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FINAL

CUMMULATIVE IMPACTS ANALYSIS COMPONENT for City of Covington's Shorelines: Big Soos Creek, Jenkins Creek and Pipe Lake

Project Title: Shoreline Master Program Update
Task 4.1 and 4.3: Cumulative Impacts Analysis

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1.0 INTRODUCTION

1.1 DEPARTMENT OF ECOLOGY DIRECTION AND GUIDANCE

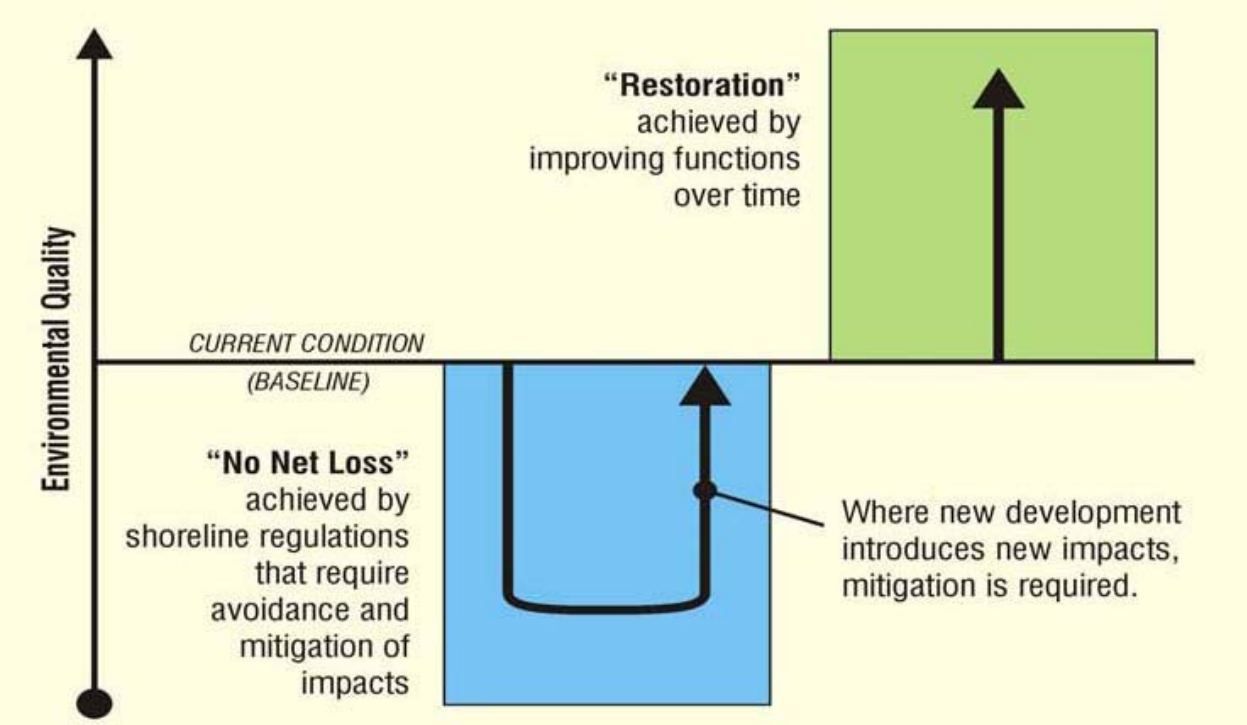
The Shoreline Management Act guidelines require local shoreline master programs to regulate new development to "achieve no net loss of ecological function." The guidelines (WAC 173-26-186(8) (d)) state that, "To ensure no net loss of ecological functions and protection of other shoreline functions and/or uses, master programs shall contain policies, programs, and regulations that address adverse cumulative impacts and fairly allocate the burden of addressing cumulative impacts."

The guidelines further elaborate on the concept of net loss as follows:

> "When based on the inventory and analysis requirements and completed consistent with the specific provisions of these guidelines, the master program should ensure that development will be protective of ecological functions necessary to sustain existing shoreline natural resources and meet the standard. The concept of "net" as used herein, recognizes that any development has potential or actual, short-term or long-term impacts and that through application of appropriate development standards and employment of mitigation measures in accordance with the mitigation sequence, those impacts will be addressed in a manner necessary to assure that the end result will not diminish the shoreline resources and values as they currently exist. Where uses or development that impact ecological functions are necessary to achieve other objectives of RCW 90.58.020, master program provisions shall, to the greatest extent feasible, protect existing ecological functions and avoid new impacts to habitat and ecological functions before implementing other measures designed to achieve no net loss of ecological functions." [WAC 173-206-201(2)(c)]

In short, updated SMPs shall contain goals, policies and regulations that prevent degradation of ecological functions relative to the existing conditions as documented in that jurisdiction's characterization and analysis report. For those projects that result in degradation of ecological functions, the required mitigation must return the resultant ecological function back to the baseline. This is illustrated in the figure below. The jurisdiction must be able to demonstrate that it has accomplished that goal through an analysis of cumulative impacts that might occur through implementation of the updated SMP. Evaluation of such cumulative impacts should consider:

(i) current circumstances affecting the shorelines and relevant natural processes;
(ii) reasonably foreseeable future development and use of the shoreline; and
(iii) beneficial effects of any established regulatory programs under other local, state, and federal laws."



Source: Department of Ecology

As outlined in the *Shoreline Restoration Plan* prepared as part of this SMP update, the SMA also seeks to restore ecological functions in degraded shorelines. This cannot be required by the SMP at a project level, but Section 173-26-201(2)(f) of the Guidelines says: "master programs shall include goals and policies that provide for restoration of such impaired ecological functions." See the *Shoreline Restoration Plan* for additional discussion of SMP policies and other programs and activities in Lake Forest Park that contribute to the long-term restoration of ecological functions relative to the baseline condition.

The following summarizes for each shoreline environment (Figure 1) the existing conditions, anticipated development, relevant Shoreline Master Program (SMP) and other regulatory provisions, and the expected net impact on ecological function.

1.2 RELATIONSHIP TO SEPA

The State Environmental Protection Act (SEPA) requires an assessment of environmental impacts. This cumulative impact analysis is a supplement to the environmental review done under SEPA and is intended to address cumulative rather than isolated or individual impacts that might not otherwise be considered as part of the environmental checklist.

The SEPA review process is intended to provide a list of possible environmental impacts that may occur as a result of a project or change in policy. This helps identify potential impacts that may need to be mitigated, conditioned, or this may result in the denial of a project or proposal. This cumulative impact analysis is intended to look at impacts as a whole on the basis of whether or not multiple similar projects collectively result in gradual, but significant impacts. While

SEPA looks at impacts by topic and the effects they may have as a whole for the project area, the cumulative impacts analysis examines impacts that may result from multiple projects over time.

1.3 ASSUMPTIONS

This analysis is looking at foreseeable impacts over time. Impacts are examined in each of the shoreline management areas and segments, as done in the rest of the SMP document and in the Covington Shoreline Characterization Report. Site specific impacts are also expected to be addressed on a case-by-case basis during individual project reviews. The segments used in this analysis correspond with the proposed shoreline environment designations and were previously analyzed for alterations to key processes.

Due to current adopted land use regulations and current land use, it is assumed that only two areas have significant redevelopment potential. These include the portion of Jenkins Creek upstream of Covington Way SE that has been recently zoned for more intensive use, and the Camp McCullough property on Pipe Lake. Other areas, such as the shoreline residential portion of Pipe Lake, are likely to see more slow and incremental changes associated with on-going uses. This is discussed in detail in this document.

1.4 DOCUMENT ROADMAP

This cumulative impacts analysis summarizes the existing conditions in each of the shoreline segments, details the potential impacts and risks to shoreline functions and processes, identifies anticipated development in each shoreline segment and how the SMP regulations would address this development, discusses how other local, state and federal regulations would address these potential impacts, and describes the net effect on ecological functions and processes. A cumulative impacts table is include in Appendix A that looks describes the relationship between ecological function, potential alteration, resource at risk and proposed SMP regulations and non-regulatory measures designed to assure no net loss at a minimum. In addition, this table provides a summary of both the current performance and the anticipated future performance for that function.

2.0 EXISTING CONDITIONS

The following summary of existing conditions in the three shoreline areas and the relevant natural processes is based on the Final Shoreline Analysis Report (The Watershed Company/AHBL, June 2008), and additional analysis needed to perform this assessment. The full report includes a more in-depth of discussion of the topics below, as well as information about transportation, stormwater and wastewater utilities, impervious surfaces, and historical/ archaeological sites and other information.

2.1 PIPE LAKE

2.1.1 Shoreline Environments

Approximately 66.5% of the upland shoreline jurisdiction is proposed to be designated as Shoreline Residential environment. Approximately 33.5% of the upland shoreline jurisdiction is

proposed to be designated as Urban Conservancy. The Pipe Lake Shoreline Management Area also include the open water areas of Pipe Lake within the City limits of Covington, which are proposed to be designated as Aquatic, consistent with WAC 173-26-211(5)(c).

2.1.2 Land Use

Within the 200 foot upland portion of the Pipe Lake Shoreline Management Area, approximately 55% is developed as single family residential housing, 32% is the private recreation facility Camp McCullough, 7% is a private shoreline tract belonging to Aqua Vista Estates and 6% is vacant single family lots. The entire Pipe Lake Shoreline Management Area is zoned R-4 (Single Family Residential, 4 Units per Acre). Future land uses, as indicated by the current designations in the Comprehensive Plan, include Open Space (4% of Pipe Lake SMA), Public (33.5%) and Low Density Residential – 4du/ac (62.5%).

Proposed shoreline environments reflect both the existing conditions and proposed future use along Pipe Lake. Designation of Camp McCullough as Urban Conservancy in the proposed SMP, is consistent with the Covington Comprehensive Plan, which indicates a strong intent to encourage public access at this site at some point in the future. Urban Conservancy also provides greater ecological protection for this portion of the shoreline, which is less developed and has the highest level of ecological function of any portion of the lake in the City. Designation of single family areas as Shoreline Residential also reflects the City's intent to encourage this use for the foreseeable future and recognizes the more developed and modified nature of this area.

