periods results in excellent shade being provided to the stream. This is not true for all areas farther upstream, however, so water may enter the City's shoreline reach at temperatures which have already been somewhat elevated. Vegetation need	Reach 1: 3 Reach 2: 5

Function	Performance	Score[1]
	not be as tall to provide shade to a narrower creek as opposed to a wider river.	
Water quality improvement	**Reach 1:** LOW/MODERATE: The lack of an active floodplain precludes too much in the way of an effective biofiltration or water quality improvement function for this Reach, though a presumed highly interactive hyporheic zone will help. **Reach 2:** HIGH: Riparian and flood plain areas are intact and well-forested, resulting in good biofiltration function. However, for fine sediments and pollutants originating from farther upstream, shoreline vegetation can only be effective at removing pollutants when stream flow is made to come in direct contact with the vegetation, which happens most effectively during flood events. Under low-flow conditions, there is less direct contact between the streamflow and the riparian vegetation, so considerably less biofiltration can occur.	Reach 1: 2 Reach 2: 5
Slowing riverbank erosion; bank stabilization	**Reach 1:** MODERATE: Streambank vegetation along Reach 1 has matured sufficiently to provide moderate bank protection. In addition, the naturally very gravelly soils through which the channel was cut provide some erosion protection, and that material which is eroded provides good, gravelly stream substrate material. **Reach 2:** HIGH: The well-forested stream banks provide good bank stabilization with erosion occurring at rates consistent with well-functioning natural processes.	Reach 1: 3 Reach 2: 5
Attenuation of flow energy	**Reach 1:** LOW/MODERATE: Shrubby vegetation along the banks provides some increase in channel roughness and flow energy dissipation, however accumulations of larger woody debris are needed to further increase this function. The lack of channel meandering along this channelized section also inhibits its ability to attenuate flow energy. **Reach 2:** HIGH: Complex flow patterns through areas of riparian wetlands and accumulated woody debris during flood events provide a rough channel, enhancing the stream's ability to absorb and dissipate flow energy.	Reach 1: 2 Reach 2: 5
Sediment removal	**Reach 1:** LOW/MODERATE: Though the flood plain towards the lower end of Reach 1 starts to widen somewhat, the generally narrow flood plain width along this reach, as well as its past disturbance history, limit its potential for vegetation-related sediment removal. **Reach 2:** HIGH: Densely-vegetated floodplain and riparian area forest vegetation, along with its associated leaf litter and forest duff, effectively filters and retains fine sediments. Also highly infiltrative soils and an active and interactive hyporheic zone (see below) also provide capacity for biofiltration	Reach 1: 2 Reach 2: 5

Function	Performance	Score[1]
	function.	
Provision of LWD and organic matter	**Reach 1:** LOW/MODERATE: A young forest and relatively narrow vegetated buffer width limit the degree to which Reach 1 provides large wood and other organic materials to the stream. **Reach 2:** HIGH: In contrast with most areas in the region, opportunity for the recruitment of large woody debris is good due to the forested condition, and should improve further as the forest continues to mature. Part of the City's Jenkins Creek shoreline areas adjoin a City of Kent protected watershed area. There are also good opportunities for the recruitment of small-to-medium woody debris and leaf litter that contribute to a decomposition-based food chain.	Reach 1: 2 Reach 2: 5
	Average Vegetation Score	**Reach 1: 2.3** **Reach 2: 5**
Hyporheic		
Removing excess nutrients and toxic compounds	**Reach 1:** MODERATE: The underlying soils along Reach 1 are very gravelly and permeable, as they tend to be throughout the basin, and hence the creek has a highly interactive hyporheic zone there. Stream flows supplement shallow groundwater or hyporheic flows and vice versa, thereby increasing the proportion of flow which routinely flows in and out of the zone to be filtered in the process. As a result, the hyporheic zone along this reach of Jenkins Creek can be reasonably effective at removing pollutants in spite of a narrow flood plain. **Reach 2:** HIGH: The overall Soos Creek basin, including the tributary Jenkins Creek basin, is dominated by highly infiltrative, glacial outwash soils which provide for a high degree of interaction between ground and surface waters. This interaction provides a high level of biofiltration and pollutant removal.	Reach 1: 3 Reach 2: 5
Water storage and maintenance of base flows	**Reach 1:** MODERATE; The combined presence of headwater lakes (Shadow, Wilderness, Pipe, and Lucerne), large wetland areas, and highly infiltrative and interactive soils throughout the Jenkins Creek basin generally provides a high level of water storage which is available for the support of stream base flows. However, although the soils along the City's Reach 1 section of Jenkins Creek are likely permeable, the limited flood plain width also limits the interactivity of the stream and the hyporheic zone particularly during high flow periods, compared to other stream sections with wider flood plains. **Reach 2:** HIGH: Hyporheic zone functioning with respect to water storage is enhanced along Reach 2 due to the high degree of interactivity between the creek and its surrounding gravelly soils (and	Reach 1: 3 Reach 2: 5

