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**CUMULATIVE IMPACTS ANALYSIS COMPONENT for
City of Lakewood Shoreline Master Program**

**Project Title: Shoreline Master Program Update
Phase 4: 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 the City of Lakewood that contribute to the long-term restoration of ecological functions relative to the baseline condition.

The following document summarizes for each shoreline environment (see Map Folio, 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 focus on an expanded analysis of cumulative that might not otherwise be considered at the same level of detail 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 that may even 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.

1.3 ASSUMPTIONS

This analysis examines foreseeable impacts over time. Impacts are examined in each of the shoreline management areas. The shoreline management areas used in this analysis also correspond with the segments that were previously analyzed in the Lakewood Shoreline Analysis Report, grouped by water body, for alterations to key processes. Site specific impacts are also expected to be addressed on a case-by-case basis during individual shoreline substantial development permit reviews.

Due to current and proposed land use regulations and the extensively developed nature of most shoreline areas, it is assumed that properties with significant redevelopment potential are concentrated in the multifamily and commercially-zoned portions of Clover Creek, as well as the American Lake. A complete discussion of redevelopment potential and vacant residential lots with subdivision potential within the shoreline jurisdiction is included in Chapter 4. The majority of shoreline areas are likely to see relatively slow and incremental changes associated with on-going uses, as well as redevelopment and expansion of existing uses. Because of the developed nature of the shoreline, redevelopment is not expected to result in substantial negative ecological impacts. Because many existing structures were built under older, less stringent standards, redevelopment can be expected to improve overall ecological function over the long term due to the application of new development standards that require a higher level of environmental protection, strictly regulate new shoreline modifications, and offer incentives for shoreline restoration. 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 management areas;
- Identifies anticipated development in each shoreline segment and how the proposed SMP regulations would address this development;
- Discusses how other local, state and federal regulations would address potential impacts;
- Details the potential impacts and risks to shoreline functions and processes; and
- Describes the net effect on ecological functions and processes.

A cumulative impacts table is included in Chapter 5 that describes the relationship between ecological function, potential alteration, resources at risk, proposed SMP regulations and non-regulatory measures designed to assure no net loss at a minimum. In addition, this table provides a summary of the anticipated net change in ecological performance for each shoreline analysis segment.

2.0 EXISTING CONDITIONS

The following summary of existing conditions in the Lakewood shoreline jurisdiction is based on the Draft Shoreline Analysis Report (Otak/AHBL, October 2010), and additional analysis needed to perform this assessment. The full report includes a more in-depth discussion of the topics briefly summarized in this section.

2.1 SHORELINE ENVIRONMENTS

Approximately 53.53% of the upland shoreline jurisdiction is proposed to be designated as the Shoreline Residential Environment, the majority of which is currently developed as low density single family residences. Approximately 16.06% of the upland shoreline jurisdiction is proposed to be designated as Urban Conservancy, approximately 16.03% as Urban Stream Protection and approximately 14.39% as Natural.

Table 1. Area and Shoreline Frontages of Shoreline Planning Segments

	Area (ac)	Shoreline Frontage (ft)	Percent of SMA Area
Shoreline Residential	322.21	67,293	53.53%
Urban Stream Protection	96.49	32,055	16.03%
Urban Conservancy	96.65	13,163	16.06%
Natural	86.62	16,612	14.39%
TOTAL	601.97	129,123	100.00%

2.2 LAND USE

Segment 1: Chambers Creek

Chambers Creek connects Lake Steilacoom to Chambers Bay, west of Lakewood. Land uses in this segment consist primarily of single-family and multi-family residences, undeveloped land, and parks and open space. The north-south portion of the creek immediately north of Lake Steilacoom is characterized by a mix of single- and multi-family residential uses, as well as a small commercial area near Steilacoom Boulevard. Chambers Creek turns west at the confluence with Leach Creek and forms the northern boundary of the city. This portion of the creek consists entirely of undeveloped land and public open space.

Segment 2: Clover Creek

As described in the Shoreline Analysis Report, Clover Creek flows northwest from the eastern city limit to discharge at the southern end of Lake Steilacoom. The portion of this analysis segment east of I-5 is heavily developed with multi-family residential, commercial, and single family residential uses. Between I-5 and Lake Steilacoom, the segment is characterized predominantly by single-family residences, as well as a small amount of multi-family and commercial development.

Segment 3: American Lake

American Lake lies within both the City of Lakewood and Joint Base Lewis-McChord; the portion within Lakewood is located at the southwestern corner of the city and is primarily developed with single-family residences. The shoreline of American Lake also includes several undeveloped parcels, as well as two City-owned parks (American Lake North Park and Harry Todd Park). A dedicated open space tract near the southwestern end of the shoreline, locally known as Eagle Point, contains a boat launch and provides lake access for the residents of the adjacent residential subdivision. The Tacoma Golf and Country Club also occupies a small portion of the shoreline near the eastern end of the lake. The golf course itself is not located within the shoreline jurisdiction, but several support buildings, the clubhouse, a swimming pool, and an open lawn area are located within 200 feet of the shoreline.

This segment also includes Silcox Island, located in American Lake near the southwestern city limits. The island is approximately 13.5 acres in size and almost entirely built out with single-family residences accessible only by boat or seaplane.

Segment 4: Lake Steilacoom

The shoreline of Lake Steilacoom is occupied almost entirely with single-family residential development, the only major exception being Edgewater Park, located on the northeastern shoreline of the lake, as well as condominium development immediately north of the park. As described in the Shoreline Analysis Report, approximately 1% of the lots with shoreline frontage are vacant.

Segment 5: Gravelly Lake

The Gravelly Lake shoreline is developed almost entirely with single-family residential uses, and approximately 2% of the lots are vacant. Lakewold Gardens, which accounts for approximately 4% of the lake's shoreline frontage, is located on the western shore. The Lakewold Gardens property is privately owned but is open to the public.

Segment 6: Lake Louise

The Lake Louise shoreline is entirely developed for residential uses with no vacant lakefront lots available. The majority of the shoreline lots contain single-family residences, though two lots on the northern shoreline and one lot on the eastern shoreline are developed for multi-family residences (i.e. duplexes).

Segment 7: Waughop Lake

Waughop Lake is entirely located within Forth Steilacoom Park, which offers sports fields, playgrounds, fishing access, and picnic facilities. The Waughop Lake shoreline includes a former road that is now used as a paved recreation trail, as well as areas along the shoreline that are devoid of vegetation and used as swimming beaches, areas to stage remote control boats and other activities. Much of the shoreline is in a relatively natural state and the lake does not currently contain any overwater structures or significant armoring.

2.3 PARKS AND OPEN SPACE/PUBLIC ACCESS

As described in the Shoreline Analysis Report, the majority of the City of Lakewood's shorelines are developed for residential uses, however there are several parks and public access points that

fall entirely or at partially within the shoreline jurisdiction. These areas account for approximately 31.6 acres of the shoreline jurisdiction. Key parks and public access points include Edgewater Park on Lake Steilacoom, American Lake Park and Harry Todd Park on American Lake, Chambers Creek Park on Chambers Creek, and Lakewold Gardens on Gravelly Lake.

2.4 SHORELINE MODIFICATIONS

Aerial photography and site observation indicates that the level of modification varies considerably between shoreline segments. Waughop Lake has some areas where vegetation has been removed from the shoreline, but does not appear to contain significant shoreline armoring, while Lake Louise, American Lake, and Lake Steilacoom are extensively armored, with largely ornamental vegetation in residential yards upland of the OHWM. Some areas of the creek shorelines, particularly along extensively developed Clover Creek, have also been modified through vegetation clearing, channelization, or channel realignment. Chambers Creek, particularly in its northern reaches, has the least modification of any shoreline in the City.

Such shoreline modifications can alter the hydrologic functions of a lake edge or stream bank, leading to changes in erosion patterns, sediment transport, and aquatic vegetation distribution. Overwater structures can affect aquatic vegetation growth and fish behavior and feeding patterns. More detailed discussion of shoreline modifications in each of the shoreline analysis segments is provided below.

Segment 1: Chambers Creek

The shoreline of Chambers Creek is relatively intact, featuring large expanses of unmodified, heavily forested shoreline. While the north-south portion of Chambers Creek has been largely developed for residential uses, much of the riparian zone remains intact, and the east-west portion of the creek remains mostly undeveloped.

Chambers Creek is not a navigable stream, and there are currently no documented overwater structures in this segment.

Buildings along Chambers Creek are generally set back a substantial distance from the shoreline, due largely to topography and the presence of a significant ravine along much of its length. The median setback for structures in this Segment is approximately 78.1 feet, indicating that the majority of existing structures are within the proposed 150 setback required for this stream in the existing critical areas ordinance (title 18A LMC) and in the proposed regulations for the Urban Conservancy environment, which covers the creek from Lake Steilacoom to the confluence with Leach Creek, as well as the proposed regulations for the Natural environment, which covers the creek from the confluence of Leach Creek west to the end of the shoreline jurisdiction.

Segment 2: Clover Creek

As a result of the extensive development along Clover Creek, much of the native riparian vegetation has been cleared, reducing the level of shading and leading to increased water

temperatures. Bank protection measures associated with the residential development along the creek have resulted in the installation of riprap and concrete along the lower portions of the creek, reducing the availability of riparian habitat. Large portions of this stream have also been straightened and rerouted.

Clover Creek is not a navigable stream, and there are currently no documented overwater structures along the stream channel. Segment 2 does contain three properties, located at the outlet of Clover Creek into Lake Steilacoom, which have overwater structures on the lake shoreline. The median size of these 3 structures is approximately 725 square feet.

Most buildings along Clover Creek have been constructed with generous setbacks from the shoreline. The median primary building setback in this Segment is 93.2 feet; only 18 primary structures (13%) are located within 50 feet of the shoreline, which is the proposed minimum setback for the Urban-Stream Protection environment.

Segment 3: American Lake

The extensive residential development of property surrounding American Lake has resulted in an extensively modified shoreline. Approximately 66% of the shoreline with the City of Lakewood is armored, and native riparian vegetation has been extensively cleared for creation of residential lawns.

Development on the shoreline of American Lake is predominantly residential, and recreational use of the lake is heavy, particularly in the summer months. Approximately 86% of shoreline lots in this segment have an overwater structure. The median size of overwater structures on American Lake is approximately 1,313 square feet. Many of the remaining lots are adjacent to properties with docks or piers, and some of these may have shared access to the structure.