2.1.3 Parks and Open Space/Public Access

There is currently no public access to Pipe Lake in Covington. In addition to access by single family homeowners, private recreation access is available at Camp McCullough and the shoreline tract owned by available to residents of Aqua Vista Estates. The City has indicated a desire to provide future public access to the Pipe lake shoreline, and the potential for a possible future public park, at Camp McCullough. If implemented, this would result in an increase in the amount of shoreline public access available in Covington. However, no funds have been allocated for this and the current owner has no plans to change the current private use.

2.1.4 Shoreline Modifications

The most common shoreline modifications on Pipe Lake are anthropogenic alterations to the natural lake edge, and include a variety of armoring types (some associated with fill), piers and docks, and other in-water structures such as boatlifts, boathouses, and moorage covers. These shoreline modifications alter the function of the lake edge, change erosion and sediment movement patters, affect the distribution of aquatic vegetation, and are often accompanied by upland vegetation loss.

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 at Camp McCullough, owned by the First Presbyterian Church of Tacoma. The limited current armoring of the lake is significant and the potential for and

regulation of future shoreline armoring along Pipe Lake is a specific concern of both the SMP and this cumulative impacts analysis.

There are approximately 30 docks or piers (additional docks or piers by be obscured by trees in the aerial photo) on 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. Digital layers of piers in Pipe Lake are not available, so details statistical analyses of pier length and area were not generated. There are 34 parcels on Covington's Pipe Lake Shoreline, indicating the potential for an increase of approximately four more piers. There is also the potential for an increase in the size, width and coverage of piers at Pipe Lake and this potential is a significant concern of both the SMP and this cumulative impacts analysis.

Total overwater cover and number of structures are relative to ecological function assessment and thus cumulative impacts assessment. Total overwater cover is an indication of the amount of the 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 can alter fish behavior and species interactions.

2.1.5 Biological Resources and Critical 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. Pipe Lake does not have a mapped flood hazard area. 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. However, we would expect that there may be possible emergent wetlands along the lakeshore at Camp McCullough. 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. Overall, biological resources and habitat functions are highest on the Camp McCullough and relatively low on single family properties. Current water quality in the lake is quite good, as discussed in the Shoreline Inventory and Analysis Report.

2.2 BIG SOOS CREEK

2.2.1 Shoreline Environments

The entire upland portion of Big Soos Creek Shoreline Management Area is proposed to be designated as Urban Conservancy. Areas below the Ordinary High Water Mark of Big Soos Creek are proposed to be designated as Aquatic.

2.2.2 Land Use

The shorelands of Big Soos Creek are predominantly very large lot single family residential, with some accessory agricultural use and an average density of .16 units per acre. For example, 25 acres of the 53 acres in the Big Soos SMA is associated with just one individual single family

property. Mapped wetlands extend the shoreline management area beyond the typical 200 foot zone, particularly to the west and northeast of Big Soos Creek. According to the King County Assessor, 67.6% of the Big Soos Creek SMA is single family, 27.2% is vacant, and 5.3% is classified as industrial or resource processing. Industrial and resource processing areas are included in the mapped boundary of the SMA only because the mapped wetland extent includes these areas. However, site specific studies would be required to determine if these areas are in fact wetlands and the current level of development and modification would appear to perhaps preclude a finding of wetland conditions in some of those areas.

Most of the land (87% of the Big Soos Creek SMA) is zoned and designated in the Comprehensive Plan as Urban Separator, which allows only one unit per acre. Wetland regulations also preclude extensive development of this area. Under the proposed SMA, single family development would require a conditional use permit, as well as a wetland study in the Big Soos SMA. 13% of the land in the mapped Big Soos Creek SMA is zoned Downtown Commercial. However, this area is only within the SMA if it is in fact a wetland, in which case wetland regulations would provide additional restrictions on development and the SMP would prohibit primary commercial uses. Uses other than recreation are either not allowed or require a conditional use permit under the proposed regulations for the Big Soos Creek Urban Conservancy environment.

2.2.3 Parks and Open Space/Public Access

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 and a net increase in public access to the shoreline. However, no funding has been dedicated for their development at this time. The SMP contains an emphasis on increasing public access to the shoreline, including the Big Soos Creek area.

2.2.4 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 as a result of these shoreline modifications.

Rip rap and weirs would be prohibited in the proposed Urban Conservancy designation for Big Soos Creek. Bridges and associated improvements would require a conditional use permit and standards calling for using more ecologically sensitive techniques wherever possible and

mitigating to achieve no net loss of function. Wetland regulations provide additional protections. The creek is not navigable so there are no docks or piers and there is no potential for docks or piers.

2.2.5 Biological Resources and 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 canary grass. 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, crosses Covington's shorelands and joins Big Soos Creek north of SR 18 from the east. 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.

2.3 JENKINS CREEK

2.3.1 Shoreline Environments

Approximately 14.5 acres of 45% of the Jenkins Creek SMA is proposed to be designated as High Intensity. This portion of the Jenkins Creek SMA is located from the eastern boundary of the City right-of-way containing the Covington Way SE bridge, downstream to the City limits and the southwest corner of the City. The entire extent of this reach or segment of Jenkins Creek fronts the Bonneville Power Administration (BPA) Covington Substation.

The remaining portion of the Jenkins Creek upstream of Covington Way SE is proposed to be given the parallel designations of Urban Conservancy and Medium Intensity. Areas within the 115 foot stream and shoreline buffer are designated as Urban Conservancy. Areas beyond 115 feet from the Ordinary High Water Mark to the SMA boundary are designated as Medium Intensity. Throughout most of this reach, the mapped Jenkins Creek SMA includes areas beyond the standard 200 foot shoreline area because of the presence of mapped, but not delineated, wetlands. A wetland study is required for development proposals in this area and will determine the actual presence of absence of wetland conditions per the proposed Critical Areas for the Shoreline Management Area in the SMP. If wetland conditions do not exist, these areas would not be regulated under the SMA.

The proposed shoreline environments for Jenkins Creek reflect the existing ecological conditions, current land use, proposed future land use and the need to assure no net loss along Jenkins Creek as described below.

2.3.2 Land Use

Currently, over half of the shoreland area surrounding Jenkins Creek (53 percent) is in low density residential use. Another 42 percent is in public utility use by the Bonneville Power Administration's (BPA) Covington substation, and the remaining six percent are undeveloped or unknown. The BPA site is zoned Industrial and designated as Utility in the Comprehensive Plan. The area upstream is zoned DN-7B and DN7-A, downtown transition sub-districts that allow single family residential, townhomes, cottage housing, small professional offices of varying sizes and the potential for mixed use development. Existing and proposed land use is

consistent with proposed environment designations in the SMP because the utility site is designated as High Intensity and the future downtown transition area is designated with parallel environments that reflect the complex combination of desired future mix of uses, protection of environmentally sensitive areas, and public access objectives as described below.

The potential for land use change at the BPA site is very low. The potential for land use change upstream of Covington Way SE is relatively high due to the current single family use and the more intensive uses allowed under current zoning. In addition to the requirements for both Urban Conservancy and Medium Intensity, development in this reach may also be subject to wetland regulations, which in many cases would preclude most development other than public access in the SMA.

2.3.3 Parks and Open Space/Public Access

There are no existing parks, open space, or public access to Jenkins Creek with the SMA. 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. In addition to the proposed Jenkins Creek Trail and South Covington Park, development of multi-family residential and commercial sites along Wax road consistent with zoning requirements and the SMP would require compliance with public access regulations. This is also expected to result in a net increase in public access opportunities in the SMA.

2.3.4 Shoreline Modifications

A review of aerial photography indicates that the Jenkins Creek channel bordering the Bonneville Power Administration (BPA) substation has been straightened. This 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.

The potential for additional shoreline modifications in the Jenkins Creek SMA is limited. The addition of rip rap is not allowed in the Urban Conservancy designation and would require a conditional use permit in the High Intensity designation. Jenkins Creek is not navigable so docks and piers are prohibited. New weirs would require a CUP (per requirements for Aquatic environment). Soil bioengineering would have to meet strict standards in the SMP but is permitted.

2.3.5 Biological Resources and 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.

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. 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. Based on aerial photos and a brief site visit, the wetland is forested with red alder, black cottonwood and willow. 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".

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. 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.

2.0 ECOLOGICAL FUNCTIONS AND PROCESSES AT RISK

The intent of the Covington SMP is to assure, at a minimum, no net loss of ecological functions necessary to sustain shoreline natural resources. Managing shorelines for protection of their natural resources depends on sustaining the functions provided by:

- Ecosystem-wide processes such as those associated with the follow and movement of water, sediment and organic materials; the presence and movement of fish and wildlife and the maintenance of water quality.
- Individual components and localized processes such as those associated with shoreline vegetation, soils, water movement through soil and across the land surface, and the composition and configuration of the best and banks of water bodies.

The following subsections outline specific ecologic functions of the Covington SMA and related processes that are at risk and must be protected by the SMP.

3.1 HYDROLOGIC

The hydrologic functions in Pipe Lake include:

- Storing water and sediment
- Attenuating wave energy,
- Removing excessive nutrients and toxic compounds, and
- Recruitment of large woody debris and other organic material.

Hydrologic functions of wetlands which are or may be found in association with Pipe Lake, Jenkins Creek, and Big Soos Creek, include:

- Storing water and sediment
- Attenuating wave energy,
- Removing excessive nutrients and toxic compounds, and
- Recruitment of woody debris and organic material.

Hydrologic functions in Jenkins Creek, Soos Creek and its associated floodplain include:

- The transport of water and sediment across the natural range of flow variability;
- Attenuating flow energy;
- Development pools, riffles, gravel bars; and
- Recruitment and transport of large wood debris and other organic materials.

These functions are addressed in more detail for each of the three shoreline areas below.