Function	Performance	Score[1]
	supporting aquifers) in combination with a wide and complex flood plain. Such a wide flood plain provides a broad area over which this interaction can occur. Water stored in the hyporheic zone is available to supplement low, dry-season stream flows.	
Support of vegetation	**Reach 1:** LOW/MODERATE: While the interaction between Jenkins Creek and its hyporheic zone is generally quite good, the combination of steeper streambanks and very permeable, gravelly soils means that only a fairly narrow band of vegetation along the streambanks would have access to hyporheic water through their root systems. **Reach 2:** MODERATE: The gravelly outwash soils that tend to be present in the hyporheic zone and throughout the basin can be so well-draining and poor at wicking water upward that plants growing above these gravelly soils can be deprived of water even when an active water table is near the surface. However, any landscaping vegetation within the shoreline zone is typically supported by irrigation water and precipitation rather than by hyporheic water storage.	Reach 1: 2 Reach 2: 3
Sediment storage	**Reach 1:** LOW/MODERATE: Although streamside soils are gravelly and permeable along Reach 1, the narrowness of the floodplain limits the potential for flows to spread out across the flood plain during high flow events such that water could interact with the hyporheic zone and deposit the sediment it carries there. **Reach 2:** MODERATE/HIGH: With a much wider flood plain, good interaction between the hyporheic zone and stream flows occurs along Reach 2. This provides good potential for filtration of interflow and hyporheic flow, and thereby sediment storage. If sediment loading is too high, however, gravels of the hyporheic zone could become clogged, their sediment storage capacity used up, and the overall functioning of the hyporheic zone impaired.	Reach 1: 2 Reach 2: 4
	Average Hyporheic Score	**Reach 1: 2.5** **Reach 2: 4.25**
Habitat		
Physical space and conditions for life history	**Reach 1:** MODERATE: Though streamside vegetation is maturing well and provides a moderately good source of cover for fish and other types of wildlife, the vegetated buffer width is fairly narrow. Also, the lack of maturity of the streamside forest vegetation means that few, if any, cavity nesting sites would be available for the birds or small mammals that need them, nor perching sites for larger birds. In-stream, the lack of channel meandering and a moderately low abundance of large woody debris and the habitat types and cover which it engenders limits the functionality of habitat. Streambed substrate	Reach 1: 2 Reach 2: 5

Function	Performance	Score[1]
	consists of high-quality, relatively clean gravels in large part due to the soils which the channel passes through. **Reach 2:** HIGH: Though second-growth, the forest in the City's Jenkins Creek shoreline area along Reach 2 provides habitat of good quality and complexity and in good quantity for fish and wildlife. The forested vegetative community is complex and maturing, with accumulating downed wood and snags, resulting in more places for various wildlife species to find cover or suitable nesting and rearing sites. This increase in dense shoreline vegetation increases the quantity and quality of habitat available for use by terrestrial species (birds, mammals, amphibians) since cover, food, nesting sites, travel corridors, etc. are available and functioning. Within the stream channel itself, an increase in logs and overall wood similarly results in more available protective cover, the creation of pool/riffle sequences, and an increase in habitat complexity as described above. Shallow, low-energy aquatic areas provide critical rearing, foraging, and refuge habitat for amphibians and juvenile fish, particularly salmonids. Streambed substrate materials, however tend to be sandier than would be ideal, in part due to the lower-gradient, lower-energy environment.	
Food production and delivery	**Reach 1:** MODERATE: In a manner similar to that described for physical habitat structure, above, the maturing streamside vegetation provides a limited source of food for wildlife, including a source of terrestrial insects for use as food by fish. Again, however, the vegetated buffer width is narrow, and it would provide a better source of more abundant food if it were wider. **Reach 2:** HIGH: The natural forest in the City's Jenkins Creek shoreline area along Reach 2 should provide the food production that native wildlife are adapted to, including native seed- and fruit-bearing vegetation from wetland, floodplain, and upland areas. Not only does such vegetation provide food directly for terrestrial wildlife, but it is a source of insects and other organic matter that drop into the water and provide food, either directly or indirectly, for fish and other aquatic life. Emergent wetland areas associated with side channels, backwaters, and extensive floodplain wetlands also provide productive foraging areas for juvenile fish, small mammals, wading birds, and waterfowl.	Reach 1: 2 Reach 2: 5
	Average Habitat Score	**Reach 1: 2** **Reach 2: 5**
AVERAGE JENKINS CREEK SCORE	**Reach 1: 2.4 (2) = Low/Moderate** **Reach 2: 4.6 (4) = High**	