The proposed standard setback for Shoreline Residential properties on American Lake is 75 feet, with a provision to reduce the required setback to 50 feet if shoreline enhancement measures are incorporated. The median setback for primary structures on American Lake is approximately 85.83 feet, which indicates that more than half of the structures are located outside the standard setback area. On many properties surrounding American Lake, the portion of the property that would fall within the standard setback is characterized by shoreline stabilization structures, dock and pier structures, and residential lawn areas relatively free of native vegetation. In exchange for the ability to expand their residences and accessory structures into this area, many property owners may be willing to replace their bulkheads and hard armoring with non-structural shoreline stabilization systems and provide shoreline plantings to replace cleared vegetation, thereby increasing ecological function.

Segment 4: Lake Steilacoom

Consistent with the extensive residential development of properties surrounding this lake, the shoreline of Lake Steilacoom has been heavily modified. Approximately 62% of the lake's shoreline is armored, and, typical of residentially developed shoreline areas, native riparian vegetation has been extensively cleared in favor of large, manicured lawn areas. Approximately 82% of shoreline parcels are served by a dock, pier, or floating swim platform, the median size of which is approximately 723 square feet.

The proposed standard setback for Shoreline Residential properties on Lake Steilacoom is 75 feet, with a provision to reduce the required setback to 50 feet if shoreline enhancement measures are incorporated. The median setback for primary structures on Lake Steilacoom is 79.32 feet, which indicates that slightly more than half of the structures are located outside the standard 75-foot setback. On many properties surrounding Lake Steilacoom, the portion of the property that would fall within the standard setback is characterized by shoreline stabilization structures, dock and pier structures, and residential lawn areas relatively free of native vegetation. In exchange for the ability to expand their residences and accessory structures into this area, many property owners may be willing to replace their bulkheads and hard armoring with non-structural shoreline stabilization systems and provide shoreline plantings to replace cleared vegetation, thereby increasing ecological function.

Segment 5: Gravelly Lake

The shoreline of Gravelly Lake has been extensively modified through the installation of residential bulkheads, docks, piers, and swim platforms, though not to as great a degree as some of the other water bodies within Lakewood. Approximately 34% of the shoreline is armored, and 87% of the parcels are served by an overwater structure. The median size of overwater structures on Gravelly Lake is approximately 729 square feet. Though some forested areas remain on the western side of the lake, a majority of the native riparian vegetation has been cleared for residential lawns.

The proposed standard setback for Shoreline Residential properties on Gravelly Lake is 75 feet, with a provision to reduce the required setback to 50 feet if shoreline enhancement measures are incorporated. The median setback for primary structures on Gravelly Lake is 129.6 feet, which indicates that the majority of structures are located outside the standard 100-foot setback. While Gravelly Lake has a lower occurrence of hard armoring than Lake Steilacoom or American Lake, the area within the standard setback is characterized on many properties by dock and pier structures, as well as residential lawn areas with varying amounts of native vegetation. In exchange for the ability to expand their residences and accessory structures into this area, many property owners may be willing to replace their bulkheads and hard armoring with non-structural shoreline stabilization systems and provide shoreline plantings to replace cleared vegetation, thereby increasing ecological function.

Segment 6: Lake Louise

The shoreline of Gravelly Lake has been extensively modified through the installation of residential bulkheads, docks, piers, and swim platforms. Approximately 72% of the shoreline has been armored, and 63% of the parcels have an overwater structure. The median size of overwater structures on Lake Louise is approximately 299 square feet. As is typical of residentially developed shoreline areas, native riparian vegetation has been extensively cleared in favor of large, manicured lawn areas.

The proposed standard setback for Shoreline Residential properties on Lake Louise is 75 feet, with a provision to reduce the required setback to 50 feet if shoreline enhancement measures are incorporated. The median setback for primary structures on Lake Louise is 57.23 feet, which indicates that the majority of structures are located inside the standard 75-foot setback. Because so many of the existing buildings would fall within the standard setback, property owners

surrounding Lake Louise are likely to be motivated to qualify for the reduced setback allowance by replacing bulkheads and hard armoring with non-structural shoreline stabilization systems and providing shoreline plantings to replace cleared vegetation, thereby increasing ecological function.

Segment 7: Waughop Lake

Due to its location within Fort Steilacoom Park, the shoreline of Waughop Lake is in a relatively natural state. The lake does not currently contain any overwater structures or significant armoring, and no buildings are located within the associated shoreline environment.

2.5 IMPERVIOUS COVERAGE

Impervious surface coverage for each segment was analyzed by reviewing land cover data from Washington Department of Ecology. This land cover data was generated from Landsat imagery, which has several limitations. Because the data is collected by satellite, image resolution is relatively low; each pixel is approximately 30 square meters. A satellite's view of the ground is also often obstructed in various ways, such as by cloud cover, vegetation, or man-made structures. In the case of impervious coverage data, dense vegetation can mask the presence of buildings, roads, or other impervious surfaces. Because of these limitations, Landsat data is best suited for calculations of broad trends over large areas.

Due to the coarse resolution of the data available (30m), it is not possible to accurately determine impervious surface at the parcel level; in many areas, parcels are smaller than the basic unit of the impervious cover dataset. Rather, Landsat data is combined with building footprint data from the County Assessor to estimate an average impervious cover percentage for each analysis segment.

Segment 1: Chambers Creek

While the southern reach of Segment 1 consists mostly of single-family residential development, large portions of the northern reach are dedicated to open space and heavily vegetated. As described in the Shoreline Analysis Report, much of the riparian vegetation along Chambers Creek has been preserved. Review of Landsat impervious cover and building footprint data indicates that impervious surfaces account for approximately 8.8 percent of Segment 1. The majority of this impervious surface is concentrated in the southern reach of Chambers Creek, which consists of approximately 11.66% impervious cover. The northern reach of the creek contains less than 1% impervious surface.

Segment 2: Clover Creek

While Segment 2 has some of the most intense uses of all the analysis segments, the middle portion of the creek between I-5 and Lake Steilacoom is devoted almost entirely to low-density single-family residential uses, and much of the riparian vegetation in this area has been preserved. Review of Landsat impervious cover and building footprint data indicates that approximately 27.9% of Segment 2 is impervious surface, much of it concentrated in the properties adjacent to I-5.

Segment 3: American Lake

As described in the Shoreline Analysis Report, the shoreline of American Lake is extensively developed with single-family residences, though some portions of the shoreline are developed at relatively low intensities and remain vegetated. Landsat and building footprint indicate that the northwestern and southwestern shorelines contain the greatest concentrations of impervious surface, and the northeastern corner of the lake maintains relatively low levels of impervious cover. Overall, approximately 26.3% of Segment 3 consists of impervious surface based on the existing data.

Segment 4: Lake Steilacoom

The shoreline of Lake Steilacoom has been extensively modified for residential development, including widespread clearing of native vegetation, which has resulted in approximately 30.0% impervious surface coverage, which is relatively high for a single-family residential area. In general, the northern and western portions of the lake's shoreline jurisdiction contain the greatest amount of impervious cover, while the southern and eastern shorelines retain more vegetation.

Segment 5: Gravelly Lake

Much like the other lakefront areas, the shoreline of Gravelly Lake is extensively developed for single-family residential use. However, Segment 5 has generally larger lots, as well as a greater retention of mature vegetation than either Lake Steilacoom or American Lake. As a result, impervious coverage is relatively low at approximately 17.9%.

Segment 6: Lake Louise

The shoreline of Lake Louise has been heavily modified for residential development, including clearing of shoreline vegetation. Due to this extensive development, coupled with relatively small lot sizes, Segment 6 consists of approximately 33.1% impervious surface, which is the highest of all the analysis segments.

Segment 7: Waughop Lake

Due to its location within Fort Steilacoom Park, the shoreline jurisdiction for Waughop Lake has remained in a relatively natural state with significant native vegetation and limited shoreline modification. Impervious coverage is relatively low at 9.5%, and impervious surfaces surrounding the lake consist primarily of a bicycle/pedestrian trail and a gravel parking lot that lies partially within the shoreline jurisdiction.

2.6 BIOLOGICAL RESOURCES AND CRITICAL AREAS

An extensive discussion of the biological resources and environmentally critical areas present in the shoreline jurisdiction is included in the Shoreline Analysis Report. A summary of conditions for each of the inventory segments is presented in Table 2.

Table 2. Summary of Biological Resources and Critical Areas Conditions

Analysis Segment	Geologically Hazardous Areas	Wetlands	Floodplain and Channel Migration Zone	Fish and Wildlife Habitat Areas	Critical Aquifer Recharge Areas and Wellhead Protection Zones
<p>Segment 1: Chambers Creek</p>	<ul style="list-style-type: none"> Slopes greater than 40% are concentrated in the northern portions of this segment near the confluence with Flett Creek and 91st Avenue SW. Overall, this segment contains approximately 8.27 acres of steep slope hazards areas, approximately 6% of the segment acreage. 	<ul style="list-style-type: none"> The Chambers Creek segment is characterized by a large wetland complex near the creek mouth on Chambers Bay, as well as associated wetlands along much of the length of the creek leading to Lake Steilacoom. As described in the Shoreline Analysis report, these wetlands vary in type and frequency of flooding by location. Segment 1 contains approximately 56.7 acres of wetlands, which accounts for 43.3% of the total segment acreage. 	<ul style="list-style-type: none"> Segment 1 contains approximately 25.5 acres of floodplain area, which represents 19.5% of the total segment acreage. The floodplain areas are concentrated along the north-south portion of Chambers Creek and in the area immediately west of the confluence with Flett Creek. All 25.5 acres are classified by FEMA as a floodway. As described in the Shoreline Analysis Report, the Department of Ecology has mapped a potential Channel Migration Zone (CMZ) along the entire northern reach of Chambers Creek and a portion of the southern reach. However, a detailed 	<ul style="list-style-type: none"> The Chambers Creek segment contains several WDFW-designated habitat areas along its entire length from Lake Steilacoom to Chambers Bay, including riparian zones, waterfowl concentration areas, and urban natural open space. 	<ul style="list-style-type: none"> Pierce County designates all locations that meet any of the following criteria as Aquifer Recharge Areas: <ul style="list-style-type: none"> Areas within the Clover/Chambers Creek Upper Aquifer Basin Areas within a 10-Year Wellhead Protection Zone Areas rated 180 or higher on the EPA's DRASTIC model. Based on the above criteria, all of the City of Lakewood is classified as an Aquifer Recharge Zone. The southern portion of this reach, near the creek's outlet from Lake Steilacoom, lies within a 5-year wellhead protection