3.1.1 Pipe Lake

A lake by definition provides excellent water and sediment storage functions. However, uplands surrounding Pipe Lake have a range of water and sediment storage capacities and functions depending on soils conditions and level of development. Pipe Lake is divided into two reaches

in the Analysis Report and two separate shoreline environments in the SMP to reflect very different levels of function. Reach 1 (Urban Conservancy – Camp McCullough) on the west shore is mostly forested with very little shoreline development. Reach 2 (Shoreline Residential – single family) in the remaining areas on the north and south shores, is almost entirely developed with extensive impervious surfaces, non-native vegetation, areas of shoreline armoring and a pier or dock associated with most of the properties.

Water and sediment storage functions are at risk from potential loss of native vegetation and additional impervious surface development. Wave energy attenuation functions are not as critical on Pipe Lake because the lake is not large enough to generate very large waves, boat wakes are not an issue on Pipe Lake due to the prohibition on gas engines, and the prevailing winds from the south or west often blow the wind offshore. However, loss of vegetation in combination with bulkheads and other shoreline modifications has the potential to further impact the natural ability of the shoreline to attenuate wave energy.

Common impacts of urban development, such as the increase in impervious surfaces and polluted run-off, elimination of natural vegetation and the increased use of lawn and garden chemicals both in the shoreline area and the larger basin containing Pipe Lake have the potential to increase nutrients and toxic compounds entering the lake. Removal of native vegetation and the armoring of the shoreline also reduces the potential for recruitment of large woody debris and organic material that are needed in a healthy system. In all cases, the potential for negative impact to hydrologic functions on Pipe Lake are highest in Reach 1 because of the high level of current function and the limited level of current development. However, the flip side of this is that there is substantial potential for enhancement of the hydrologic functions of Reach 2 over time. The hydrologic functions are also impacted by potential alterations outside of shoreline jurisdiction, such as the overall increase in impervious surfaces associated with the urbanization of this once rural area.

3.1.2 Jenkins Creek

Jenkins Creek was also broken into two major reaches for the purposes of this project. Reach 1 is downstream of Covington Way SE and includes shoreline are impacted by utility facility development. Reach 2 upstream of Covington Way SE contains floodplain wetlands and is flanked by single-family development. Reach 2 was further divided into parallel shoreline environments during the development of the SMP to reflect very different management objectives for different portions of the shoreline area.

Hydrologic functions vary between the two reaches and thus the potential for additional cumulative negative impact and improvement to these processes also varies accordingly. The channel of Jenkins Creek along Reach 1 is artificial and was dug in the past to make more room for the adjoining BPA substation. As such it has a greatly reduced floodplain and has little capacity to store water and sediment, but transports both efficiently. Pools, riffles and gravel bars are absent from Reach 1 as a result of the human modification. The lack of a floodplain results in this Reach being relatively poor at removing excess nutrients and toxic compounds. Vegetation is growing and maturing near the channel and improving the natural ability of the channel to attenuate wave energy, as well as provide potential recruitment and transport of the LWD and organic material in the future. The relatively low hydrologic function of Reach 1

means there is significant room for future improvement through restoration and enhancement and less risk that additional development will significantly further degrade these functions. Restoration projects as discussed in the Restoration Plan have also occurred within this reach in the last 10 years.

Within Reach 2, Jenkins Creek flows within a densely wooded area containing extensive wetlands. Areas on the right bank are within the City of Covington and contain large lot single family residential development. Areas on the left bank that border the stream to the southeast are managed as City of Kent watershed with restricted access. This reach has a larger floodplain that high flows can spread out in and the soils beneath it are sandy, gravelly, and permeable. Hydrologic functions in this reach are accordingly high in terms of the ability of this reach to store water and sediment, attenuate flow energy, develop a natural stream structure with pools and riffles, remove toxic compounds and nutrients, and recruit large woody debris. These functions are potentially at risk from future development both within, but as upstream and upland of the SMA. Development upstream has increased peak flows to the point where erosion and sedimentation are becoming issues.

Any future removal of vegetation, placement of impervious surfaces, filling of wetlands, armoring of banks or the straightening of the channel would all negatively impact the hydrologic functions of this reach. In addition, stormwater inputs from the larger basin (both inside and outside of the City) have the potential to negatively impact hydrologic functions in Jenkins Creek. This requires a local and regional emphasis on effective stormwater management and ideally low impact development which has proven more effective at replicating natural hydrology.

Development within and just outside of the shoreline area along Reach 2 is expected as this area transitions to a broader range of uses that are allowed under current zoning and the SMP. This is discussed in detail in Section 4. As such, the protection of the high ecological function of this reach is a particular focus of the SMP and is reflected in a variety of ways, from the parallel designation of Urban Conservancy and Medium Intensity, to wetland regulations, vegetation conservation regulations, and restrictive use standards, etc.

3.1.1 Big Soos Creek

The Soos Creek subbasin, which extends well beyond the City of Covington, is in the process of changing from a rural and forested condition to a more heavily urbanized area, particularly in the western areas. The subbasin has an extensive system of interacting lakes, wetland, and gravelly, infiltrating soils that collectively help to attenuate peak stream flows. Wetland mapping by the City, King County, and WDFW PHS (2007) wetland mapping show that much of the Big Soos Creek shoreline within the City limits is a wetland. According to King County, the wetland is 62 acres in size and is classified as Category I, the highest category and level of protection.

Existing flow related problems occur in the upper reaches of the creek, which are subject to low and high stream flows. As discussed in the Inventory and Analysis Report, in the 1980's, Soos Creek discharged about 8 to 10 cfs to the Green River during the summer and 400 cfs during one-year event high flows. Soos Creek is one of the largest tributaries of the Green River and its hydrologic regime is dominated by winter rain events, with low flows 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). Overall, the current condition and potential future impacts to ecological functions in the Big Soos Creek SMA are heavily influenced by what occurs outside of the City of Covington boundary.

Within the City of Covington, hydrologic functions, such as water and sediment storage would be negatively impacted by urban development in this designated wetland. Impervious surface development and loss of vegetation would have negative impacts on hydrologic function. Protection of wetlands associated with Big Soos Creek is important to prevent and reduce downstream flooding. Though shrubby willow and similar species occur with the Big Soos Creek SMA in the City Covington, little mature vegetation remains in the riparian zone along the creek. This appears to be the result of past human modification and agricultural practices, including grazing, and possibly existing soil conditions as discussed later in this section. Where trees do occur, they are generally small. This means that there is relatively low potential or recruitment of large wood debris.

Big Soos Creek has an extensive floodplain within Covington which does provide competent biofiltration function (i.e. removal of excess nutrients, sediment and toxic compounds). The moderate level of hydrologic function means there is significant room for improvement within the Big Soos SMA. Limited future development potential as discussed in Section 4.0 and significant restrictions on development, including agriculture, should help improve conditions in this area overtime. However, from a hydrologic standpoint, the impacts of urbanization, in the overall basin (including increased peak flows and reduced summer flows) that is largely outside of the control of the City have the potential to negate potential positive impacts at the site scale.

3.2 SHORELINE VEGETATION AND HABITAT

Shoreline vegetation functions in Pipe Lake, Jenkins Creek, Big Soos Creek and associated wetlands and floodplains include:

- Maintaining temperature,
- Removing excessive nutrients and toxic compounds,
- Sediment removal and stabilization, and
- Attenuation of flow energy;

- Provision of large woody debris and other organic matter.

The potential for these functions to be impacted is addressed in more detail for each of the three shoreline areas below.

3.2.1 Pipe Lake

Reach 1 (Urban Conservancy – Camp McCullough) has a combination of a healthy forest and east facing shoreline which provides good shading, particularly in the warmer afternoon hours. As the trees mature, shade and thus temperature regulation functions of this vegetation should improve unless they are removed. The maturing mixed forest areas line the lake and macrophytic vegetation in the nearshore, combined with native understory, helps capture and breakdown toxics and nutrients, filter run-off, and stabilize banks. This also provides opportunities for large wood debris recruitment and the naturally vegetated banks provide wave attenuation functions. These processes are potentially at risk from future development, including recreational development which could disturb, shade or remove lakeshore and nearshore vegetation. Removal of understory, tree removals and swim beach creation through aquatic vegetation removal and substrate modification would all negatively impact these functions.

Reach 2 (Shoreline Residential – Single Family Areas) has sparse shoreline vegetation and limited shading of the shallow-water nearshore area. The function of vegetation and the related habitat in this reach is poor. Native nearshore vegetation is largely absent. Upland vegetation is also less effective at shading south and west-facing shoreline areas due to midday sun from the south and afternoon sun from the west. Residential landscaping in this reach is dominated by lawns rather than dense buffers of native vegetation. These areas are likely to be sources of water quality contaminants such as fertilizers, herbicides and pesticides. In addition the lack of vegetation and the presence of upland pollution generating impervious surfaces means that water quality is impacted by urban stormwater runoff and related hydrocarbons, metals, sediments and other pollutants. The lack of shoreline vegetation means that the current condition provides very little wave attenuation function in this reach. Bulkheads on some properties have replaced natural land forms and vegetation. This condition also limits the natural recruitment of sediment for lakebed materials, large woody debris, and other organic matter. Substantial room exists for improvement of vegetation functions in Reach 2. However, additional residential development also has the potential to further negatively impact vegetation through tree removal, native vegetation conversion and bulkheading.

3.2.2 Jenkins Creek

Reach 1 along the BPA site has low to moderate shoreline vegetation function. The strip of native vegetation near the stream is relatively narrow, but it is maturing and the condition can thus be expected to improve in the future if it is not removed or otherwise significantly modified. Temperature regulation is moderate and the vegetation does help to protect the bank from erosion currently. Sediment removal functions and water quality improvement functions in this narrow area of vegetation that does not have floodplain are limited. Loss of this maturing vegetation would negatively impact these functions, but alternatively, significant potential exists for restoration and enhancement of this area. It is important to note that improvement in

vegetation function in this area over time is likely even if no direct action is taken as the existing vegetation matures.