[1] Low = 1, Low/Moderate = 2, Moderate = 3, Moderate/High = 4, High = 5

6.0 LAND USE ANALYSIS

As noted in Section 3.1, land use patterns are an important consideration in SMP analysis because such analysis can identify opportunities for "preferred uses," especially water-dependent, water-oriented and water-enjoyment uses. Land uses adjacent to the water are also a determinant in assigning environment designations to specific sections of the shoreline. Additionally, an analysis of land use conditions is necessary to determine potential land use changes and their effect on shorelines with respect to SMA objectives. The existing land uses and proposed environment designation boundaries and provisions must be mutually consistent with Covington's comprehensive plan. It is also particularly important to look at current zoning of shorelands within Covington. In many cases, mapped zoning classifications in Covington have been updated more recently and/or are detailed to a greater specificity than the Comprehensive Plan Land Use Map and are a better reflection of the City's current plans for a given area.

Based on the guidance provided in WAC 173-26-211 a range of Shoreline Environment designations would appear to be appropriate in Covington's shoreline jurisdiction. Environment designations must be based on existing land use patterns, the biological and physical character of the shoreline, the goals and aspirations of the community as expressed in the Comprehensive Plan as well as the criteria provided in WAC 173-26-211(4) and (5). In delineating environment designations Covington should assure that existing shoreline ecological functions are protected with the proposed pattern and intensity of development.

In areas currently dominated by single family homes at urban or suburban densities, e.g. portions of Pipe Lake, the Shoreline Residential Environment appears to be the clear choice when examining the Purpose and Designation Criteria contained in WAC 173-26-211(5)(f). In areas such as Big Soos Creek, where existing land use, future land use and existing physical character support the protection and restoration of the "ecological functions of open space, floodplain and other sensitive lands", the Urban Conservancy Designation appears to be appropriate. For some of Covington's shorelines, more than one designation may be appropriate based on the existing physical and biological conditions. For instance, at Camp McCullough, three environmental designations (Natural, Urban Conservancy or a locally developed "alternative system" designation pursuant to WAC 173-26-211(4)(c)(i)) may be appropriate, depending on the City's management goals and objectives. This is discussed further in section 6.2.2 below.

In other areas, parallel environments may be appropriate, pursuant to WAC 173-26-211(4)(c)(ii). Parallel environments divide shorelands into different sections generally running parallel to the shoreline. For instance along Jenkins Creek, parallel environments of Urban Conservancy and an "alternative system" designation of Medium Intensity may be useful to accommodate resource protection and public access to the shoreline and planned redevelopment with a wider range of uses further from the shoreline as anticipated in the zoning regulation. See section 6.3.2 for further discussion.

This report provides a strong basis for designation, but it cannot fully capture "the goals and aspirations of the community" without additional public input. The City will further investigate potential designations during the public involvement process. The following section examines the data gathered in the inventory and describes likely land uses and Comprehensive Plan designations, and implications for shoreline management for each segment.

6.1 BIG SOOS CREEK

6.1.1 Likely Changes in Land Uses

This area is predominantly designated and zoned as "Urban Separator." A small portion along the eastern edge is designated as "Industrial" and zoned Downtown Commercial 3 (DN-3). "Urban Separator" may redevelop as low- to medium-density residential. Current regulations limit the density in this area to one unit per acre. In addition, wetlands (Figure 14) and associated stream and wetland buffers severely restrict development in this area. A wide range of commercial and industrial uses are allowed in the DN-3 zone. Light industrial, office or retail are possible future uses of this area.

6.1.2 Implications for Shoreline Management

The creek and adjacent shorelands lay predominately within the Comprehensive Plan's Urban Separator designation, with a small upland portion within the Industrial designation. Urban Separator "will help the City of Kent and the City of Covington develop as distinct communities and maintain an individual identity and sense of place." Industrial designated land "comprises of non-polluting manufacturing and processing, wholesaling, warehousing and distribution and similar activities" which are "important to the City's economic development strategy and tax base stability."

Urban Conservancy is the most appropriate designation for this shoreline segment. In some areas, shoreline jurisdiction extends beyond the typical 200-foot management zone from the ordinary high water mark of the creek because it includes associated wetlands. While High Intensity might otherwise be an appropriate designation for Industrial properties, there is only a small portion of the shoreline management area within Industrial properties and the majority of that area appears to be wetlands. Shoreline regulations should be prepared to ensure that the environment is not degraded with any potential new development. This is especially true for Industrial land uses which have the potential to generate more noise and increased susceptibility to pollution sources.