Analysis Segment	Geologically Hazardous Areas	Wetlands	Floodplain and Channel Migration Zone	Fish and Wildlife Habitat Areas	Critical Aquifer Recharge Areas and Wellhead Protection Zones
			delineation of the CMZ has not been performed.		zone. See Figure 1 for the locations of wellhead protection zones in Lakewood.
Segment 2: Clover Creek	<ul style="list-style-type: none"> No documented steep slope hazard areas are located within the Clover Creek segment. 	<ul style="list-style-type: none"> No wetlands are currently mapped within the Clover Creek segment of the shoreline jurisdiction. 	<ul style="list-style-type: none"> The Clover Creek segment contains approximately 26.8 acres of floodplain, which represents 27.8% of the total segment acreage. The floodway encompasses approximately 8.5 acres immediately adjacent to the stream channel. The remaining floodplain areas are generally concentrated in the eastern half of the segment in the areas upstream of Lake Steilacoom. 	<ul style="list-style-type: none"> Clover Creek has WDFW-designated riparian zones along most of its length upstream of Gravelly Lake Drive SW. A small area of WDFW waterfowl concentration area is present where Clover Creek empties into Lake Steilacoom. 	<ul style="list-style-type: none"> As described for Segment 1, the entire City of Lakewood lies within an Aquifer Recharge Area. Clover Creek passes through several wellhead protection areas, including a 1-year wellhead zone south of 112th Street SW and another near Interstate 5. The remainder of the reach lies within a 5-year wellhead protection zone. The locations of wellhead protection zones are illustrated in Figure 1.
Segment 3: American Lake	<ul style="list-style-type: none"> A very small amount of steep slopes (0.1 acre) occurs at the northeast corner of the lake. Overall, this segment is mostly free of 	<ul style="list-style-type: none"> No wetlands are currently mapped within the shoreline jurisdiction surrounding American Lake. 	<ul style="list-style-type: none"> The American Lake segment contains approximately 19.3 acres of floodplain areas, generally located in a narrow strip immediately 	<ul style="list-style-type: none"> All of American Lake is classified by WDFW as a waterfowl concentration area. A concentration of urban natural open 	<ul style="list-style-type: none"> As described for Segment 1, the entire City of Lakewood lies within an Aquifer Recharge Area. American Lake is classified as a 1-year

Analysis Segment	Geologically Hazardous Areas	Wetlands	Floodplain and Channel Migration Zone	Fish and Wildlife Habitat Areas	Critical Aquifer Recharge Areas and Wellhead Protection Zones
	geologically hazardous areas.		along the shoreline. This represents 16% of the total segment acreage.	space is mapped on the south shore of American Lake near Harry Todd Park.	wellhead protection zone, as is the majority of its associated shoreline management area. Small portions of the northeastern shoreline are within a 5-year wellhead protection zone. The locations of wellhead protection zones are illustrated in Figure 1.
Segment 4: Lake Steilacoom	<ul style="list-style-type: none"> • A very small amount of steep slopes (less than 0.03 acre) occurs at the southeast corner of the lake. Overall, this segment is mostly free of geologically hazardous areas. 	<ul style="list-style-type: none"> • No wetlands are currently mapped within the shoreline jurisdiction surrounding Lake Steilacoom. 	<ul style="list-style-type: none"> • Segment 4 contains approximately 24.8 acres of floodplain areas, generally located in a narrow strip immediately along the shoreline with several larger areas on the various points and inlets along the shoreline. The floodplain represents 17.8% of the total segment acreage. 	<ul style="list-style-type: none"> • All of Lake Steilacoom is classified by WDFW as a waterfowl concentration area. • A small area of riparian zone is mapped at the north end of the lake at the outlet for Chambers Creek. 	<ul style="list-style-type: none"> • As described for Segment 1, the entire City of Lakewood lies within an Aquifer Recharge Area. • Most of the Lake Steilacoom shoreline lies within a 5-year wellhead protection zone, and the northern end of the lake lies within a 1-year wellhead protection zone. The locations of wellhead protection zones are illustrated in Figure 1.

Analysis Segment	Geologically Hazardous Areas	Wetlands	Floodplain and Channel Migration Zone	Fish and Wildlife Habitat Areas	Critical Aquifer Recharge Areas and Wellhead Protection Zones
Segment 5: Gravelly Lake	<ul style="list-style-type: none"> Steep slope areas in the Gravelly Lake segment generally occur on the north shore and near the southern point. Segment 5 contains approximately 1.6 acres of steep slope areas, which represents approximately 3.1% of the total segment acreage. 	<ul style="list-style-type: none"> No wetlands are currently mapped within the shoreline jurisdiction surrounding Gravelly Lake. 	<ul style="list-style-type: none"> Segment 5 contains approximately 10.14 acres of floodplain areas, generally located in a narrow strip immediately along the shoreline. The floodplain represents 19.5% of the total segment acreage. 	<ul style="list-style-type: none"> All of Gravelly Lake is classified by WDFW as a waterfowl concentration area. 	<ul style="list-style-type: none"> As described for Segment 1, the entire City of Lakewood lies within an Aquifer Recharge Area. Most of the Gravelly Lake shoreline lies within a 5-year wellhead protection zone, though the western shoreline falls within a 1-year wellhead protection zone. The locations of wellhead protections zones are illustrated on Figure 1.
Segment 6: Lake Louise	<ul style="list-style-type: none"> A very small amount of steep slopes (less than 0.05 acre) occurs at the north end of the lake. Overall, this segment is mostly free of geologically hazardous areas. 	<ul style="list-style-type: none"> No wetlands are currently mapped within the shoreline jurisdiction surrounding Lake Louise. 	<ul style="list-style-type: none"> Segment 6 contains approximately 0.36 acre of floodplain area, generally located in a narrow strip immediately along the shoreline. The floodplain represents 1.4% of the total segment acreage. 	<ul style="list-style-type: none"> All of Lake Louise is classified by WDFW as a waterfowl concentration area. 	<ul style="list-style-type: none"> As described for Segment 1, the entire City of Lakewood lies within an Aquifer Recharge Area. The entire Lake Louise shoreline is located within a 1-year wellhead protection zone.
Segment 7: Waughop Lake	<ul style="list-style-type: none"> A very small amount of steep slopes (less than 0.02 acre) 	<ul style="list-style-type: none"> As described in the Shoreline Analysis Report, there are two 	<ul style="list-style-type: none"> No floodplain areas are currently mapped within the shoreline 	<ul style="list-style-type: none"> Most of Waughop Lake is classified by WDFW as a 	<ul style="list-style-type: none"> As described for Segment 1, the entire City of Lakewood

Analysis Segment	Geologically Hazardous Areas	Wetlands	Floodplain and Channel Migration Zone	Fish and Wildlife Habitat Areas	Critical Aquifer Recharge Areas and Wellhead Protection Zones
	<p>occurs at the northwest corner of the lake. Overall, this segment is mostly free of geologically hazardous areas.</p>	<p>mapped wetlands within the shoreline jurisdiction associated with Waughop Lake, one on the eastern shore and one to the west. The wetland on the eastern shore extends northward from the lake in a ditch toward Steilacoom Boulevard SW. Segment 7 encompasses approximately 22.1 acres of wetlands, which represents approximately 59.3% of the total segment acreage.</p>	<p>jurisdiction surrounding Waughop Lake.</p>	<p>waterfowl concentration area.</p> <ul style="list-style-type: none"> • The entirety of the shoreline jurisdiction surrounding Waughop Lake is classified by WDFW as urban natural open space. 	<p>lies within an Aquifer Recharge Area.</p> <ul style="list-style-type: none"> • The Waughop Lake shoreline area lies primarily within a 1-year wellhead protection zone. A small portion of the associated wetlands lies within a 5-year wellhead protection zone. The locations of wellhead protection zones are shown on Figure 1.

3.0 REGULATORY FRAMEWORK

3.1 CITY OF LAKEWOOD

3.1.1 Shoreline Master Program

The City of Lakewood's Shoreline Master Program has been designed in consideration of the ways in which reasonably foreseeable development in the shoreline jurisdiction could negatively affect shoreline functions and processes. This subsection provides an overview of the master program and how it generally addresses protection of ecological functions. The core of the proposed SMP is the designation of five shoreline environments described below:

Shoreline Residential

This designation is intended to provide for residential uses in the shoreline environment where the necessary facilities to support development can be reasonably provided is generally applied to areas where land is already platted for residential uses. Public access and recreational uses are also appropriate in the Shoreline Residential designation.

Urban – Stream Protection

The Urban-Stream Protection designation is intended to protect stream functions in areas where the shoreline environment has already been degraded through urban development while recognizing the limited demand for water dependent uses on non-navigable streams. Residential, commercial, recreational, and stream restoration/enhancement uses are appropriate for the Urban – Stream Protection environment. This designation is currently only proposed for both sides of Clover Creek.

Urban Conservancy

The Urban Conservancy designation is intended to protect and restore ecological functions of open space and sensitive lands that are located within urban areas while allowing for compatible uses. The Urban Conservancy designation is intended for lands that are suitable for water-related and water-enjoyment uses but which should not be intensely developed and have potential for ecological restoration.

Natural

The Natural environment designation is intended to provide protection for shoreline areas that are relatively free of human influence and where ecological functions are either intact or minimally degraded. Shorelands designated as Natural require that future development remain very low in intensity in order to maintain the integrity of current ecosystem-wide processes.

Aquatic

The Aquatic designation applies to all lands waterward of the ordinary high water mark and is intended to protect, restore, and enhance the unique characteristics and resources of these areas.

3.1.2 Comprehensive Plan

The City's Comprehensive Plan, contains a Land Use element, which includes goals and policies to guide development of residential, commercial, industrial, and recreational lands, as well as

protect sensitive environmental resources and shoreline areas. Techniques proposed include expansion of public ownership of shoreline areas to provide greater public access to the water, identification of stream enhancement opportunities, and development of a natural resources program to educate the public, as well as perform project review and code interpretation and enforcement. These policies are implemented by the Lakewood Municipal Code and functional plans, such as the Parks and Recreation Department's Lakewood Legacy Plan.