Reach 2, upstream of Covington Way SE, has very high vegetation function. The combination of a well-established and maturing forest in the shoreline buffer area and a relatively narrow active channel during low-flow periods results in excellent temperature regulation from the resulting shade. This is not true for upstream areas beyond the SMA, so water may already be elevated in temperature in this reach. Nonetheless, the high quality and multi-layered vegetation in this reach provide a high level of functions, including bank stabilization, flow attenuation, sediment removal and LWD and organic matter recruitment. These functions are potentially at risk from residential, commercial, mixed-use and recreational development, if not done in an appropriate manner. As discussed in Section 4.0 this area has been a focus of the regulations to ensure protection of the existing functions. This includes specific standards which address the impacts of impervious surfaces, buffers and building setbacks from Jenkins Creek, tree conservation, wetland protection and low impact development standards for recreational facilities.

3.2.3 Big Soos Creek

Big Soos Creek has existing problems with the low density and small size of shoreline vegetation with Covington. The creek is currently on the State's 303(d) list as Category 5 waters for dissolved oxygen. Despite these problems, the existing willows, grasses, emergent vegetation and other vegetation types do provide a moderate level of water quality improvement, bank stabilization, and sediment removal. Other vegetation functions, such as LWD recruitment, temperature regulation and the attenuation of flow energy would also benefit from larger and denser vegetation in the shoreline area. As discussed in more detail in Section 4.0, additional residential development in this area is unlikely due to continuing floodplain and wetland restrictions, as well as the proposed requirements in the SMP. However, if allowed such development, which typically includes the conversion of native plant communities to residential landscapes and resulting removal of vegetation, would negatively impact vegetation functions. This could lead to reduced water quality, decreased bank stability, higher temperatures and more sediment and pollutants in Big Soos Creek.

3.3 HYPORHEIC FUNCTIONS

The hyporheic zone is the transition region between groundwater and surface water, and represents an important interface between terrestrial and aquatic ecosystems where groundwater combines with surface water. Hyporheic functions in Pipe Lake, Jenkins Creek, Big Soos Creek and associated wetlands and floodplains include:

- Removing excessive nutrients and toxic compounds,
- Water storage;
- Support of vegetation;
- Sediment storage, and
- Maintenance of base flows.

The potential for these functions to be impacted is addressed in more detail for each of the three shoreline areas below.

3.3.1 Pipe Lake

The hyporheic zone along the mostly natural lakeshore in Reach 1 likely provides a relatively high nutrient and toxic compound removal function. Water likely infiltrates into the hyporheic zone rather than running off into the lake as surface flow. This helps support aquifer recharge. Water quality is generally 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 currently has good water quality with chemical conditions that discourage algal blooms and favor water clarity. This supports beneficial uses such as swimming, boating and fishing. Protection of the hyporheic zone is important for maintaining these positive current conditions.

The hyporheic zone in Reach 1 also provides a relatively high water storage function, although water storage is not particularly important in a lake with a high average retention time and relatively low fluctuations in water surface elevation. Granular soils in the basin are not conducive to wicking water very far upwards from the static water table, restricting the shoreline areas where the roots of vegetation would be within the range of the hyporheic zone. These porous, gravely soils provide moderate support for base flows (lake level) and likely support aquifer recharge. As is the case with the other functions discussed, all of these processes could potentially be impacted from urban development and recreational development in Reach 1. Specifically, the filling and bulkheading of beaches and creation of impervious surfaces near the shoreline could negatively impact the hyporheic zone.

Reach 2, which comprises the single family homes along the south and north shores of Pipe Lake, likely has reduced hyporheic functions when compared to Reach 1, due to the shoreline armoring present. Lawns and landscaping in this area are generally supported by irrigation and precipitation rather than hyporheic water storage. Additional shoreline armoring, impervious surface development, and conversion of remaining native vegetation to lawn and other species would negatively impact hyporheic and relative vegetation functions. However, as with other functions, there is substantial room for enhancement and improvement. The SMP targets the maintenance of existing natural conditions and the enhancement of altered shoreline functions in Reach 2 of Pipe Lake. Specifically, incentives are provided for bulkhead removal in the form of reductions from the standard buffer of 115 feet plus a 15 feet building setback.

3.3.2 Jenkins Creek

Throughout both reaches of Jenkins Creek the soils are very gravelly and permeable and hence the creek has a highly interactive hyporheic zone. This flow supports groundwater recharge. Stream flows supplement shallow groundwater flows or hyporheic flows and vice versa, thereby increasing the proportion of flow which routines flows in and out of the zone that is filtered through this process. Thus even in Reach 1, where the floodplain has been confined and the stream has been placed in an artificial channel, the hyporheic zone provides a moderate degree of function in terms of removing pollutants, storing water, recharging aquifers, and maintaining base flows, primarily due to the nature of the soils present.

However, these functions are higher in Reach 2, where there is a wider and more complex floodplain which provides a broader area over which this hyporheic interaction can occur. Within Reach 1, the combination of steeper streambanks and very permeable soils means only a narrow band of vegetation along the streambanks would have access to hyporheic water through their root systems. Support of vegetation functions are better in Reach 2, but again, the gravelly outwash soils can be so well-draining and poor at wicking water that plants growing above these soils can be deprived of water even when an active water table is near the surface. However, precipitation usually provides ample support for vegetation in this climate in most areas. Sediment storage also varies considerably between the two reaches due to the narrowness of the floodplain in Reach 1. A much wider floodplain in Reach 2 upstream of Covington Way SE, provides a wider area for this interaction, including sediment storage.

Hyporheic functions can be negatively impacted by channel armoring, channel modification and realignment, flood control structures and development of the floodplain and associated wetlands. In addition, if sediment loading in Jenkins Creek (from increased flows related to upstream development, erosion and bank failures) is too high, gravels of the hyporheic zone could become clogged, their sediment storage capacity used up, and the overall function of the hyporheic zone could be impaired.

3.3.3 Big Soos Creek

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. These soils can be so well draining that they do not support forest vegetation very well. Big Soos Creek in the City of Covington has a large floodplain, which provides an increased area for these hyporheic interactions to occur. The hyporheic zone also provides some nutrient and toxic compound removal when water from the developed uplands infiltrates into the permeable soils instead of funning off of the surface. Though overall water quality parameters show mixed results and include specific problems related to oxygen, temperature, and fecal coliform, water quality is likely improved due to its infiltration as groundwater prior to entering stream flow. Likewise, this interaction across the broad floodplain of Big Soos Creek, likely contributes to aquifer recharge. Water stored in the hyporheic zone is also available to supplement dry season low stream flows.

Hyporheic functions can be negatively impacted by channel armoring, channel modification and realignment, flood control structures and development of the floodplain and associated wetlands. In addition, if sediment loading in Big Soos Creek (from increased flows related to upstream development, erosion and bank failures) is too high, gravels of the hyporheic zone could become clogged, their sediment storage capacity used up, and the overall function of the hyporheic zone impaired.

3.4 HABITAT

3.4.1 Pipe Lake

Upland habitat conditions vary widely between Reach 1 (Camp McCullough) and Reach 2 (Single Family Areas). The shoreline along Reach 1 is lined with dense native vegetation which provides physical space and conditions suitable for terrestrial species - birds, mammals, and amphibians. These species likely use the shoreline more in Reach 1 since cover, food, nesting sites, travel corridors, etc. are more available. Shallow nearshore areas include both emergent and submerged vegetation, which provides refuge for small fish and amphibians. These shallow nearshore areas also provide rearing, foraging and migration habitat for fish. Food production from the uplands in Reach 1 is available in a variety of forms, including native seed and fruit bearing vegetation. This provides food directly for wildlife, as well as a source of insects and other organic matter that drop into the water to provide food for fish and aquatic life. The emergent wetland areas present along sections of the lakeshore in this reach provide productive foraging areas for small mammals, wading birds and waterfowl.

Within Reach 2, habitat conditions are generally poor. Within the lake and nearshore, the presence of bulkheads and non-native vegetation makes these areas less hospitable for fish and amphibians. 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 in Reach 2 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 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.

Habitat functions are at potential risk from future development, including both upland and aquatic development. Shoreline stabilization, including bulkheads, in particular is an important source of potential negative impact to aquatic habitat functions. In addition, conversion of native vegetation to lawn and other species with limited value can eliminate food, cover, and insects for wildlife. Fragmentation of existing habitat, particularly in Reach 1, through additional roads, developed trails, parking, etc. could diminish the existing functions. Development of additional docks or larger docks can also negatively impact nearshore vegetation (impacting the entire food chain), substrate, and provide habitat for fish that prey on salmonids.

3.4.2 Jenkins Creek

Habitat conditions vary widely from Reach 1 (BPA site) to Reach 2 (Upstream of Covington Way SE). Within Reach 1, although 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 consists of high-quality, relatively clean gravels in large part due to the soils which the channel passes through. 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.

The maturing second-growth 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 along Reach 2, 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 for salmonids, in part due to the lower-gradient, lower-energy environment.

The natural forest in the City's Jenkins Creek shoreline area along Reach 2 provides food sources for native wildlife, 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.

Habitat functions are potentially at risk from residential, commercial, mixed-use and recreational development, if not done in an appropriate manner. This risk is much higher in Reach 2 due to the high level of current habitat function. As discussed in Section 4.0 this area has been a focus during development of draft SMP regulations to ensure protection of the existing functions. This includes specific standards which address the impacts of impervious surfaces, buffers and building setbacks from Jenkins Creek, tree conservation, wetland protection and low impact development standards for recreational facilities. Sensitive habitat functions in this area are also

considered through the designation of all areas within 115 feet of Jenkins Creek as Urban Conservancy, with restrictive standards and a minimum 115 feet buffer for all non-water related development and 130 feet combined buffer/setback for nearly all structures other than bridges.

3.4.3 Big Soos Creek

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 absence 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. 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 the small size of trees in the riparian zone. Summer low flow discharges are also decreasing, which limits available rearing production for species of salmonids that require over-summer residency (Kerwin and Nelson 2000).

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.

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 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.