6.2 PIPE LAKE

6.2.1 Likely Changes in Land Uses

Pipe Lake shorelands are designated as "Public Use" and "Low Density Residential." The entire Pipe Lake shoreline in Covington is zoned Low Density Residential, a classification that allows up to 4 dwelling units per acre. "Low Density Residential" zoned and designated properties are generally developed to their full potential under current land use regulations as single family homes, and therefore changes would likely be limited to remodels, additions and tear-down/rebuilds which based on regional trends can generally be expected to increase the size of homes, the amount of vegetation cleared and the amount of impervious surface created over

time, absent additional regulation. The large property along Pipe Lake, designated as "Public Use" in the Comprehensive Plan, is operated by Camp McCullough, a campground and conference center owned by First Presbyterian Church of Tacoma. This property is zoned Low Density Residential and there is the potential that all or a portion of this area could develop as single-family homes in the future. The current property owner has expressed an interest in possibly developing a limited portion of the property as single-family homes at some undetermined time in the future. The City has expressed a possible interest in acquiring a portion of the property or otherwise securing the right for public access to the shoreline, possibly in the southeastern corner of the property.

6.2.2 Implications for Shoreline Management

Shoreline Residential appears to be the most appropriate environment designation for the Pipe Lake shoreline segments that include single-family residential uses. As previously noted in Section 5.0 of this report, the Camp McCullough shoreline has a Moderate/High ecological function which is considerably higher that the adjacent single family areas which are rated Low. Given the existing ecological condition of this area, Park Plans which point to the possible future acquisition of Camp McCullough and the designation of this area as Public Use in the Comprehensive Plan, the City should explore the possibility of designating the property as Urban Conservancy to reflect current use as a private camp and in anticipation of the development of an active or passive shoreline public access site. A Natural designation could also be an appropriate designation because of the relatively pristine nature of portions of the Camp McCullough shoreline. The Natural designation would likely provide less flexibility for future recreation development, but could also provide a greater certainty that the ecological functions of the site are protected. The City will discuss the designation of this key site in detail during the SMP development process and work with stakeholders and the property owners on related implications.

Camp McCullough will likely remain as a private camp for the foreseeable future. Provisions should call for continued environmental conservation for the property while the property continues as a church camp. Provisions should also be included that address the potential development of public access facilities, including docks, bathing areas, parking and other ancillary facilities. For the residential properties, shoreline provisions should address shoreline modifications associated with single-family residences, such as decks, shoreline stabilization, and vegetation conservation.

6.3 JENKINS CREEK

6.3.1 Likely Changes in Land Uses

Jenkins Creek shorelands are designated in the Comprehensive Plan as Public Utility and Low Density Residential, with a relatively smaller portion of shorelands designated as Downtown Commercial. Public Utility properties are zoned Industrial, and the remaining area is zoned as Downtown Commercial (DN) 7B, a designation which allows single family housing and some limited office uses and somewhat broader range of housing types, including duplexes and townhomes. The City is currently in the process of deciding whether a broader or different range of uses could be allowed in the DN-7B zone. Uses within the Public Utility designation are unlikely to change since the Bonneville Power Administration operates them. Areas in the DN-

7B zone, which are currently developed as single family housing, may redevelop into a broader range of residential and office uses. In addition, this mix could expand to include some retail, depending on the outcome of the current zoning proposal for the DN-7B zone.

6.3.2 Implications for Shoreline Management

High Intensity would likely be the most appropriate for the segment along the Bonneville Power property currently classified as Public Utility. Shoreline Residential is generally an appropriate designation for areas developed with single-family homes at urban and suburban densities. However, this designation usually excludes uses such as office and retail. Current zoning allows limited office and small scale multi-family uses, in addition to single family development, within areas of the Jenkins Creek Corridor that are currently developed as single family. The City is considering whether to expand the allowed uses in this zone to include a broader range of office and retail uses, which would likely change the future land use of this area.

Further complicating matters are the presence of wetlands and floodplains associated with Jenkins Creek, the proposed South Covington Park and proposed Jenkins Creek Regional Trail in this area. Designation of the areas immediately adjacent to Wax Road as Medium Intensity (or similar) may be appropriate. Parallel designation of areas closer to Jenkins Creek that meet the regulatory criteria for wetlands as Urban Conservancy may be appropriate, in recognition of their value as habitat and passive or visual public access. Provisions within the Medium Intensity designation should address shoreline modifications associated with single-family residences, such as decks, shoreline stabilization, and vegetation conservation. In addition, regulations should address the use and development of these properties as office and potentially retail sites. For Urban Conservancy areas, shoreline regulations should focus on the protection of the ecological functions and values of these areas and the limited development of passive recreation facilities, such as trails. Additional community discussion regarding management objectives in this area is needed.

7.0 SHORELINE MANAGEMENT RECOMMENDATIONS

The following are recommended actions for translating inventory and characterization findings into proposed SMP policies, regulations, environment designation boundaries and restoration strategies.