3.1.3 Critical Areas Ordinance

The City currently regulates Environmentally Critical Areas and Natural Resource Lands under Title 14A of its Municipal Code. These regulations are intended to designate and protect sensitive areas in order to limit development and alteration in these areas and ensure no net loss of ecological function. Sensitive areas regulations apply areas designated and mapped as follows:

- Geologically Hazardous Areas,
- Aquifer Recharge Areas,
- Fish and Wildlife Habitat Areas,
- Flood Hazard Areas, and
- Wetlands Areas.

The applicable provisions of the Critical Areas Ordinance are incorporated into Chapter 3 of the proposed SMP.

3.1.4 Stormwater Program

Stormwater runoff is the largest source of water quality pollution for urban water bodies. Untreated stormwater can carry a wide variety of toxic substances from upland areas into lake and streams, degrading water quality in the process and posing potential health risks to area residents. The Federal Clean Water Act requires municipalities who discharge stormwater runoff into State water bodies to obtain a National Pollutant Discharge Elimination System (NPDES) permit to ensure that water quality standards are being met. The City of Lakewood currently holds a Phase II NPDES permit and has adopted the latest edition of the Department of Ecology's *Stormwater Manual for Western Washington*.

Per the conditions of its NPDES permit, the City of Lakewood has adopted a Stormwater Management Plan that contains practices for protecting water quality by reducing discharge of pollutants. The Stormwater Management Program includes provisions for public involvement and outreach, detection and elimination of illicit discharges, runoff control for construction sites and new development, and a pollution prevention and operation and maintenance program for municipal activities.

Compliance with the conditions of the NPDES permit is phased over the 5-year life of the permit, and the City is continuing to work toward fully meeting the permit requirements by 2012. The City currently has a maintenance program for public facilities and conducts inspections of private facilities to prevent pollutant discharge. The City also inspects construction sites and requires spill control and response measures to be in place.

In addition, Chapter 12A.11 of the Lakewood Municipal Code sets requirements for stormwater pollution prevention, including standards for preservation of natural drainage systems, runoff treatment, flow control, and wetland protection.

3.2 STATE REGULATIONS AND FEDERAL REGULATIONS

As described in detail in the Shoreline Analysis Report, development activities within the City’s shoreline jurisdiction may be regulated under the following laws and regulations:

- Section 404 of the Clean Water Act;
- The Endangered Species Act;
- Section 401 Water Quality Certification; and
- Washington State Hydraulic Code.

Any development activity within the shoreline jurisdiction that takes place below the OHWM of a Water of the United States or a Water of the State will trigger the need for review by Federal or State agencies, respectively. Section 2 of the Shoreline Analysis Report contains a detailed discussion of the applicability of these State and Federal regulations to development within the shoreline jurisdiction.

4.0 FUTURE DEVELOPMENT AND ECOLOGICAL FUNCTIONS AT RISK

Future development in the shoreline management area has the potential to impact ecological function. The goal of the Lakewood Shoreline Master Program is to assure no net loss of existing ecological function. The following subsections describe the potential for future development in the shoreline jurisdiction and the ecological functions potentially impacted by such development.

4.1 PATTERNS OF SHORELINE DEVELOPMENT

As discussed in the Shoreline Analysis Report, the City of Lakewood has experienced a moderate amount of shoreline development since incorporation in 1996. The most common development activity has been pier construction; 51 permits were issued for pier construction or replacement between 1996 and 2009. The majority of shoreline permits issued by the City during that period have been Substantial Development Permits (36), and Shoreline Exemptions account for the second-largest group of granted permits (27). The City has granted very few Shoreline Conditional Use Permits and Variances since incorporation (8). Table 3 presents the shoreline permit history for the city from 1996-2009.

Table 3. Shoreline Permit History in the City of Lakewood Since Incorporation

Year	Pier		Bulkhead Mod.	Upland Residential Structure	Upland Com/MF Structures	Utilities	Other	Permit Type			
	Extension / Mod.	New/ Replace						Exemption	SS DP ¹	CU P ²	Variance
1996	0	4	1	0	0	0	3	0	3	0	1
1997	0	1	0	1	0	0	0	0	1	0	0
1998	0	3	0	0	0	0	3	0	3	0	0

Year	Pier		Bulkhead Mod.	Upland Residential Structure	Upland Com/MF Structures	Utilities	Other	Permit Type			
	Extension / Mod.	New/ Replace						Exemption	SSDP ¹	CUP ²	Variance
1999	2	0	0	0	0	0	2	0	2	0	0
2000	2	2	0	0	0	0	4	0	4	0	0
2001	1	3	0	0	0	0	4	0	4	0	0
2002	1	3	0	1	0	0	3	2	1	0	1
2003	0	2	0	2	1	3	0	2	4	0	0
2004	0	5	0	0	1	0	5	1	4	1	0
2005	1	4	0	1	0	0	4	3	1	0	1
2006	1	7	1	1	2	0	5	4	5	1 ³	1 ³
2007	0	4	1	1	1	0	3	4	2	1 ³	0
2008	0	6	0	3	0	0	5	5	1	0	0
2009	0	7	0	1	0	1	5	6	1	0	1 ³
TOTAL	8	51	3	11	5	4	46	27	36	3	5

¹ Shoreline Substantial Development Permit

² Shoreline Conditional Use Permit

³ Land use application approval was associated with a SSDP

Review of permitting data indicates that the City has granted very few permits for bulkhead modifications, which is somewhat unexpected, given the large number of properties in the city with shoreline armoring. Permitting activity for upland residential, commercial, and manufacturing development has likewise been low. The City has, however, granted 46 permits for development activities classified as “Other,” which makes it difficult to determine the exact nature of these activities.

4.2 ECOLOGICAL FUNCTIONS AND PROCESSES AT RISK

As described in the Shoreline Inventory Report, the City of Lakewood’s shorelines provide a range of ecological functions for hydrologic, vegetative, hyporheic, and habitat processes, which must be protected by the SMP. A detailed evaluation of the relative performance of each shoreline inventory segment with regard to these processes was included in the Shoreline Analysis Report, and the potential impacts to these functions from future development in each shoreline segment is analyzed in Chapter 5.3 – General Cumulative Impacts Assessment. Below is a general discussion of these ecological functions and how each function could potentially be impacted by future development.

4.2.1 Hydrologic Functions

Water and Sediment Transport (Streams)

Streams convey water and sediment from surface runoff, wetlands, or lakes to other waterbodies. Upland areas adjacent to streams that have large areas of impervious cover or that have been extensively cleared of vegetation provide less opportunity for water infiltration and can increase

the amount of surface runoff collected by the stream, increasing flows to downstream waterbodies. Channelization of streams can compound this effect by eliminating the ability of water to infiltrate into the stream bed.

Streams often transport sediment, which can be collected from surface runoff or scoured from the streambed itself. Development that clears upland or riparian vegetation can contribute to greater sediment transport by removing the stabilizing effect that vegetation has on soil, thus increasing the amount of sediment that enters the stream channel.

Water and Sediment Storage (Lakes)

Lakes, by definition, provide capacity for water and sediment storage from stream flows and surface runoff. Lakes also have the potential to improve water quality by entrapping sediments that may contain toxic compounds. Surrounding uplands also have the potential for water and sediment storage, depending on the amount of vegetation present. Areas that have been extensively cleared or converted to impervious surface provide little opportunity for water infiltration and storage. As such, development of shoreline areas that clears vegetation or creates new impervious surface has the potential to reduce water and sediment storage function.

Attenuation of Wave Energy (Lakes)

Wave energy, generated either naturally by wind or by man-made sources such as watercraft, can cause shoreline erosion. Natural or “soft” shorelines that feature vegetation or accumulated organic material provide a buffer that attenuates wave energy and protects the shoreline from erosive forces. Modification of the shoreline to remove vegetation or organic material, including the installation of bulkheads and other forms of “hard” armoring, eliminates this attenuation effect. The result is the reflection of wave energy back into the lake and the amplification of erosive wave forces on those lake shorelines that are not protected. The presence of docks, piers, or other artificial in-water structures can also interfere with movement of sediments along the shoreline, altering substrate conditions. Development that would create new shoreline armoring, increase the presence of in-water structures, or would remove vegetation from the water’s edge has the potential to adversely affect the wave energy attenuation function of lake shorelines. Conversely, development that removes existing bulkheads or implements bio-engineered or natural shoreline protection measures can positively affect this function.

Attenuation of Flow Energy (Streams)

Streams rely on the recruitment and accumulation of large woody debris and other organic material to stabilize stream banks and prevent downcutting, which alters streambed conditions and increases sediment transport to downstream waterbodies. Lack of riparian vegetation along stream channels reduces the availability of this plant material, which, in turn, reduces the ability of the stream banks to attenuate flow energy. Development that would channelize or pipe streams, or which would clear upland and riparian vegetation, is likely to have an adverse effect on this ecological function.

Developing Pools, Riffles, and Gravel Bars (Streams)

Perennial streams often develop variable streambed conditions in response to obstructions or debris in the stream channel, such as rocks, vegetation, or pieces of large woody debris. Streambed complexity slows stream flows, provides improved habitat function, and promotes streambed stability. If adjacent uplands are highly developed and contain large amounts of impervious surface, large runoff flows from these areas can cause downcutting, which negates the ability of vegetation or large woody debris to stabilize the stream channel.

Removal of Excess Nutrients and Toxic Compounds (Lakes)

Upland areas often provide filtration of stormwater into adjacent water bodies by allowing runoff to be filtered either by passing through surface vegetation or by infiltrating into the soil and joining subsurface flow. Highly vegetated areas and wetlands provide the greatest potential for natural filtration, while impervious surfaces and areas cleared of vegetation provide little to no filtration capacity. Filtration of stormwater runoff improves water quality by removing excess nutrients and toxics generated by residential development, such as fertilizers, herbicides, hydrocarbons, petroleum, and septic overflow. Overwater structures, such as docks, piers, or swimming platforms that use chemical treatments to prevent rot, such as creosote, can contribute to contamination of the water body, further reducing water quality. Development that would increase the level or impervious surface surrounding the lake or that would remove native vegetation has the potential to adversely affect water quality by inhibiting filtration of runoff and preventing removal of these excess nutrients and toxic substances.