Big Soos Creek has significant potential for enhancement. Discontinuation of agricultural uses can also be expected to improve conditions in this shoreline area. Future urban development in the sensitive floodplain and wetland area would negatively impact habitat that has already been impacted by past practices and upstream impacts that have changed the flow regime. This area is currently zoned for low density single family development, but the SMP includes significant protections to ensure the protection of the existing functions and processes in this area. These include mandatory 115 foot buffers, wetland regulations that prohibit development on Class I wetlands, no new agricultural uses allowed, conditional use permit requirements for single family homes, prohibitions on armoring of stream channels, and other necessary protections.

4.0 REASONABLY FORESEEABLE DEVELOPMENT AND THE REALATIONSHIP TO PROPOSED STANDARDS IN THE SMP

Cumulative impacts to the shoreline environment may result from a wide range of possible actions. Consistent with the guidelines, an appropriate evaluation of cumulative impacts on ecological functions will consider reasonably foreseeable future development and use of the shoreline that is regulated by the shoreline master program, as well as actions that are caused by unregulated activities and development exempt from permitting. The guidelines state,

> "Recognize that methods of determining reasonably foreseeable future development may vary according to local circumstances, including demographic and economic characteristics and the nature and extent of shorelines."

The focus of foreseeable development thus is on those actions that have been identified as potential impacts to the shoreline environment and that are or would be foreseeable based on past development patterns, dependent on shoreline regulations. This section provides a description of how elements of the SMP address the potential impacts of reasonability foreseeable development, including exempt and unpermitted development.

4.1 PIPE LAKE

4.1.1 Patterns of Shoreline Activity

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

4.1.2 Residential Development

Residential development would not be allowed within the Urban Conservancy environment on the current Camp McCullough property within the shoreline management are of Pipe Lake (200 feet, plus any wetlands,) consistent with the standards in the proposed SMP (Chapter 6, Table 1, Shoreline Uses). This is a significant change from current regulation which allows single family residential development along this portion of the Pipe Lake shoreline.

Within the existing single family areas that are designated as Shoreline Residential in the draft SMP, there is limited potential for new residential development, with perhaps as many as five (5) additional homes theoretically possible within shoreline jurisdiction over the medium to long term based on the application of the proposed dimensional standards for all uses in Table 2 in Chapter 6 of the SMP. Key standards include the 60 ft. minimum lot width and the maximum density of four units per acre for the R-4 zone in the City's zoning code. However, it is <u>unlikely</u> that any new homes will be constructed on Pipe Lake in the near to medium term due to the factors discussed below.

According to the King County Assessor records, there are three vacant lots on the northwestern shoreline of Pipe Lake. However, one of these lots is located contiguous with an existing single family home and is currently being used as part of the developed site. There does not appear to

be any major structures on this contiguous lot, so new development is possible. However, there is no sewer currently available to this property, so major new development is generally not possible under current Covington utility requirements (also articulated in the SMP) without connecting to sewer. Bringing sewer to the property is a major investment (likely too much for one to three lots to shoulder) and development of this property is therefore not likely at this time. Similarly, the two other vacant lots appear to be too small and too close to the lake for on-site septic systems, indicated by the designation of "private-restricted" under the sewer system heading in the assessor's records, even if the City did allow septic systems. Therefore, development of these properties is also not likely in the near term.

It is also possible, but unlikely, that the approximately .75 acre private recreation tract owned by Aqua Vista Estates could be converted and subdivided at some future date into up to three single family lots based on existing density standards. However, based on the lot width requirements in the proposed SMP and the existing lot configuration, it appears than only two lots (i.e. one new lot) could be provided in shoreline jurisdiction on this property. Furthermore, this parcel is a designated as a Tract and the conversion to a residential lot would require a subdivision amendment and may not be allowed by the City.

Based on density requirements, three additional parcels on Pipe Lake appear to have subdivision potential. However, application of the proposed lot width requirements in the SMP would likely mean than only one property could be subdivided for one additional lot. This lot is located three lots to the northeast of Camp McCullough). However, subdivision of this lot would require removal of the existing home and is not expected in the short term.

Development of vacant lots and expansion of existing residences often results in replacement of pervious, vegetation areas with impervious surfaces and a landscape management regime that often includes chemical treatments of lawn and landscaping. These impacts can occur to various degrees, for example, some of the potential future lots along Pipe Lake are already part of a developed site. It would certainly be applicable for the two vacant lots to the northeast of Camp McCullough that are currently forested. Development of vacant sites can have multiple effects on shoreline ecological functions, including the potential for:

- Reduction in ability of site to improve quality of waters passing through the untreated vegetation and healthy soils.
- Potential contamination of surface water from chemical and nutrient applications.
- Increase in surface water runoff due to reduced infiltration area and increased impervious surfaces, which can lead to excessive soil erosion and subsequent in-lake sediment deposition.
- Elimination of upland habitat occupies by wildlife that use riparian areas.

Re-builds and substantial remodels of existing homes are anticipated in the Pipe Lake Shoreline Residential portion of the SMA. The City has no record of shoreline permits and exemptions since incorporation, so it is not known how frequently structures along Pipe Lake have been modified and expanded. Redevelopment of lots along Pipe Lake under current and proposed

development regulations also has the potential to improve shoreline functions if done under appropriate standards. Specifically,

- New development and major redevelopment are required to meet current stormwater standards in adopted Stormwater Manual, including improved water quality and quantity standards, improving stormwater discharge to Pipe Lake,

- New development and major redevelopment are required to connect to sewer. Conversion of Camp McCullough and some remaining single family properties along the lake to sewer will reduce potential water quality impacts from failing septic systems.

- Proposed standards in the SMP require natural vegetation to be protected, including mature trees and native understory.

In addition, enhancements to shoreline ecological functions along Pipe Lake are expected from the proposed new shoreline buffer standards in Chapter 6, Table 2 on page 68. Specifically, the standards establish a flexible buffer of between 115 feet and 60 feet with a building setback from the buffer of an additional 15 feet. Applicants can propose various combinations of enhancement actions as part of their proposal to reduce the buffer from the standard of 115 feet down to a minimum of 60 feet (plus an additional 15 foot building setback) pursuant to the Shoreline Buffer reduction mechanisms in Table 3 on page 71. In this way, the regulations provide a strong incentive for enhancement. Enhancements are tiered with more beneficial actions receiving correspondingly higher buffer reduction allowances. Enhancements include bulkhead removal, vegetation protection and enhancement in various upland zones, landform protection, stormwater enhancements, use of pervious materials, more restrictive impervious surface limits and limits on lawn area and lot-wide standards for native vegetation. Please see the SMP for more details.

Currently, roughly half of the 33 lots on Pipe Lake in Covington have structures that are less than 75 ft. from the OHWM (52%) and roughly half of the lots have structures that are more than 75 feet from the OHWM (i.e. 48%). 42% of the structures are currently less than 65 feet from the OHWM. Based on closer air photo interpretation, primary structures are located closer than 50 feet to the OHWM on approximately 8 parcels or 24% of the lots on Pipe Lake, with the closest primary structures located about 30 feet away. However, in many cases impervious surfaces and other minor improvements, such as decks, are located closer to the OHWM, including lots with such improvements less than 10 feet from the OHWM. Approximately 6 homes are located at least 100 feet from the OHWM of Pipe Lake, or less than 20%.

Under the proposed regulations, non-water dependent structures would not be allowed closer than 75 feet from the OHWM. New impervious surfaces would be restricted within 60 feet of the lake. Homes that are closer to the Lake than 75 feet could only be rebuilt in their existing footprint. Furthermore, enhancements would be needed to get closer than 130 feet to the Lake. The proposed new shoreline buffer and building setback regulations can be expected to have beneficial impacts on ecological function over time, as homes are brought into conformance and homeowners institute vegetation enhancements, bulkhead removals, limit lawn area and make other voluntary enhancements in exchange for meeting the new buffer and setback requirements that impact nearly all new development, including remodels, tear downs and homes on vacant or

subdivided lots. The average setback for homes is expected to slightly increase, while the typical ecological function on a particular lot is expected to moderately increase under the proposed new standards in the SMP.

4.1.3 Commercial and Industrial Development

No potential existing for primary commercial or industrial development along Pipe Lake pursuant to Table 1, Shoreline Uses, in Chapter 6. Under the proposed regulations, accessory commercial development may be allowed on the Camp McCullough property with a Conditional Use Permit, provided no net loss can be achieved. Within the Shoreline Residential environment, commercial uses would be limited to home occupations, consistent with the current zoning standards.

4.1.4 Recreational Development

Shoreline Residential Environment

Only limited potential exists for additional recreational development with the proposed Shoreline Residential Environment along Pipe Lake. There are only three vacant lots on Pipe Lake and as previously discussed these sites are likely to continue as vacant lots of as extensions of adjacent developed sites. Additional recreational development could occur at the private tract owned by the residents of Aqua Vista Estates. However, the site is already used for water oriented recreation and this use, including a dock is currently located on this site, is expected to continue.

Pursuant to Table 1, Shoreline Uses, in Chapter 6, water related recreational facilities are a permitted use and non-water oriented recreational facilities require a conditional use permit unless they are accessory to a permitted use. All development would also be required to meet all standards in the SMP, including Table 2, Dimensional Standards, in Chapter 6, as well as specific Shoreline Use Regulations for Recreational Development in Chapter 6. These standards are designed to ensure no net loss of ecological function.

Urban Conservancy Environment

Potential for private and public recreation development exists at Pipe Lake, primarily at the Camp McCullough property. This site is identified in both the SMP and the City's comprehensive plan as a potential site for future public access. Because of this high potential for future public and private recreational development, the proposed regulations in the SMP are intended to provide a high degree of environmental protection with the Urban Conservancy designation at Pipe Lake.

Pursuant to Table 1, Shoreline Uses, in Chapter 6, water related recreational facilities are a permitted use and non-water oriented recreational facilities require a conditional use permit unless they are accessory to a permitted use. All transportation facilities would require a conditional use permit. Parking would not be allowed as a primary use in the shoreline area and would only be allowed as an accessory use with a conditional use permit. Parking use regulations in Chapter 6 of the proposed SMP provide significant restrictions on how parking can be sited, designed, and constructed in the shoreline area. Significantly, new and reconstructed parking areas shall use low impact development techniques as appropriate and adequate controls to prevent contamination of water bodies with polluted run-off.