7.1 SHORELINE MASTER PROGRAM

7.1.1 Environment Designation Provisions

- Recommendations for specific shoreline segments are discussed in Chapter 6.0.
- Consider the Urban Conservancy designations for the Big Soos Creek segment: The Urban Separator area is severely constrained by current zoning regulations and regulatory wetlands. This area tends to be underdeveloped but have the potential to experience low-density development. It may be that special environmental protections should be placed on new development in these areas. There is only a small portion of the shoreline management area along Big Soos Creek that is designation as Industrial (and zoned DN-

3, a designation that allows for a wide range of commercial and industrial uses). The majority of this area is wetland. Therefore a separate designation of the small Industrial designated area (less than one acre) that is not environmentally constrained is not proposed. However, special consideration should be given to future applications within the Industrial segment to allow for upland development which meets the City's goal of establishing local industries, while also ensuring water quality and habitat is protected along the corridor, especially since this segment is shared with the City of Kent.

- Consider the High Intensity designation for the portion of the Jenkins Creek corridor that is adjacent to the BPA utility site. Consideration should be given to allowing current intensive upland use of the site. In addition, the possibility of softening the current riprap bank treatment and adding some additional vegetation immediately adjacent to the stream channel should be explored.

- Consider a parallel designation of Urban Conservancy and Medium Intensity Urban (or similar) to reflect the complex management objectives for the shoreline segment in areas currently zoned DN-7B. Designation of this area will require additional community discussion. While somewhat more intensive urban development is anticipated along Wax Road on portions of sites currently developed as single-family homes, there are important recreational improvements planned for this area and a need to protect high value habitat resources such as wetlands.

- Additional consideration should be given to permit applications for those uses along the Jenkins Creek corridor. The City of Kent owns an isolated adjacent parcel on Jenkins Creek that is managed by the City for water supply. All future uses should be carefully considered to ensure habitat is enhanced and water quality is protected.

- Areas currently developed as single family, where that use is anticipated to continue in the Comprehensive Plan and Zoning Code, should be designated as Shoreline Residential. Ensure that Pipe Lake designations are consistent with City of Maple Valley.

- Consider an Urban Conservancy, Natural or a combination of the two designations for the Camp McCullough property along Pipe Lake to promote continuation of the camp while preserving and enhancing the ecological functions of the undeveloped portions of the shoreline and retaining future options for shoreline recreation and public access.

7.1.2 General Policies and Regulations

Archaeological and Historic Resources

- Due to previous archaeological finds along Big Soos Creek and the proximity of other Muckleshoot resources in the vicinity, policies should address clear direction regarding cultural resources and circumstances when a special study may be necessary and what action to undertake in the event of an unexpected archaeological discovery. The following standards shall be incorporated into the City's SMP, per Ecology's SMP guidelines:

- Require that developers and property owners immediately stop work and notify the local government, the office of archaeology and historic preservation and affected Indian tribes if archaeological resources are uncovered during excavation

- Require that permits issued in areas documented to contain archaeological resources require a site inspection or evaluation by a professional archaeologist in coordination with affected Indian tribes

Critical Areas Regulations

- Provide for critical area regulations within the Shoreline Management Area that provide at least an equal level of protection to the current City-wide critical area regulations.

- Ensure the SMP includes provisions for the protection of the City's aquifer recharge areas, since a majority of the City lies within Critical Aquifer Recharge Areas.

- Incorporate or reference the City's critical areas regulations, inter-local watershed plans, and state, tribal and federal programs in the Master Program. Address the fact that there are a number of wetlands potentially in SMA jurisdiction so these regulations could apply to wetlands located outside the primary jurisdictional areas.

Flood Hazard Management Regulations

- Include policies and regulations that address the protection of properties located along the City's floodplain/floodways, specifically located along Big Soos and Jenkins Creeks. Provisions should be included which limit development and shoreline modifications that interfere with channel migration and/or cause impacts to property or public improvements and loss of ecological functions.

Parking Regulations

- Include policies and regulations that address the placement of parking areas such that guidance and/or requirements are included that site these areas on portions of development sites that are not immediately adjacent to the shoreline. Where possible, native landscaping and passive use areas should be placed between development and the shoreline.

Public Access

- Public access to the shoreline within the Covington SMA is currently very limited. Figure 12 contains a map of existing and proposed public access sites. Policies should be developed that more specifically identify the City's goals and priorities for the development of shoreline public access sites. Sites that are both long term and short term priorities should be identified. Where sites that have been previously identified are not truly feasible or desirable, City plans and improvement programs should be amended to reflect updated information.

- Policies and regulations that address the development active facilities should ensure that the development of such facilities result in no net loss of ecological function. Regulations should address upland concerns, such as the location and design of parking

facilities and active play areas, as well as the development on in-water and nearshore structures, such as docks and swimming areas.