Recruitment of Large Woody Debris and Organic Material

As described under *Attenuation of Wave Energy* and *Attenuation of Flow Energy*, the accumulation of large woody debris and other organic material on shorelines allows wave and flow energy to be released in a way that reduces potential for erosion. This organic material typically enters the waterbody from surrounding uplands during overland flooding, from direct deposition by overhanging vegetation, or, in the case of lakes, through stream inflow. Clearing of vegetation from surrounding upland areas can reduce the amount of organic material that falls into the waterbody or is recruited through overland water flows. For lakes, the placement of obstructions at stream outlets, such as dams, weirs, or culverts, can reduce or eliminate recruitment of large woody debris from stream channels. Development that obstructs stream passages or clears upland and riparian vegetation can have an adverse effect on this function.

4.2.2 Shoreline Vegetation Functions

Temperature Regulation

Shoreline vegetation that overhangs streams and lakes can provide temperature regulation by shading the water and limiting the potential for solar gain in the water body. This function is typically more important for streams because lakes have large expanses of unshaded water in the center, which reduces the relative contribution of shoreline shading to overall temperature regulation.

Removal of Excess Nutrients and Toxic Compounds

As described in Section 4.2.1, the presence of shoreline vegetation provides filtering of stormwater runoff, which can remove excess nutrients and toxic compounds that originate in upland developed areas, such as fertilizers, pesticides, herbicides, hydrocarbons, petroleum products, and septic overflows. Filtration of these substances improves the overall water quality of the waterbody. Removal of shoreline vegetation reduces this capacity for filtration, leading to potential decreases in water quality.

Attenuation of Wave Energy (Lakes)

As described in Section 4.2.1, vegetated shorelines provide “soft” shoreline protection and allow wave energy to be released, thereby reducing erosive effects on unprotected shorelines. Development that clears shoreline vegetation, removes accumulated organic debris, or installs new “hard” armoring reduces the ability of the shoreline to attenuate wave energy, while development that removes existing armoring or uses natural shoreline protection methods preserves this function.

Attenuation of Flow Energy (Streams)

As described in Section 4.2.1, vegetation stabilizes streambeds and prevents downcutting, which alters streambed conditions and increases sediment transport to downstream waterbodies. Development that would channelize or pipe streams, or which would clear upland and riparian vegetation, is likely to have an adverse effect on this ecological function.

Sediment Removal and Bank Stabilization

Shoreline vegetation filters surface runoff from adjacent uplands, removing water-borne sediment and preventing it from entering the waterbody. Vegetation also provides bank stabilization by anchoring soils on stream banks and lake shores. This also reduces sediment transport because shoreline soils are trapped by vegetation and less likely to be eroded by wave action or stream flows. The clearing of vegetation eliminates this benefit. Likewise, the introduction of bulkheads or armoring may stabilize a shoreline and prevent immediate upland erosion, but often leads to increased scouring at the bulkhead base, which may alter substrate conditions and affect other hydrologic, hyporheic, and habitat functions.

Recruitment of Large Woody Debris and Organic Material

As described in Section 4.2.1, the accumulation of large woody debris and other organic material aids the attenuation of wave energy and flow energy. Stream outlet obstructions and clearing of vegetation reduces the overall amount of organic material recruited.

4.2.3 Hyporheic Functions

Removal of Excess Nutrients and Toxic Compounds

As described in the Shoreline Analysis Report, the area where groundwater and surface water exchange has potential to provide removal of excess nutrients and toxics, though the effectiveness of this function varies by soil type and substrate conditions. In general, portions of the shoreline with impervious surface have a reduced potential for runoff infiltration and filtering, and shoreline bulkheads and armoring act as a barrier to water exchange between surface water and groundwater.

Water Storage

As described in the Shoreline Analysis Report, the exchange zone between surface water and groundwater can provide water storage, but this function is depended on soil type and level of impervious coverage. Under natural conditions, groundwater stored in the upland soils would discharge into the lakes and streams on a seasonal basis, providing surface water recharge. The presence of impervious coverage prevents stormwater infiltration, precluding subsurface recharge. Bulkheads along the shoreline also inhibit recharge by creating a barrier to subsurface water exchange.

Vegetation Support

Under natural conditions, shallow groundwater at a lake's edge or adjacent to a stream channel can support a riparian vegetation community. Upland development that includes construction of shoreline armoring, backfilling, or compaction of soils reduces the availability of shallow groundwater and precludes the establishment of riparian vegetation communities.

Sediment Storage and Maintenance of Base Flows

The contribution of groundwater-surface water exchange in the hyporheic zone to base flows can vary depending on soil conditions and grades, but shoreline armoring, including bulkheading, generally has a negative effect on this function as it presents a barrier to water exchange.

4.2.4 Habitat Functions

Physical Space and Conditions for Life History

Under natural conditions, the near-shore environment provides valuable habitat for aquatic species, including den sites, spawning grounds, and rearing and foraging areas. Upland vegetation provides cover, food, and nesting sites for terrestrial species. Modification of the shoreline, specifically armoring, can create deeper, more turbulent near-shore conditions that are inhospitable to aquatic species. Deep water adjacent to the shoreline also allows larger predatory fish to prey on young fish. Armoring of the shoreline also frequently involves removal of shoreline vegetation, which eliminates cover and habitat for terrestrial species. The presence of overwater structures can also alter natural patterns of light transmission into the water column, which can affect growth and behavior of aquatic organisms. Artificial lighting installed on docks and piers has also been shown to affect fish movement patterns.

Food Production and Delivery

Upland riparian areas, including emergent wetlands, often provide food for a variety of species. Residential development of the shoreline and the installation of shoreline armoring greatly reduce the potential for the shoreline to provide foraging areas for both aquatic and terrestrial species. While some domestic plants, such as fruit trees or garden plants, can supply food for wildlife, the function is diminished compared to natural conditions. Food production and delivery can also be affected by the presence of overwater structures, which alter the natural patterns of lighting and may interfere with the growth of aquatic vegetation.

4.3 POTENTIAL FOR FUTURE DEVELOPMENT

As described in the Shoreline Analysis Report, the potential for changes in land use on the City of Lakewood's shorelines is limited because the majority of parcels are currently developed, and those lots available for development would not have drastic effects on the character of the waterbody if they were to develop in the future.

4.3.1 Segment 1 – Chambers Creek

Anticipated Changes in Land Use

Approximately 52% of the land area in Segment 1 is developed, concentrated primarily in the southern reach of the creek; most of the vacant area is located in the northern portion of the Segment, which is dominated by Chambers Creek Park and has widespread areas of steep slopes, making development of these parcels difficult. Overall, land use changes in Segment 1 are anticipated to be modest because development would likely consist of new residential construction on vacant developable parcels and additions to or redevelopment of existing structures.

Likely Development and Implications for Shoreline Management

Redevelopment of Existing Properties

As described in Chapter 2, large portions of Segment 1 consist of undeveloped land and dedicated open space, and many properties along Chambers Creek are challenging development

sites due to the presence of steep slopes on both sides of the creek. Single-family and multifamily uses are concentrated at the southern end of the segment, north of the creek mouth on Lake Steilacoom. The conventional strategy for predicting whether a property is likely to redevelop, as described by Hubner and Moudon (*Monitoring Land Supply with Geographic Information Systems: Theory, Practice, and Parcel-Based Approaches*, 2000), is to compare the assessed value of its buildings and other improvements to the assessed value of the land. Properties with lower improvement values relative to land value are generally more likely to redevelop because the owner is more likely to invest in additional improvements to increase the economic value of the property. Review of assessed land and improvement values for developed parcels in Segment 1 showed that, in most cases, the assessed value of improvements compared favorably to the value of the land. Only four developed lots (not including open space dedications, drainage tracts, or publicly owned parcels) showed assessed improvement values equal to less than half the assessed value of the land, indicating that redevelopment of these lots is likely to occur in the future. Redevelopment of the remaining developed lots in Segment 1 is anticipated to consist of incremental expansions, renovations, or remodels of existing structures. Related appurtenances, such as driveways and parking areas, may also be expanded over time.

In addition to residential parcels, Segment 1 contains 4 lots zoned for commercial development under the Arterial Residential Commercial (ARC) zone. This zone is designed to allow low-intensity commercial development in areas characterized by residential development. Of the 4 ARC parcels in Segment 1, two are currently occupied by a veterinary clinic (one parcel dedicated to parking), one is occupied by a single-family residence, and one is occupied by a residential triplex. The veterinary clinic is unlikely to redevelop or expand due to its size relative to the lot area; ARC limits building coverage to 50% and impervious coverage to 60%. The parcel dedicated to parking is bisected by Chambers Creek and is therefore subject to shoreline setbacks and stream buffers, making any future development problematic.

The single-family and triplex parcels could potentially redevelop to higher-intensity multifamily residential uses. Based on development standards for the ARC zone, these two properties could potentially replace the 3 existing dwelling units with up to 10 multifamily dwelling units.

Development of Vacant Properties

Chambers Creek contains 32 parcels currently classified as vacant. Of these, 16 lots are dedicated park and open space lands owned by Pierce County, precluding them from development for the foreseeable future. An additional 2 vacant parcels are owned by the State of Washington and are likewise unlikely to be developed in the near future. Three parcels lie primarily outside the shoreline jurisdiction, and very little, if any, of the future development on the site would be located within 200 feet of the shoreline.

The remaining 10 vacant parcels could each be developed to create a new single-family residential use, as allowed by the City's development regulations. However, the proposed setback for Chambers Creek of 150 feet (100 feet with enhancement incorporated) may prevent development of several of these parcels by prohibiting construction on a large portion of the lot.

New Lots from Subdivision

Along Chambers Creek, 12 shoreline parcels meet both the proposed minimum lot size and minimum shoreline frontage requirements for subdivision, as shown in Table II of the proposed SMP. Three of these parcels are currently heavily forested and classified as open space under the

Washington Open Space Taxation Act (RCW 84.34). The Act allows lands meeting certain criteria for open space, agriculture, or timber lands to be assessed and taxed according to their current use, rather than their highest and best use. Any lands classified and taxed under the Act must continue to meet the designation criteria for at least 10 years from the time of designation, and a request for withdrawal of designation must be submitted to the State two years in advance. As a result, it is unlikely that these 3 parcels will be subdivided in the foreseeable future.

In addition, 6 of the parcels eligible for subdivision are unlikely to do so due to building configuration; subdivision would require the demolition or relocation of existing residences in order to create lots that meet minimum width standards.

The remaining 3 parcels could potentially be subdivided to create a total of 8 lots. This would result in the addition of up to 5 new homes with developed shoreline frontages along Chambers Creek.