All development would also be required to meet all standards in the SMP, including Table 2, Dimensional Standards, in Chapter 6, as well as specific Shoreline Use Regulations for Recreational Development in Chapter 6. These standards are designed to ensure no net loss of ecological function. Under the proposed dimensional standards in Chapter 6, Table 2, impervious surface coverage would be limited to 10% within the shoreline management area, and all non-water dependent development would be required to meet a 115 foot shoreline buffer, with an additional 15 foot building setback. Because of the high ecological function on the Camp McCullough property, no buffer reduction would be allowed in the Urban Conservancy Environment.

4.1.5 Overwater Structures

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.

Under the proposed SMP standards for Overwater Structures in Chapter 7 of the SMP, piers and docks are only allowed for a water dependent use (which includes single family where needed for a boat), and pier length, width and area must be limited to the "minimum necessary to support the intended use". Specially, pier length is limited to 40 feet for a single property owner, 50 feet for a joint use structure and 80 feet for a pier that allowed public access. Pier walkways must be fully grated and all ells and floats must have a minimum 20 foot wide strip of grating down the center. Surface coverage, including all floats, ramps and ells, shall be limited to 400 feet for a single property owner, 600 hundred feet for a joint-use structure and 800 feet for a pier that allows public access.

Outside of the Urban Conservancy environment, recreational floats would be allowed in lieu of a moorage pier. Within the Urban Conservancy designation, both a moorage pier and a recreational float are allowed, but both would require a conditional use permit. Because of the existing presence of docks, only a very limited potential exists for additional floats (e.g. approximately 5). Under the new proposed standards, recreational floats must have fully grated decks, encapsulated float tubs and are limited to a maximum of 200 square feet. Recreational floats must be in water depths of 8 feet or more at the landward end of the float and may be located up to a maximum distance of 50 feet or where the water depth is demonstrated safe for swimming, whichever is reached first.

Launching rails would be permitted as a conditional use in the shoreline residential environment in the Urban Conservancy environment when not accessory for residential structures, but only in lieu of a moorage pier. Therefore limited potential exists for these modifications. Launching

ramps are only permitted in the Urban Conservancy environment with a Conditional Use Permit and are restricted to the minimum length to safely launch the intended craft.

All shoreline modifications would be required to comply with the SMP (e.g. Regulation 1, Chapter 4, "no use activity or modification shall result in a net loss of shoreline ecological function. Impacts to ecological functions in the SMA shall be avoided, minimized and mitigated to achieve this standard". Based on the existing developed condition of the single family residential areas in combination with the requirements of the SMP, which provide for effective reductions in future dock size when compared to a typical existing dock, no net loss of ecological function is expected. Within the Urban Conservancy environment, there is an existing overwater structures and in addition, in some cases, more restrictive regulations apply to both in overwater and upland modifications. Therefore, no net loss of ecological function is expected in this proposed environment.

4.1.6 Shoreline Stabilization

Shoreline Residential Environment

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. Potential exists for new shoreline stabilization in the Shoreline Residential Environment. However, under the proposed SMP standards, new structural stabilization measures and enlargement of existing structural stabilization measures shall be limited to the minimum size necessary and shall be permitted only when it has been conclusively demonstrated through scientific analysis that shoreline stabilization is necessary to protect existing primary structures, public improvements, ecological function restoration projects or hazardous substance remediation projects from erosion, and that nonstructural measures, planting vegetation, or installing on-site drainage improvements are not feasible or not sufficient.

There are only three vacant lots on Pipe Lake and as previously stated, there is no significant short term potential for subdivision of existing residential lots. Standards in the SMP also prohibit the creation of new lots that would require shoreline stabilization (see Chapter 7, Shoreline Stabilization). Furthermore, based on the size of Pipe Lake and the fact that motorized boats are not allowed and that there are no steep or landslide prone slopes within the Pipe Lake SMA, there is very little potential for erosion based on wave action. As previously described, the vast majority of structures are more than 50 feet from the Lake and most of the existing shoreline stabilization appears to be installed for primarily aesthetic reasons. Based on these factors, it is unlikely that there will be new structural stabilization permitted with the Shoreline Residential Environment of Pipe Lake because such proposals would not meet the new requirements.

There is somewhat greater potential for existing shoreline stabilization measures to be replaced. Under the proposed SMP, an existing shoreline stabilization structure may be replaced with a similar structure if there is a demonstrated need to protect principal uses or structures from erosion caused by currents or waves. Shoreline stabilization solutions developed to replace existing shoreline stabilization shall be placed along the same alignment as, or landward of, the shoreline stabilization being replaced, except as noted below. Where existing structural

stabilization is replaced by soft shoreline stabilization using bioengineering techniques and results in a documented improvement of shoreline functions, such stabilization may be allowed waterward of the ordinary high-water mark subject to state and federal approvals.

However, the Shoreline Buffer Reduction Mechanisms in Table 3 in chapter 6 of the SMP provide significant incentives for the removal of existing shoreline stabilization during redevelopment. For example, a property owner could reduce the required buffer of 115 feet to 85 feet by removing an existing bulkhead consistent with the specific requirements. Based on the proposed regulations, it is expected that over time there will be a net reduction in shoreline armoring along Pipe Lake because it generally is not needed to prevent any real threat of erosion, it is not allowed unless the applicant demonstrates this need and meets certain other conditions, and the proposed standards create significant incentives for removal of existing bulkheads.

Urban Conservancy Environment

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). Based on the proposed regulations as previously discussed, it is not likely that shoreline stabilization measures would be allowed at this site. Furthermore, shoreline stabilization other than bioengineering using plant materials would require a Conditional Use Permit.

4.2 JENKINS CREEK

4.2.1 Patterns of Shoreline Activity

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

4.2.2 Residential Development

Reach 1 of Jenkins Creek is currently developed as the BPA Substation. There is no current residential development in this segment. Although residential development is allowed under the proposed SMP, none is expected because of the current and likely future use of this property as a major utility facility.

The vast majority of Reach 2 of Jenkins Creek is developed as large lot single family, with two vacant lots. Sewer is not available to the majority of lots in this reach of Jenkins Creek and would be necessary for additional major development. Therefore no new residential development is expected in the near term in the majority of this area.

In the medium to long term, single family and multifamily residential development is possible. Under the existing DN7-B Zone, up to 36 dwelling units per acre are allowed. Under the existing DN7-A zone, up to 12 units per acre are allowed. Approximately 15 lots are located in the DN7-B zone within shoreline jurisdiction. Up to 8 lots may be located within the DN7-A zone in shoreline jurisdiction. These 23 lots amount to approximately 26 acres of land. However, at the most, only 17 acres is located within the Shoreline Management Area of this reach of Jenkins Creek. This figure could be as little as 10 acres in shoreline jurisdiction if areas currently mapped as wetlands do not meet the criteria for wetlands. Lots along this stretch of

Jenkins Creek abut Wax Road and most of the lots appear to contain buildable area outside of shoreline designation. The mapped landward edge of the boundary of the shoreline management area in this reach of Jenkins Creek is based largely upon the location of a mapped wetland. However, site specific studies would be required to determine the actual boundary. Areas that do not meet wetland criteria and are located outside more than 200 feet from the OHWM or floodway would not be subject to the requirements of the SMP.

There is a 115 foot buffer and an additional 15 foot building setback proposed from the Jenkins Creek OHWM under the draft SMP to provide the necessary protection for this shoreline reach. Furthermore, wetlands associated with Jenkins Creek are also known to exist in this area. Critical area regulations contained in Appendix A of the SMP would provide additional restrictions on residential development where these features are located. Based on these factors particularly wetland requirements that would be applied based on site specific conditions, it is difficult to say with any certainty the actual number of new residential units that could be constructed with this reach of the Jenkins Creek SMA. If the mapped boundary of the suspected wetlands is accurate this could be as little as 36 new units up to perhaps 200 units.

4.2.3 Commercial and Industrial Development

Reach 1 of Jenkins Creek is currently developed as the BPA Substation, which can be considered a type of industrial site. There is no current commercial development in this segment. Although allowed under the proposed SMP, commercial development in this reach is not likely as the BPA Substation is expected to remain for the long term. Additional intensification of this site and the utility use may occur. The Dimensional Standards in Table 2 of Chapter 6 establish at 115 foot buffer and 15 foot building setback. However, it is not clear whether the federal government would follow these local standards. No development is expected beyond the existing graded, leveled and fenced compound however.

According to the King County Assessor, there are no current commercial uses in Reach 2 of the Jenkins Creek SMA. However, limited commercial uses are allowed in the DN7-A and DN7-B zones are previously described. Although some commercial uses would be allowed in the Medium Intensity environment closer to Wax road in areas that are currently used for single family home sites, commercial uses would not be allowed as a primary use within the Urban Conservancy environment (i.e. 115 feet from the OHWM of Jenkins Creek) and all structures would be required to be setback 130 feet from the Creek as previously described.

Commercial uses in the Medium Intensity environment would also be subject to wetland standards as previously described, which in some cases may preclude development of this use on a site. Buildings of up to 45 feet would be allowed in the Medium Intensity Environment. Within the DN7-B zone there is approximately 2,400 feet of street frontage along Wax Road and an additional 740 feet of street frontage in the DN-7A zone within potential shoreline jurisdiction, for a total of 3,140 feet. Based on the minimum lot width of 60 feet for non-residential construction in the Medium Intensity environment, this area could be reconfigured into a maximum of 52 lots. CMC Section 18.30.045 allows a building footprint of up to 5,000 square feet in the DN-7B zone and 77,000 square feet in the DN-7A zone.