- Detailed guidance should be provided for the construction of trails in particularly environmentally sensitive shoreline segments along Jenkins and Big Soos Creek.

- In general, physical access for swimming and non-motorized boating, passive recreation (such as interpretive trails) and habitat enhancement should be important policy objectives for the management of shoreline public access sites.

- Camp McCullough represents a particularly important public access opportunity given the location on Pipe Lake, the current use as a private recreation facility and the high ecological functions. Guidance should be provided for the continued recreation use of the property, possible future public access and/or acquisition and the development of related water-oriented recreation facilities.

Shorelines of Statewide Significance

There are no Shorelines of Statewide Significance within the Shoreline Management Area in Covington.

Water Quality

- Incorporate as appropriate any goals, policies or regulations that result from the City's efforts to comply with its NPDES Phase II stormwater permit requirements.

- Pipe Lake is on the 303(d) list for total phosphorus impairment and Big Soos Creek is on the 303(d) list for fecal coliform and dissolved oxygen impairments. Include appropriate goals, policies and regulations in the SMP targeting improvements in these water quality parameters.

- Existing single family residences with septic systems pose a continued source and risk of pollution to water bodies, particularly Jenkins Creek. Required connection to future sewer facilities will address this risk. Redevelopment to more intensive uses should not be allowed without sewer availability and existing development should be required to hook up to sewer when it becomes available to protect water quality.

Vegetation Management

- Conservation of existing native vegetation during land development and ongoing use is critical to maintaining the ecological processes and natural functions of shoreline areas.

- The removal of mature trees and native vegetation in areas where the Urban Conservancy designation is recommended along Big Soos Creek and Jenkins Creek should be regulated in a manner that provides protection that is equal to or greater than current Critical Area Regulations.

- Vegetation removal in wetland areas and associated buffers within the majority of the Big Soos Creek and portions of the Jenkins Creek Shoreline management areas should also be restricted to only allow the removal of hazardous trees. Additional flexibility can be

provided for areas within currently developed yards and non-wetland areas where more intensive urban development is anticipated.

- Vegetation removal should also be restricted within portions of the Pipe Lake shoreline that are recommended for Urban Conservancy designation. Upland areas can be regulated in a manner that provides greater flexibility than those areas which are also encumbered by critical areas, but a higher level of protection should be provided than currently afforded these areas. In particular, removal of non-hazardous mature trees throughout the shoreline management area and native vegetation within at least 50 feet of the shoreline should be severely restricted to maintain the current level of high ecological function and value.

- Incentives should be provided for the retention and planting of native vegetation, particularly in areas recommended for designation as Shoreline Residential. Incentives could include additional flexibility with building setbacks from Pipe Lake. Current City of Covington regulations do not require tree and vegetation retention outside of critical areas.

- Include provisions for continued monitoring and control of aquatic invasive species in Pipe Lake to maintain eradication of Brazilian elodea and prevent establishment of other aquatic invasive species.

Low Impact Development and "Green Building" Practices

- Incentives (and in some limited cases potentially requirements) should be provided for the use of Low Impact Development techniques and Green Building practices within the Shoreline Management Area.

- Low impact development and green building practices, such as those promulgated under the Leadership in Energy and Environmental Design (LEED) and Green Built programs, are particularly important in those areas recommended for Urban Conservancy designation.

- In those areas along Jenkins Creek currently dominated by single-family development (i.e. Wax Road Properties), LID and Green Building could help balance the complex set of potentially competing goals for this area, where more intensive development is proposed and/or contemplated in areas immediately adjacent to high value scenic, recreation and ecological resources along Jenkins Creek.

- Only limited additional development should be allowed in high value resources areas along Big Soos Creek. LID and Green Building requirements and incentives could help maintain the relatively intact ecology of these areas, while allowing for limited development and reasonable use of private property.

7.1.3 Shoreline Modification Provisions

Shoreline Stabilization

- Explore a range of solutions to reduce the amount of bulkheads and shoreline armoring over time around Pipe Lake. Alternative methods to typical shoreline armoring using native vegetation and other natural shoreline features should be considered.

Piers and Docks/Boating Facilities

- Provide clear dimensional standards for new piers and replacement/modified piers. Consider special standards for any public access docks or facilities that may be proposed as part of future Camp McCullough developments.

- Pier regulations should be consistent with Washington Department of Fish and Wildlife design standards, and recognize any special local issues or circumstances.

Fill

- As directed by the Shoreline Master Program Guidelines, provide appropriate limitations on placement of fill in shoreline areas, including areas waterward of the ordinary high water mark. Restoration fills should be encouraged, including improvements to spawning gravels in streams, material to anchor large woody debris placements, and as needed to implement lakeshore restoration on Pipe Lake.