Shoreline Armoring

As described in Section 2.4, the shoreline on Chambers Creek is relatively free of modifications. Even though the north-south portion of the creek is extensively developed for residential development, much of the vegetation along the creek has been preserved.

Future development in Segment 1 is unlikely to result in a substantial increase in shoreline armoring or modification. Approximately half of the property in Segment 1 is owned by Pierce County and engaged in open space use, and any new residential development would be required by the SMP to maintain a 150-foot setback (100 feet if enhancement is incorporated). Structural shoreline stabilization measures are a conditional use in the Urban Conservancy environment, and applicants for new shoreline stabilization projects must demonstrate that non-structural methods would not be sufficient to protect an existing legal structure. Given the current setback conditions along Chambers Creek, it is unlikely that future development will result in increased shoreline armoring.

Overwater Structures

As described in Section 2.4, no overwater structures are currently documented on Chambers Creek. The stream is not suitable for navigation, and future development in Segment 1 is not anticipated to result in the construction of any new overwater structures in this area.

4.3.2 Segment 2 – Clover Creek

Anticipated Changes in Land Use

Properties within this segment are mostly developed; approximately 6% (11 parcels) are currently vacant. While the amount of vacant land is relatively low, several parcels in the eastern portion of the segment are occupied by single-family residences but are zoned for multi-family and neighborhood commercial uses, increasing the likelihood that these properties may redevelop in the future. In addition, several parcels in the western portion of the segment are large enough to potentially be subdivided, creating additional residential lots in the area. Improvements are also planned for Springbrook Park, located in the eastern portion of the creek, including a small parking area and a bridge over Clover Creek to connect the park with other open space properties. However, the park itself does not have creek frontage and is located only partially within the shoreline jurisdiction.

Likely Development and Implications for Shoreline Management

Redevelopment of Existing Properties

As described in Chapter 2, Segment 2 consists of a mix of properties zoned for single-family residential, multifamily residential and neighborhood commercial uses. Commercial and multifamily zoning is concentrated at the eastern end of the creek, east of I-5, with a few multifamily and neighborhood commercial properties at the western end of the creek near Lake Steilacoom; the area between is dominated by single-family zoning.

While incremental expansions, renovations, and remodels to existing single-family homes may occur over time, including expansion of related appurtenances such as driveways and parking areas, most existing single-family residences along Clover Creek are anticipated to continue in their current use. A few single-family properties have been identified as potential redevelopment sites, but any future development at these locations would be similar to current development in size and lot coverage.

Redevelopment of developed lots along Clover Creek is anticipated to occur primarily on multifamily and commercially zoned properties. Compared to other areas of the shoreline jurisdiction, Segment 2 contains a much higher proportion of multifamily and commercially zoned property, and many of these properties are not fully developed to the level allowed by adopted development regulations. Based on a review of existing and allowed densities, 17 multifamily parcels were identified within Segment 2 as being underdeveloped. However, 7 of these lots lie primarily within the flood plain, and while development may occur, it may be limited or modified by critical area regulations. Seven of the 10 remaining multifamily lots are currently occupied by single-family structures, and it is likely that these properties will eventually be converted to multifamily use in the future.

Redevelopment of commercial properties along Clover Creek could potentially lead to expanded building footprints and increased levels of impervious coverage as commercial buildings are expanded or replaced in order to achieve full development potential under currently adopted zoning regulations. Segment 2 contains 13 commercially zoned parcels, of which 4 lie completely or mostly within the floodplain for Clover Creek, making them subject to mitigation or shoreline enhancement requirements due to their location within the floodplain. Two parcels are currently used as parking areas for other commercial lots and are anticipated to continue in that use. Additionally, one commercial parcel is currently in use as a dry-cleaning store and is unlikely to redevelop; this building has a relatively large footprint compared to the lot it occupies, and its assessed improvement value exceeds the land value, indicating that there is little market incentive for this property to redevelop. One parcel is also occupied by a small office building and unlikely to redevelop; like the drycleaners, this building already occupies most of the lot, and its assessed improvement value exceeds the land value, offering little incentive to redevelop.

Of the remaining 5 commercially-zoned parcels, three are currently developed with residential uses (two single-family residences, and one duplex). These properties could reasonably be anticipated to convert to higher-density multifamily uses in the future. If converted, current zoning would allow development of 19 dwelling units on the duplex property and a total of 40 dwelling units on the two single-family properties. The remaining 2 commercial properties

could potentially redevelop up to the 70% building coverage (combined total of 0.92 acre) allowed by the NC1 zone, though overall impervious surface coverage would be limited to 70% by the proposed SMP.

Development of Vacant Properties

Segment 2 contains 9 parcels currently classified as vacant. One residential lot extends into the shoreline jurisdiction by only a few feet, and any future development on the site is unlikely to substantially affect shoreline function.

Three of these lots are zoned for multifamily or commercial use. One lot lies primarily outside the shoreline jurisdiction, and little, if any, of the future development on the site would occur within 200 feet of Clover Creek. The two remaining vacant parcels lie mostly within the flood plain of Clover Creek, which may limit development potential. Development may occur with the implementation of mitigation or compensatory enhancement.

The remaining 6 properties are zoned for low-density residential use, and each could potentially develop a single residential structure, as allowed by the City's development regulations.

New Lots from Subdivision

Along Clover Creek, six parcels meet both minimum lot size and minimum shoreline frontage requirements for subdivision, based on the proposed dimensional standards contained in Table II of the proposed SMP. Two of these parcels are unlikely to subdivide based on the location of existing buildings; subdivision would require the demolition of primary residences. A third parcel is developed with four duplex condominium buildings, surrounded by green space. As the site is already developed to the maximum density allowed by adopted zoning, and subdivision would be difficult while meeting lot width and coverage standards, this property is not anticipated to develop in the foreseeable future.

A fourth parcel, located where Clover Creek enters Lake Steilacoom, meets the minimum lot size requirement for subdivision but has a relatively narrow shoreline frontage for its size. The site is currently occupied by a large, estate-style single-family home, and subdivision of the property to create an additional shoreline lot would limit shoreline access from the primary residence, making it unlikely that this property owner would choose to subdivide in the near future.

The two remaining parcels could be subdivided to create a total of 4 lots, which would create up to 2 new homes with shoreline frontages on Clover Creek.

Shoreline Armoring

While much of the creek shoreline upstream from Lake Steilacoom has been extensively modified, the SMP limits structural shoreline stabilization to locations where a legally established primary structure is in danger of damage from shoreline erosion and it can be demonstrated that non-structural, or "soft" armoring techniques would not be sufficient. Only 18 structures in Segment 2 are located within 50 feet of Clover Creek, making it unlikely that additional shoreline stabilization will be necessary to protect existing structures, and the SMP requires new development to be designed to avoid the need for shoreline armoring. As a result, future development on Clover Creek under the provisions of the SMP is not anticipated to result in increased armoring of the creek shoreline.

Overwater Structures

As described in Section 2.4, Clover Creek does not currently contain any documented overwater structures, as the stream is not large enough to support boating or recreational swimming, and no overwater structures are anticipated to be constructed in the foreseeable future. The three properties in Segment 2 with frontage on Lake Steilacoom already have docks, and overwater development at these properties is anticipated to consist of repair and replacement of these existing structures as they age.

4.3.3 Segment 3 – American Lake

Anticipated Changes in Land Use

The shoreline of American Lake is mostly developed, with the exception of 21 vacant parcels, which represents only approximately 6% of the lots in this segment. This segment also contains three City-owned parks, as well as portions of the privately-owned Tacoma Country Club and Golf Course. While several of the developed parcels in this segment meet the City's requirements for subdivision, any new lots created are anticipated to develop in residential or recreational uses, based on adopted zoning, which would not significantly change land use patterns in the area. Future development at the park properties is anticipated to consist of improvements detailed in the City's 2005 Parks and Recreation Plan, including boat launch and dock renovations, and repairs to a retaining wall at American Lake Park. Additionally, the City has plans to improve the currently undeveloped Lakeland Park on the north shore of American Lake.

Likely Development and Implications for Shoreline Management

Redevelopment of Existing Properties

As described in Chapter 2, development on American Lake is primarily single-family residential, and a significant number of homes are located on large, estate-style lots, though the Tillacum area southwest of Harry Todd park is characterized by comparatively narrow lots with smaller residences. Redevelopment of single-family residences on the lake is anticipated to consist primarily of incremental expansions, renovations, and remodels, including expansions of on-site appurtenances such as driveways and parking areas.

Segment 3 contains a limited amount of property zoned for multifamily use. Two condominium developments on the northeast shore of American Lake are currently slightly underdeveloped, based on review of existing and allowed residential density. While these properties could potentially add new residential units to maximize allowed density, there is limited room on the parcels to add additional buildings, so the addition of more dwelling units would likely require expansions to existing buildings or demolition and reconstruction, which is unlikely to occur, based on their relatively recent completion in 2009. In either case, redevelopment would not change the use of the properties, and any new development would be subject to the SMP's regulations regarding shoreline setbacks, impervious surface coverage, and preservation of shoreline vegetation.

Development of Vacant Properties

Segment 3 contains 19 parcels currently classified as vacant. One vacant lot on American Lake currently meets the square footage and lot width requirements for subdivision and is discussed in the following section, New Lots from Subdivision. Additionally, one vacant lot north of American Lake lies primarily outside the shoreline jurisdiction, and very little, if any, of the future development on this site would be likely to fall within 200 feet of the shoreline. The City of Lakewood also owns a parcel on the northeastern shore of the lake, making it unlikely that this lot will develop for residential use in the foreseeable future.

The remaining 16 lots could each develop a single residential structure, as allowed by the City's development regulations.

New Lots from Subdivision

Within Reach 3, 34 parcels meet both the minimum lot size and minimum shoreline frontage requirements for subdivision. Of those, 18 parcels are unlikely to subdivide due to site configuration constraints; the placement of existing buildings would make subdivision difficult without demolition or relocation. One parcel, located on the lake's southern shore, is currently classified under the Open Space Taxation Act (RCW 84.34) and is unlikely to subdivide, based on the requirements of the Act as described in Section 4.3.1.