Based on these factors, and particularly wetland requirements that would be applied based on site

specific conditions, it is difficult to say with any certainty the actual amount of commercial development that could be constructed with this reach of the Jenkins Creek SMA. At the very most, no more than 300,000 square feet of commercial and office space would be constructed along this portion of Wax Road, with less than 30% or about 90,000 square feet of commercial development actually located in the shoreline management area where it would be confined to the Medium Intensity environment, where it is allowed. However, this amount of development appears to be unlikely in the foreseeable future. Short term to medium development potential is more limited as approximately the northern half of this area is not currently connected to sewer. Alternatively, wetland restrictions could mean as little as only one acre of actual land could be available in the Jenkins Creek SMA for commercial development. Based on a maximum building sizes of 5,000 square feet in the DN-7B Zone, maximum expected floor area ratio of perhaps 1:1 for development with surface parking, 20,000 to 50,000 square feet of commercial in the Jenkins Creek SMA might be closer to the range of commercial square footage expected over the long-term in the Medium Intensity portion of the SMA.

4.2.4 Recreational Development

Reach 1 of Jenkins Creek is currently developed as the BPA Substation. This is no current recreational development in this segment. Although recreational development is allowed under the proposed SMP, none is expected because of the current and likely future use of this property as a major utility facility.

Recreational development is likely in Reach 2 of Jenkins Creek, upstream of the Covington Way SE bridge. 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. Recreational development would be required to meet all standards in the SMP. Most structures would not be allowed (e.g. bridges would be allowed). Trails would be required to meet specific standards in the SMP to minimize impacts and mitigation would be required to meet no net loss.

4.2.5 Overwater Structures

Jenkins Creek is not navigable. Overwater structures other than a foot, bike or road bridge would not be permitted under the regulations contained in Chapter 7 of the proposed SMP. The only anticipated overwater structures would be potential expansion of the Covington Way SE road bridge and the potential for a bridge than would link the potential Jenkins Creek Trail with the existing King County Open Space parcel to the south , which is primarily on the left bank of Jenkins Creek, looking downstream.

4.2.6 Shoreline Modifications

Reach 1 of Jenkins Creek is currently developed as the BPA Substation and shoreline armoring and other modifications exist along most of this reach as previously in this report. New rip rap is not permitted, unless associated with the bridge, however spoil bioengineering is allowed pursuant to Table 4 in Chapter 7. Weirs would require a conditional use permit in all aquatic areas, however, pursuant to the standards in Chapter 7 related to this shoreline modification, new weirs shall be allowed as a conditional use only when evidence is presented through a report prepared by a geotechnical engineer or other qualified professional that conclusively demonstrates that a weir is necessary and all other alternatives have proven infeasible. Repair and maintenance of existing weir is permitted, but when a more environmentally sound solution exists, weirs must be modified or removed. Weirs must be constructed of natural materials and meet no net loss, with mitigation as necessary to meet this standard.

No known shoreline modifications exist along Reach 2. New rip rap is not permitted, unless associated with a bridge and is determined to be necessary, however spoil bioengineering is allowed pursuant to Table 4 in Chapter 7. Additional shoreline modifications are expected to be limited to abutments and erosion protection associated with future public access to the Creek.

4.4 BIG SOOS CREEK

4.4.1 Patterns of Shoreline Activity

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

4.4.2 Residential Development

Additional residential development is expected to be extremely limited along Big Soos Creek because virtually the entire Big Soos Creek SMA is mapped as a large, high quality wetland. Although up to one house per acre would be allowed with a conditional use permit in the Big Soos Creek SMA, we do not expect virtually any residential development in this area because of wetland as well as flood plain restrictions. There is potential for perhaps one additional home in the extreme northeast corner of the Big Soos Creek SMA, the only portion of the SMA that is believed to be outside of designated wetlands. However, development would be required to meet wetland setbacks, the 115 foot buffer and an additional 15 foot building setback.

4.4.3 Commercial and Industrial Development

Industrial development and commercial development as a primary use are prohibited in the Urban Conservancy environment in the proposed SMP. Limited accessory commercial development could be allowed with a Conditional Use Permit, however this use (other than a home occupation) is considered unlikely in the Big Soos Creek SMA.

4.4.4 Recreational Development

Future recreational development is likely in the Big Soos Creek SMA. The City currently has a public access site north of SR 18 and has plans to expand the Soos Creek trail system along Big Soos Creek. However, no funding has been dedicated for this trail at this time.

4.4.5 Overwater Structures

Other than potential modifications to the SR 18 highway bridge and foot or bike trail bridges under a conditional use permit, there is no potential for additional overwater structures at this time because Big Soos Creek is not navigable and other types of overwater structures are prohibited.

4.4.6 Shoreline Stabilization

Shoreline stabilization would be limited to bioengineering under the proposed SMP, unless such stabilization is necessary for a road, bike or trail bridge. Weirs would be allowed under specific conditions with a conditional use permit.

5.0 STATE, LOCAL AND FEDERAL REGULATIONS

5.1 CITY MASTER PROGRAM

As discussed in detail in Section 4.0, the SMP has been crafted after consideration of reasonably foreseeable development and how this development could impact the functions and processes that are potentially at risk that were discussed in Section 3.0. In addition to the specific details provided in these previous sections, this section provides a brief overview of the entire master program and how it generally addresses the protection of ecological functions and processes from cumulative impacts. The section is intended to put the SMP regulations within context of the other regulations that apply to this area.

The first level of protection provided by the SMP is the recognition of five different shoreline environment types in Covington: High Intensity, Medium Intensity, Shoreline Residential, Urban Conservancy, and Aquatic. These environments were assigned based primarily on existing and proposed land uses, which implicitly encompasses differing levels of ecological functions and different probabilities and potentials for improvements of ecological functions.

The High Intensity Environment along Jenkins Creek contains the BPA Substation and has been heavily modified. The intent of this designation is to allow for this utility use and the restoration of degraded functions. The Medium Intensity Environment along Jenkins Creek, is limited to those areas at least 115 feet from the Ordinary High Water Mark of the stream. This area is intended to allow a greater range of uses and public access and encourage needed sewer improvements for environmental protection in areas currently developed as single family residential lots on septic systems. The Shoreline Residential Environment is very developed with residential uses, with reduced structure setbacks, increased shoreline modifications, and high imperviousness. This area is intended to allow these uses to continue, along with encouraging environmental enhancement of degraded functions through redevelopment incentives. Finally the Urban Conservancy Environment has been designated in those area that have high or moderate environmental function, limited development, that are susceptible to negative impacts, and where improvement of public access is a high priority along with enhancement of ecological function.

The proposed SMP contains numerous policies, with supporting regulations intended to protect the ecological functions of the shoreline and maintain, at a minimum, the current level of function. Key relevant policies and regulations were provided as examples in Sections 3.0 and Section 4.0. Major sections of the proposed SMP are referenced and summarized below and in more detail in the Cumulative Impact Analysis Tables in Appendix A.

Table 1. Summary of Shoreline Master Program Policies and Regulations

SMP Goal, Policy or Regulation	**Purpose/Result of SMP Provision**	**Key general ecological functions protected**
Chapter 3, Goals of the Shoreline Management Program	Identifies the major elements of the SMP, including conservation, and outlining the intent of economic development, public access, recreation, circulation, shoreline us, flood hazard management and all uses and development to be consistent with ecological protection to the maximum extent possible.	All, with specific focus on key concepts, balancing major and at times competing objectives while achieving no net loss
Chapter 4, General Shoreline Policies and Regulations	Identifies general policies and regulations that apply to uses, developments and activities in all shoreline areas. Specifically, it contains the requirement that all development and uses meet no net loss, and provides specific standards for areas such as critical areas, vegetation conservation, and water quality.	All, with focus on critical areas, vegetation and water quality, including wastewater and stormwater.
Chapter 5, Shoreline Environments	Identifies the system to classify shoreline areas into specific designations based on existing use, biologic and physical character and the goals and aspirations of the community. Specifically, the environments are the key to providing appropriate and specific regulations to ensure no net loss in both developed and relatively undeveloped areas with high functions.	All, with specific focus on protecting upland soils, vegetation and habitat and aquatic areas based on the specific needs and conditions of that land area.
Chapter 6, Specific Shoreline Use Policies and Regulations	Contains a matrix that tells you what uses are allowed in what shoreline environments. Sets forth policies and regulations necessary to achieve no net loss for specific categories of uses and activities found in the shoreline area. The policies and regulations cover the following uses and activities: Agriculture, Aquaculture, Commercial Development (Primary and Accessory), Industrial Development, Mining, Parking (as a primary use), Recreational Facilities, Residential Development, Scientific, Historical, Cultural, or Educational Uses, Signage, Transportation, and Utilities (Primary and Accessory). This section contains important dimensional standards and key buffer and setback reductions provisions.	All, with specific focus on the unique aspects of specific uses (e.g. utilities, parking, transportation and recreation) that require specific and unique requirements to assure no net loss.
Chapter 7, Shoreline Modification Policies and Regulations	Provides policies and regulations for those activities that modify the physical configuration or qualities of the shoreline area, such as clearing and grading, shoreline stabilization, dredging and fill and overwater structures, such as docks, floats and piers. Contains the important shoreline modification matrix that tells you what modifications are allowed where.	All, with specific focus on protecting aquatic habitat, organic matter and sediment recruitment, attenuating wave energy, water quality and stabilization

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5.2 BENEFICIAL EFFECTS OF OTHER ESTABLISHED REGULATORY PROGRAMS

5.2.1 Other Laws and Programs

There are a number of established local, state, and federal laws and regulatory programs that provide beneficial effects on shorelines, besides the SMP and the state SMA. City regulations and programs include: Critical Areas Ordinance, Comprehensive Plan, Tree Protection Regulations, Stormwater and Clearing and Grading Regulations, and Parks, Recreation and Open Space Plan. The City is currently working on updating its stormwater manual and other efforts related to NPDES Phase II stormwater compliance under the federal clean water act. These efforts will have major positive impacts on water quality and water quantity in the SMA of Covington. This will impact the full range of related functions.