Breakwaters, Jetties, Groins and Weirs

- Jenkins Creek is the only shoreline system in Covington that includes these types of in-stream structures (weir below Covington Way SE crossing). While repair and maintenance of this weir would be allowed, provisions should be included in the SMP to encourage removal or modification of the weir if a more environmentally sensitive solution is feasible.

Dredging and Dredge Material Disposal

- As directed by the Shoreline Master Program Guidelines, provide appropriate limitations on dredging (excavation) in shoreline areas. Dredging activities in the City's shorelines are not expected to occur on a frequent basis, but may be conducted as part of certain conveyance maintenance activities, or to implement restoration projects or culvert/bridge replacements.

Shoreline Habitat and Natural Systems Enhancement Projects

- To the maximum extent feasible, the SMP should include provisions to encourage restoration projects, particularly in areas identified as having low function. The use matrix should clearly state that modifications that are part of a restoration project should be allowed as an SDP, rather than prohibited or allowed only as a conditional use. For example, some jurisdictions have inadvertently limited certain restoration projects by prohibiting fill waterward of the ordinary high water mark. Certain fills can be an important component of some restoration projects.

7.1.4 Shoreline Uses

Boating Facilities

- Under state law, "boating facilities" excludes docks serving four or fewer single-family residences. Existing and future boating facilities are limited to Pipe Lake. There are currently no public boating facilities on Pipe Lake. Private facilities are located at Camp McCullough and may occur on joint use sites on single family residential properties. Camp McCullough represents the most significant opportunity for an increase in these facilities, particularly if this site is used for public access in the future. The SMP should include provisions that provide for prudent development of these facilities, while protecting the high ecological function of this important shoreline.

Industry

- Master programs must give first preference to water-dependent industrial uses over non-water-dependent industrial uses; and second, give preference to water-related industrial uses over non-water-oriented industrial uses. Lands designated for industrial uses should not include shoreline areas with severe environmental limitations, such as critical areas.
- Industrial areas within the SMA are limited to the BPA substation property along Jenkins Creek and a very small area within the Big Soos Creek Corridor. Potential for additional industrial development is limited along Jenkins Creek because it is unlikely that the existing use of the BPA property as an electrical transmission and distribution facility will change. However, with the continued growth of Covington, intensification of this use is likely. Required buffers and setbacks in the SMP are needed to protect Jenkins Creek.
- Within the Soos Creek SMA, the majority of the small area that is designated Industrial in the Comprehensive Plan appears to be located within the boundaries of a mapped wetland, where required buffers and other regulations will restrict or limit future development. The SMP should contain provisions which allow continued industrial use of whatever small upland area that may or may not be located outside of required wetland buffers, while protecting the adjacent resources. Formal delineation and buffer determination of this wetland would be needed to determine if industrial development is possible within any portion of the Big Soos Creek SMA.

Recreation

- SMP provisions should provide for future recreational development in all SMA areas other than the potential High Intensity designation at the BPA substation along Jenkins Creek. Particularly important are areas where the Urban Conservancy designation appears to be appropriate, such as Camp McCullough, Big Soos Creek and potentially portions of the Jenkins Creek corridor where trail improvements are anticipated.
- The SMP should give shoreline recreational development priority and assure the activities are primarily related to the access and enjoyment of the water and shoreline area. In addition to emphasizing water-oriented recreational uses, appropriate limits should be established for non-water oriented activities, such as the proximity, location, design and operation of developed ball fields.
- The SMP provisions must protect the ecological functions of the shoreline area. Particularly important are high function areas at Camp McCullough and sensitive wetland areas along Big Soos Creek and Jenkins Creek.

- The SMP should specifically address trail location, design and construction, particularly with the Big Soos Creek and Jenkins Creek corridors where improvements are planned. Pervious trail construction using low impact development methods should be emphasized.

Residential Development

- Single family residences are the most common form of shoreline development and are identified as a priority use when developed in a manner consistent with control of pollution and prevention of damage to the natural environment. The SMA must address continued shoreline residential development, particularly redevelopment along portions of Jenkins Creek and replacement and expansion of existing homes along Pipe Lake.
- The SMP should include provisions which address shoreline armoring, storm water runoff, septic systems, introduction of pollutants and vegetation modification and removal. The SMA should address areas of Big Soos Creek that are not connected to sewer.
- Particularly along the residential portions of the Pipe Lake, the SMP must place appropriate restrictions on shoreline armoring and the design and construction of piers to assure no net loss of ecological functions. Currently much of the Pipe Lake shoreline is in a semi-natural condition.