Five lots on Silcox Island meet the square footage and lot width requirements for subdivision. However, these properties are unlikely to redevelop due to limited access and the lack of utility service to the island. The SMP's residential development policies indicate that new residential development should only be allowed where there is adequate provision for utilities, circulation, and access, and parcels currently using septic systems shall be required to connect to sanitary sewer service before undergoing substantial redevelopment. (SMP 3.B.9.c.7)

The remaining 10 parcels could be subdivided to create as many as 26 shoreline lots. This would result in the addition of up to 16 new homes and shoreline frontages on American Lake.

Shoreline Armoring

As described in the Shoreline Analysis Report, most of the American Lake shoreline has been modified with armoring and stabilization structures. Approximately 90 waterfront parcels are not currently armored, including 11 vacant lots. While additional armoring could result from future residential development of the shoreline, the use of structural shoreline stabilization methods is limited by the SMP. New construction on unarmored vacant lots would be required to be designed and sited to avoid the need for shoreline stabilization, and developed lots would not be allowed to use structural stabilization measures without demonstrating that non-structural methods are insufficient to protect an existing primary structure. Given that only 11 of the unarmored parcels have buildings within 50 feet of the shoreline, the potential for a substantial increase in shoreline armoring on American Lake is low.

Overwater Structures

Segment 3 contains 34 parcels without overwater structures. Of these, 12 lots are in common ownership with adjacent parcels that have overwater structures and are not anticipated to develop docks or piers of their own. Additionally, the City of Lakewood owns 4 waterfront parcels on American Lake that do not currently have overwater structures. The Parks and Recreation Advisory Board has conducted a study of shoreline public access opportunity sites and prepared a list of recommended improvements for City-owned waterfront properties. One of the City-

owned properties is a paved street right-of-way at the end of Wadsworth Street that functions as a boat launch and is regularly used by residents traveling to Silcox Island. While the City may install improvements at the site in the future, it is likely to continue in its current use as a boat ramp; the proximity of adjacent docks, the availability of moorage at the adjacent Marina and the narrow width of the right-of-way would make development of a dock or pier at this location difficult.

The City also owns a parcel at the end of Lakeland Avenue on the northeastern shore of American Lake. This property was designated as a park by Pierce County prior to the City of Lakewood's incorporation and consists mostly of heavily vegetated upland areas with a short trail leading to a narrow beach. The Parks and Recreation Advisory Board has recommended development of this site by the City, but they have made no specific recommendation regarding a dock or pier structure. Given the small beach area available at the site, development of a pier or fishing platform would provide greater public access to the water, and it is possible that the City will eventually construct such a structure at this site if it retains ownership.

Of the 18 remaining parcels without overwater structures, 4 are eligible for subdivision. Three of these could be subdivided into 2 lots each, and one could be divided into 3 lots. According to the proposed SMP's regulations for overwater structures, development of more than two residential dwellings is required to construct a joint-use dock instead of individual docks for each dwelling. Therefore, subdivision of these lots would produce 1 joint-use dock and up to 6 single-use docks.

The remaining 14 parcels without overwater structures would, under the SMP, each be allowed to develop a single dock or pier structure, provided that it is associated with a water-dependent or public access uses.

4.3.4 Segment 4 – Lake Steilacoom

Anticipated Changes in Land Use

Land along the shoreline of Lake Steilacoom is mostly developed with single-family residential uses, with the exception of Edgewater Park on the northeastern shoreline. Based on the residential and recreational zoning adopted for the area, no significant changes in land use are anticipated to occur in Segment 4. Land uses are anticipated to remain primarily residential in nature, including new construction from development of vacant and subdividable lots and redevelopment or expansion of developed parcels.

Likely Development and Implications for Shoreline Management

Redevelopment of Existing Properties

As described in Chapter 2, development on Lake Steilacoom is primarily single-family residential, including a number of homes located on large, estate-style lots. Redevelopment of single-family residences on the lake is anticipated to consist primarily of incremental expansions, renovations, and remodels, including expansions of on-site appurtenances such as driveways and parking areas. Based on review of land and improvement values for properties on Lake

Steilacoom, complete redevelopment involving demolition of existing single-family homes is anticipated to be relatively rare.

Segment 4 contains a small collection of parcels zoned for multifamily development at the northeast corner of the lake. Approximately half of this area is developed as a condominium complex, while the remainder is developed with approximately nine single-family residences. Based on existing and allowed densities, both sites are considered underdeveloped, but substantial redevelopment of the existing condominium complex is unlikely; little space exists on the site for the addition of new buildings, so the construction of additional units would require expansions to existing buildings or complete demolition and reconstruction. In either case, new development would be required to meet the SMP's regulations for shoreline setbacks, impervious surface coverage, and shoreline vegetation preservation.

Conversion is more likely for the single-family residences south of the condominium complex. These properties are zoned for multifamily use, and it is anticipated that the existing homes will eventually be redeveloped in favor of multifamily uses; adopted zoning for the site would allow up to 26 multifamily dwelling units, for a net increase of 19 dwelling units.

Development of Vacant Properties

Segment 4 contains 43 parcels currently classified as vacant. However, 33 of these parcels consist of small, mostly submerged lots that are in common ownership with an adjacent upland parcel and used to provide shoreline access; these 33 waterfront lots contain several docks and piers used by upland property owners. An additional 2 parcels lie primarily outside the shoreline jurisdiction, and very little, if any, of the future development at these sites would occur within 200 feet of the shoreline. In addition, one parcel lies partially within the shoreline jurisdiction, and while development at this location could occur within the shoreline jurisdiction, the lot does not have shoreline frontage.

Two of the vacant parcels meet the lot size and width requirements for subdivision and are discussed in the following section, New Lots from Subdivision.

The remaining 6 parcels could each develop a single residential structure with shoreline frontage, as allowed under the City's development regulations.

New Lots from Subdivision

Within Reach 4, 22 parcels meet both the minimum lot size and minimum shoreline frontage requirements for subdivision. Of these, 11 parcels are considered unlikely to subdivide based on the location of existing buildings, as substantial demolition of primary structures would likely be required in order to subdivide these lots. Additionally, one large parcel on the northeast shore of Lake Steilacoom is currently developed as condominiums and is unlikely to be subdivided for single-family residential use.

The remaining 10 parcels could potentially be subdivided to create up to 35 shoreline lots. However, 11 of these lots would be created from a single parcel located on a point on the western shore of Lake Steilacoom. Due to its location, the parcel has a relatively high proportion of shoreline frontage to parcel area; this makes the parcel very attractive for development but poses lot configuration challenges. As such, it is estimated that this property is likely to develop into no more than 3 parcels. As a result, subdivision of lots in Reach could potentially create up to 27 lots, resulting in up to 17 new homes with shoreline frontages on Lake Steilacoom.

Shoreline Armoring

As described in the Shoreline Analysis Report, most of the Lake Steilacoom shoreline has been modified with armoring and stabilization structures. Approximately 85 waterfront parcels are currently unarmored, including 5 vacant lots. While additional armoring could result from future residential development of the shoreline, the use of structural shoreline stabilization methods is limited by the SMP. New construction on unarmored vacant lots would be required to be designed and sited to avoid the need for shoreline stabilization, and developed lots would not be allowed to use structural stabilization measures without demonstrating that non-structural methods are insufficient to protect an existing primary structure. Given that only 16 of the unarmored parcels have buildings within 50 feet of the shoreline, the potential for a substantial increase in shoreline armoring on Lake Steilacoom is low.

Overwater Structures

Segment 4 contains 53 waterfront parcels without overwater structures. Of these, 16 lots are in common ownership with adjacent parcels that have overwater structures and are not anticipated to develop docks or piers of their own. The City of Lakewood also owns property on the northeastern shore of the lake at Edgewater Park. This park currently includes a public access boat ramp, and the City's Parks and Recreation Advisory Board has recommended further improvements at the site. Given the popularity of the park and the relatively low number of public access boating facilities on Lake Steilacoom, it is reasonable to assume that future improvements to Edgewater Park may include an expanded boat ramp or pier structure.

Of the remaining 36 lots without overwater structures, 3 are eligible for subdivision. Two of these could be subdivided into 2 lots each, and one lot could be divided into three lots. According to the SMP's regulations for overwater structures, development of more than 2 residential dwellings is required to construct a joint-use dock instead of individual docks for each dwelling. Therefore, subdivision of these lots would produce up to 1 joint-use dock and up to 4 single-use docks.

The remaining 33 parcels without overwater structures would, under the SMP, each be allowed to develop a single dock or pier structure, provided that it is associated with public access or a water-dependent use. A total of 39 new public and private overwater structures are anticipated on Lake Steilacoom.

4.3.5 Segment 5 – Gravelly Lake

Anticipated Changes in Land Use

The shoreline of Gravelly Lake is mostly developed, with the exception of two vacant parcels, one on the northeast side of the lake and one on the southwest shoreline. Zoning is primarily for single-family residences, except for Lakewood Gardens, which is zoned for open space and recreation. Based on the built-out nature of the shoreline and the adopted zoning, land uses in Segment 5 are not anticipated to change significantly over time. Future development in the area is likely to consist of development of the two vacant parcels and a limited number of short subdivisions, as well as redevelopment or expansion of existing structures on developed parcels.

Likely Development and Implications for Shoreline Management

Redevelopment of Existing Properties

Redevelopment of single-family residences on the lake is anticipated to consist primarily of incremental expansions, renovations, and remodels, including expansions of on-site appurtenances such as driveways and parking areas. A review of assessed improvement and land values in the area indicates that approximately 55% of the developed lots on Gravelly Lake have improvements assessed at less than half the value of the underlying lot, which often indicates a high potential for redevelopment. However, land values are often inflated for highly desirable real estate, such as waterfront property, and this can give the impression of a greater potential for redevelopment than may actually exist. Given the ownership patterns and adopted zoning in the area, it is unlikely that widespread demolition and redevelopment residential lots on Gravelly Lake will occur. However, these relatively low improvement-to-land value ratios could potentially contribute to subdivision of existing parcels to create new waterfront lots, which is discussed under New Lots from Subdivision.

Development of Vacant Properties

Segment 5 contains 2 vacant parcels, one of which does not have water frontage. Development of these two lots would result in 2 additional residential structures and 1 additional developed frontage on Gravelly Lake.

New Lots from Subdivision

Within Segment 5, 20 parcels meet both the minimum lot size and minimum shoreline frontage requirements for subdivision. Of these, 15 parcels are unlikely to be subdivided based on the observed locations of existing buildings; the prevailing market preference in the area is for estate-size lots and large homes, and many of these parcels are unlikely to subdivide because it would require demolition of the existing residence. The remaining 5 parcels could potentially be subdivided to create up to 22 parcels, which would add up to 17 new homes with shoreline frontages to Gravelly Lake.