State and federal regulations and programs include: Growth Management Act (GMA), State Environmental Policy Act (SEPA), Regulatory Reform (ESHB 1724), Clean Water Act, Public Trust Doctrine, and Aquatic Lands. In addition, there are numerous regional programs that provide benefits to the City's shoreline. These include the Puget Sound Water Quality Management Plan, King County Flood Hazard Reduction Plan, King County Basin Reconnaissance Program, Watershed Forums, and WRIA 9 Chinook Salmon Conservation Plan.

Through its planning goals, the Growth Management Act (GMA) encourages economic development that is consistent with adopted comprehensive plan and that is within the capacities of the state's natural resources. The GMA also requires local governments to maintain and enhance natural-resource-based industries, including anadromous fisheries and agricultural industries. Policies that give preference to development that is dependent on the economic resources of the shoreline, including anadromous fisheries and agriculture, would be consistent with these GMA goals. Discouraging intense economic development in critical salmon spawning areas would be consistent with other GMA goals for protecting fish and wildlife habitat, and protecting the environment. Encouraging water-enjoyment uses in appropriate locations would further GMA's directive to increase access to natural resource lands and water.

The Comprehensive Plan directs that businesses shall limit adverse impacts such as noise, vibration, smoke, fumes, surface or groundwater pollution, air pollution, hazardous wastes and risk of explosion. The Plan also contains numerous policies that direct land uses to respond to important natural or community features, and that limit development in areas with significant natural resource values, reflecting the city's goals for a high quality of life and for protecting the quality of the environment. The Comprehensive plan contains policies designed to protect critical areas, water quality, fish and wildlife habitat and wildlife corridors. These policies limit development in areas with significant natural resource values. Policies that establish guidelines for managing the impacts of shoreline development would be consistent with the Comprehensive Plan. The Covington Municipal Code guides the character and quality of development relative to shoreline features, especially through critical areas regulations, landscaping regulations and tree protection regulations.

5.2.2 Washington Department of Fish and Wildlife

The Washington Department of Fish and Wildlife has jurisdiction over in- and over-water activities up to and including the ordinary high water mark, as well as any other activities that could "use, divert, obstruct, or change the bed or flow of state waters" (http://www.wdfw.wa.gov/hab/hpapage.htm). Practically speaking, these activities in the City of Lake Forest Park include, but are not limited to, installation or modification of shoreline stabilization measures, piers and accessory structures such as boatlifts, culverts, and bridges and footbridges. These types of projects must obtain a Hydraulic Project Approval from WDFW, which will contain conditions intended to prevent damage to fish and other aquatic life, and their habitats. In some cases, the project may be denied if significant impacts would occur that could not be adequately mitigated.

5.2.3 Washington Department of Ecology

The Washington Department of Ecology may review and condition a variety of project types in Covington, including any project that needs a permit from the U.S. Army Corps of Engineers (see below), any project that requires a shoreline Conditional Use Permit or Shoreline Variance, and any project that disturbs more than 1 acre of land. Project types that may trigger Ecology involvement include pier and shoreline modification proposals and wetland or stream modification proposals, among others. Ecology's three primary goals are to: 1) prevent pollution, 2) clean up pollution, and 3) support sustainable communities and natural resources (http://www.ecy.wa.gov/about.html). Their authority comes from the State Shoreline Management Act, Section 401 of the Federal Clean Water Act, the Federal Water Pollution Control Act, the Federal Coastal Zone Management Act of 1972, the State Environmental Policy Act, the Growth Management Act, and various RCWs and WACs of the State of Washington.

5.2.3 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers has jurisdiction over any work in or over navigable waters (including Pipe Lake) under Section 10 of the Federal Rivers and Harbors Act of 1899, and discharges of dredged or fill material into waters of the United States (including Lake Washington, streams, and non-isolated wetlands) under Section 404 of the Federal Clean Water Act.

6.0 NET EFFECT ON ECOLOGICAL FUNCTIONS AND PROCESSES

As described above, the proposed SMP provides a substantially increased level of protection to shoreline ecological functions relative to the existing SMP. On its own, the proposed SMP is expected to protect shorelines within the City of Covington, resulting in no net loss of shoreline ecological function. In addition, the application of the SMP may improve ecological functions over time in several areas due to these areas being degraded from past practices that will no longer be allowed under the new SMP and significant enhancement incentives in targeted areas, such as the shoreline residential environment. State and federal regulations, acting in concert with this SMP, will provide further assurances of improved shoreline ecological functions over time. Together with the implementation of the Shoreline Restoration Plan over time, the SMP is expected to begin to address the enhancement and restoration of shoreline functions in those areas where they are currently impaired.

APPENDIX A

CUMMULATIVE IMPACT ANALYSIS TABLE

4.1 PIPE LAKE

Shoreline Process and Function	Potential Alteration and Resource at Risk	Proposed SMP Policies and Regulations	Non-regulatory Measures	Current Performance	Future Performance
Hydrologic					
Storing water and sediment (water quantity and quality)	Removal of vegetation and impervious surface development Camp McCullough property in Reach 1 is largely undeveloped with natural shoreline conditions and is the most important conservation objective on Pipe Lake, in addition there are two undeveloped vacant single family properties and potential for additional impacts through redevelopment of larger homes on existing single family sites.	List key policies and regs here	List any items from restoration plan	Reach 1 (Urban Conservancy): MODERATE/ HIGH Reach 2 (Shoreline Residential): LOW/ MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Attenuating wave energy	Vegetation removal, increased runoff from impervious surfaces and the development of bulkheads all have potential impacts on this function. Only 30% of the shoreline			Reach 1: MODERATE/ HIGH Reach 2: LOW/	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED

	has been bulkheaded, but many lots of grass down to water. Camp McCullough has largely natural shoreline conditions.			MODERATE	IMPROVEMENT
Removing excess nutrients and compounds				Reach 1: MODERATE/ HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Recruitment of LWD and other organic material				Reach 1: LOW/ MODERATE Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Vegetation					
Temperature regulation				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Water Quality Improvemen t				Reach 1: MODERATE/ HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED

					IMPROVEMENT
Attenuating wave energy				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE /EXPECTED IMPROVEMENT
Sediment removal and bank stabilization				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
LWD and organic matter recruitment				Reach 1: MODERATE/ HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Hyporehic					
Removing excess nutrients and toxic compounds				Reach 1: MODERATE/ HIGH Reach 2: MODERATE/ LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT

Water storage				Reach 1: MODERATE/ HIGH Reach 2: MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Support of vegetation				Reach 1: MODERATE Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Sediment storage and maintenance of base flows				Reach 1: MODERATE Reach 2: LOW/ MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Habitat					
Physical space and conditions for life history				Reach 1: MODERATE/ HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: EXPECTED IMPROVEMENT
Food production				Reach 1: MODERATE/	Reach 1: NO CHANGE

and delivery				HIGH Reach 2: LOW	Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Overall Pipe Lake Ecological Function					**Reach 1: NO CHANGE** **Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT**

4.2 JENKINS CREEK

Ecological Function	Potential Alteration and Resource at Risk	Proposed SMP Policies and Regulations	Non-regulatory Measures	Current Performance	Future Performance
Hydrologic					
Storing water and sediment				Reach 1 (Urban Conservancy): MODERATE/HIGH Reach 2 (Shoreline Residential): LOW/MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Attenuating wave energy				Reach 1: MODERATE/HIGH	Reach 1: NO CHANGE Reach 2: NO

				Reach 2: LOW/MODERATE	CHANGE/ EXPECTED IMPROVEMENT
Removing excess nutrients and compounds				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Recruitment of LWD and other organic material				Reach 1: LOW/ MODERATE Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Vegetation					
Temperature regulation				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Water Quality Improvemen				Reach 1: MODERATE/HIGH	Reach 1: NO CHANGE Reach 2: NO

t				Reach 2: LOW	CHANGE/ EXPECTED IMPROVEME NT
Attenuating wave energy				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE /EXPECTED IMPROVEME NT
Sediment removal and bank stabilization				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEME NT
LWD and organic matter recruitment				Reach 1: MODERATE/HI GH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEME NT
Hyporehic					
Removing excess nutrients and toxic compounds				Reach 1: MODERATE/HI GH Reach 2: MODERATE/L	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED

				OW	IMPROVEMENT
Water storage				Reach 1: MODERATE/HIGH Reach 2: MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Support of vegetation				Reach 1: MODERATE Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Sediment storage and maintenance of base flows				Reach 1: MODERATE Reach 2: LOW/MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Habitat					
Physical space and conditions for life history				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: EXPECTED IMPROVEME

					NT
Food production and delivery				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Overall Pipe Lake Ecological Function					**Reach 1: NO CHANGE** **Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT**

4.2 BIG SOOS CREEK

Ecological Function	Potential Alteration and Resource at Risk	Proposed SMP Policies and Regulations	Non-regulatory Measures	Current Performance	Future Performance
Hydrologic					
Storing water and sediment				Reach 1 (Urban Conservancy): MODERATE/HIGH Reach 2 (Shoreline Residential): LOW/MODERA	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT

				TE	
Attenuating wave energy				Reach 1: MODERATE/HIGH Reach 2: LOW/MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Removing excess nutrients and compounds				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Recruitment of LWD and other organic material				Reach 1: LOW/ MODERATE Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Vegetation					
Temperature regulation				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEME

					NT
Water Quality Improvement				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Attenuating wave energy				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE /EXPECTED IMPROVEMENT
Sediment removal and bank stabilization				Reach 1: HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
LWD and organic matter recruitment				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT

Hyporehic					
Removing excess nutrients and toxic compounds				Reach 1: MODERATE/HIGH Reach 2: MODERATE/LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Water storage				Reach 1: MODERATE/HIGH Reach 2: MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Support of vegetation				Reach 1: MODERATE Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Sediment storage and maintenance of base flows				Reach 1: MODERATE Reach 2: LOW/MODERATE	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT

Habitat					
Physical space and conditions for life history				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: EXPECTED IMPROVEMENT
Food production and delivery				Reach 1: MODERATE/HIGH Reach 2: LOW	Reach 1: NO CHANGE Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT
Overall Pipe Lake Ecological Function					**Reach 1: NO CHANGE** **Reach 2: NO CHANGE/ EXPECTED IMPROVEMENT**