Commercial Development

- The SMP must give preference to water-dependent commercial uses over non-water dependent commercial uses; and second, give preference to water-related and water-enjoyment commercial uses over non-water oriented commercial uses.
- Master programs should prohibit non-water-oriented commercial uses on the shoreline unless they meet the following criteria:
    - The use is part of a mixed-use project that includes water-dependent uses and provides a significant public benefit with respect to the Shoreline Management Act's objectives, such as providing public access and ecological restoration; or
    - Navigability is severely limited at the proposed site; and the commercial use provides a significant public benefit with respect to the Shoreline Management Act's objectives such as providing public access and ecological restoration.
- Where the SMP anticipates new uses within the SMA other than residential uses, such as along Wax Road within portions of the Jenkins Creek corridor, SMP policies and regulations must reflect the above requirements of state law.

7.2 RESTORATION PLAN

The Restoration Plan should be prepared consistent with 173-26-201(2)(f)(i-vi) by addressing the following six subjects:

(i) Identify degraded areas, impaired ecological functions, and sites with potential for ecological restoration;

The discussions of degraded areas, impaired functions, and opportunity areas included in this report should be carried forward to the Restoration Plan.

(ii) Establish overall goals and priorities for restoration of degraded areas and impaired ecological functions;

A recommended starting point for development of restoration goals and priorities is the WRIA 9 products. Although the WRIA 9 work is largely salmon-focused, many of the salmon-related goals, policies, and other actions benefit other fish and wildlife as well. The WRIA 9 goals and policies should be examined and supplemented as needed to ensure that these goals are appropriate and comprehensive, not just for application to Big Soos Creek, but also to Pipe Lake and Jenkins Creek that receive less attention in those documents.

(iii) Identify existing and ongoing projects and programs that are currently being implemented, or are reasonably assured of being implemented (based on an evaluation of funding likely in the foreseeable future), which are designed to contribute to local restoration goals;

Identify City programs and outside organizations that are actively engaged in planning and implementing projects that could directly or indirectly contribute to achievement of restoration goals. A special effort should be made to ensure that all City departments are contacted to identify additional projects or programs. Further, other organizations should be contacted to determine what projects or programs may be implemented in the future that would have a positive effect on shoreline ecological functions.

(iv) Identify additional projects and programs needed to achieve local restoration goals, and implementation strategies including identifying prospective funding sources for those projects and programs;

The degraded areas, impaired ecological functions, and sites with potential for ecological restoration identified under (i) above, and not addressed by any of the programs and projects identified in (iii) above, could be translated into additional projects and programs that the City should evaluate for implementation potential. Often, implementation of projects and programs is dependent on annual budgets, grant funding, partnerships with other entities, and unexpected "windfalls." The City should clearly identify and then pursue potential partners for implementation of certain projects or programs.

(v) Identify timelines and benchmarks for implementing restoration projects and programs and achieving local restoration goals; and

(vi) Provide for mechanisms or strategies to ensure that restoration projects and programs will be implemented according to plans and to appropriately review the effectiveness of the projects and programs in meeting the overall restoration goals.

To the best of its ability, the City should identify timelines and benchmarks for each project and program. For some planned actions, such as implementation of CIP projects, this may be easy. For other projects and programs that are the responsibility of outside organizations or that do not have a clear City authority, timelines and benchmarks may of necessity be vague and speculative. City staff and elected officials must share a commitment to planning for restoration and monitoring project and program effectiveness in order for the City to meet its long-term restoration goals.

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9.0 LIST OF ACRONYMS and ABBREVIATIONS

CAC .....City of Covington Critical Areas Code

Corps.....U.S. Army Corps of Engineers

Ecology .....Washington Department of Ecology

GMA .....Growth Management Act

HPA.....Hydraulic Project Approval

KZC.....Covington Zoning Code

LWD .....Large Woody Debris

NOAA Fisheries.....National Marine Fisheries Service

NRCS .....Natural Resources Conservation Service

PAA.....Potential Annexation Area

PAHs.....polycyclic aromatic hydrocarbons

PCBs .....polychlorinated biphenyls

PHS .....Priority Habitats and Species

SMA.....Shoreline Management Act

SMP.....Shoreline Master Program

USFWS .....U.S. Fish and Wildlife Service

WDFW.....Washington Department of Fish and Wildlife

APPENDIX A

INFORMATION REQUEST LETTER AND DISTRIBUTION LIST

APPENDIX B

ASSESSMENT OF SHORELINE JURISDICTION

APPENDIX C

PHOTOGRAPHS

Big Soos Creek

Facing downstream from SR 516/South 272nd Street

Jenkins Creek

Facing downstream from the Covington Way SE crossing. Note the weir.

Pipe Lake

Facing south from the Camp McCullough dock – native forested lake edge.

View of typical residential lakefront.

APPENDIX D

MAP FOLIO