Shoreline Armoring

As described in the Shoreline Analysis Report, the shoreline of Gravelly Lake has a relatively low degree of armoring, compared with the other lakes in the City; only approximately 34% of the shoreline is armored. The unarmored portion of the shoreline consists of 52 parcels, of which only one is currently vacant. While the relatively unarmored condition of the shoreline would appear to indicate a high potential for additional armoring from future residential development, the use of structural shoreline stabilization methods is strictly limited by the SMP. New construction on the single unarmored vacant lot would be required to be designed and sited to avoid the need for shoreline stabilization, and developed lots would not be allowed to use structural stabilization measures without demonstrating that non-structural methods are insufficient to protect an existing primary structure. Given that none of the unarmored parcels contain buildings within 50 feet of the shoreline, the potential for applicants being able to demonstrate such a need for structural stabilization is low, and no substantial increase in shoreline armoring on Gravelly Lake is anticipated. Over time, the level of shoreline armoring on Gravelly Lake is anticipated to decrease as existing structural stabilization systems age and are replaced with non-structural stabilization under the proposed SMP regulations.

Overwater Structures

Segment 5 contains 12 waterfront parcels without overwater structures. Of these, three lots are in common ownership with adjacent parcels that have overwater structures and are not anticipated to develop docks of their own. Additionally, one vacant lot is in common ownership with an adjacent developed lot that also has no overwater structure; for the purpose of this analysis, it is assumed that these two lots will develop only a single shared dock or pier structure.

The remaining 8 properties would, under the SMP, each be allowed to develop a single dock or pier structure, provided that it is associated with public access or a water dependent use, for a total of 9 new overwater structures.

4.3.6 Segment 6 – Lake Louise

Anticipated Changes in Land Use

The Lake Louise shoreline is extensively built out, consisting almost exclusively of single-family residences. This Segment contains a small amount of vacant land at the north end of the lake, and future development is anticipated to consist of development of these vacant lots and subdividable parcels, as well as redevelopment or expansion of existing residential structures. Based on the built-out nature of the shoreline and the adopted residential zoning, no significant changes to land use are anticipated in this segment.

Likely Development and Implications for Shoreline Management

Redevelopment of Existing Properties

As described in Chapter 2, the shoreline of Lake Louise is extensively developed with single-family residences with very little vacant property. Based on review of assessed improvement and land values in the area, no substantial redevelopment of residential parcels in Segment 6 is anticipated; less than 20% of the lots have improvements whose assessed value is significantly lower than that of the underlying lot, and most lots on Lake Louise are narrow, leaving little room for the construction of substantially larger structures than currently exist.

Redevelopment of single-family residences on the lake is anticipated to consist primarily of incremental expansions, renovations, and remodels, including expansions of on-site appurtenances such as driveways and parking areas.

Development of Vacant Properties

Segment 6 contains six currently vacant properties, none of which have lake frontage. Of these, one parcel is very narrow and would be difficult to develop for residential use. Two of the remaining parcels lie only partially within the shoreline jurisdiction, and future development on these lots may or may not fall within 200 feet of the shoreline.

The remaining 3 properties could each develop a single residential structure, as allowed by the City's development regulations.

New Lots from Subdivision

Within Reach 6, 3 parcels meet both the minimum lot size and minimum shoreline frontage requirements for subdivision. All three lots are currently developed, and the potential for subdivision varies between the properties. Two lots are unlikely to be subdivided as this would require demolition of the primary residences, while the third could be subdivided without substantial difficulty. This parcel could be divided to create a total of 2 lots, which would result in one additional home with shoreline frontage on Lake Louise.

Shoreline Armoring

As described in the Shoreline Analysis Report, the shoreline of Lake Louise is the most extensively armored shoreline of all the analysis segments; approximately 72% of the shoreline has been armored. The unarmored portion of the shoreline consists of 24 parcels, none of which are vacant. While most of the shoreline is already armored, some potential for additional armoring exists. The SMP limits the use of structural shoreline stabilization measures to those locations where it can be demonstrated that non-structural methods are insufficient to protect an existing primary structure. Buildings on Lake Louise are located relatively close to the shoreline compared to other water bodies in the shoreline jurisdiction, and a moderate potential exists that some may require armoring to provide protection from shoreline erosion.

Overwater Structures

Segment 6 contains 32 waterfront parcels without overwater structures. Two of these parcels are adjacent and in common ownership. For purposes of this analysis, it is assumed that these two lots would develop a single joint-use dock, rather than individual docks.

Of the 31 remaining lots, two are eligible for subdivision, and each could be divided into two lots, creating up to 4 docks. The remaining 29 lots would, under the SMP, each be allowed to develop a single dock or pier structure, provided that it is associated with public access or a water-dependent use.

4.3.7 Segment 7 – Waughop Lake

Anticipated Changes in Land Use

Segment 7 is located entirely within Fort Steilacoom Park, and the area is zoned exclusively for park and open space use. The City recently completed a master plan for Fort Steilacoom Park, which proposes improvements and shoreline restoration, but it is anticipated that the property will remain in park use and that no significant changes to land use will take place in the area.

Likely Development and Implications for Shoreline Management

Because the entire segment lies within Fort Steilacoom Park, no subdivision of parcels or development other than park improvements is likely to occur. As described under Anticipated Changes in Land Use, the City recently completed a master plan for Fort Steilacoom that includes development of a variety of park improvements, such as new soccer fields, parking areas, a community garden, an off-leash dog park, playgrounds and picnic areas, an amphitheater, walking trails, and a dock and boat rental facility on Waughop Lake. With the exception of the walking trails and the dock associated with the boat rental facility, these park improvements would lie outside the shoreline jurisdiction.

Increased Impervious Surface

Future upland improvements at Fort Steilacoom Park, including walking trails and parking areas, could moderately increase the amount of impervious surface coverage in the immediate vicinity of the analysis segment, which may increase the amount of surface runoff that would drain to the lake. Because Waughop Lake is a relatively small kettle lake with no drainage outlet, water quality is a primary concern. Any additional surface runoff may cumulatively increase pollutant concentrations and degrade water quality. The shoreline jurisdiction contains an existing paved trail that was previously used as a road. This trail is beginning to deteriorate and will require replacement in the future. The City could minimize the increase in stormwater runoff by converting the paved trail to a pervious pavement system and providing stormwater detention for any new parking areas.

Vegetation Clearing

While the park is not uniformly vegetated, the area that lies within the shoreline jurisdiction has a relatively high level of forest cover. While improvements within the shoreline area are not anticipated to involve significant vegetation clearing, upland construction, which is not subject to regulation by the SMP, may disturb native vegetation, which has the potential to reduce infiltration and filtration of stormwater runoff, which will ultimately flow into Waughop Lake and could potentially affect water quality.

Overwater Structures

Development at Fort Steilacoom Park is anticipated to include at least one new public access pier on Waughop Lake. Under the proposed SMP regulations, public access piers are limited in size to 1,400 square feet, and mitigation measures are required for all reconstructed, repaired, or modified overwater structures to ensure no net loss of ecological function (SMP 5.C.5.d.2).

4.3.8 Summary of Potential Future Development

Table 4 summarizes the potential for new development within each analysis segment and for the shoreline management area as a whole.

Table 4. Summary of Reasonably Foreseeable Land Use Changes by Water Body

Inventory Segment	Redevelopment of Developed Lots	Development of Existing Vacant Lots	Potential New Lots from Subdivision	Total Potential New Dwelling Units	New Overwater Structures
Segment 1: Chambers Creek	<ul style="list-style-type: none"> • Up to 10 multifamily dwelling units. 	<ul style="list-style-type: none"> • 10 new residences 	<ul style="list-style-type: none"> • 3 lots subdivided to create 5 new waterfront lots 	<ul style="list-style-type: none"> • 25 total new dwelling units 	None.
Segment 2: Clover Creek	<ul style="list-style-type: none"> • Up to 55 new multifamily dwelling units. • Up to 0.92 acre of new commercial development. 	<ul style="list-style-type: none"> • 6 new residences. 	<ul style="list-style-type: none"> • 2 lots subdivided to create 2 new waterfront lots 	<ul style="list-style-type: none"> • 63 total new dwelling units 	None.
Segment 3: American Lake	<ul style="list-style-type: none"> • Incremental renovation and expansion of existing single-family uses. 	<ul style="list-style-type: none"> • 16 new residences. 	<ul style="list-style-type: none"> • 10 lots (9 developed and 1 vacant) subdivided to create 16 new waterfront lots. 	<ul style="list-style-type: none"> • 32 total new dwelling units 	<ul style="list-style-type: none"> • 1 City-owned public access pier. • 1 private joint-use dock/pier. • 20 private, single-use docks/piers.
Segment 4: Lake Steilacoom	<ul style="list-style-type: none"> • Up to 19 new 	<ul style="list-style-type: none"> • 6 new residences. 	<ul style="list-style-type: none"> • 10 lots (8 developed and 2 vacant) subdivided to create 	<ul style="list-style-type: none"> • 42 total new dwelling 	<ul style="list-style-type: none"> • 1 City-owned public

Inventory Segment	Redevelopment of Developed Lots	Development of Existing Vacant Lots	Potential New Lots from Subdivision	Total Potential New Dwelling Units	New Overwater Structures
	<p>multifamily dwelling units.</p> <ul style="list-style-type: none"> Incremental renovation and expansion of existing single-family uses. 		17 new waterfront lots).	units	<p>access pier.</p> <ul style="list-style-type: none"> 1 private joint-use dock/pier. 37 private, single-use docks/piers.
Segment 5: Gravelly Lake	<ul style="list-style-type: none"> Incremental renovation and expansion of existing single-family uses. 	<ul style="list-style-type: none"> 2 new residences (one without shoreline frontage). 	<ul style="list-style-type: none"> 5 lots subdivided to create 17 new waterfront lots. 	<ul style="list-style-type: none"> 19 total new dwelling units 	<ul style="list-style-type: none"> 9 single-use docks/piers.
Segment 6: Lake Louise	<ul style="list-style-type: none"> Incremental renovation and expansion of existing single-family uses. 	<ul style="list-style-type: none"> 3 new residences (none with lake frontage). 	<ul style="list-style-type: none"> 1 developed lot subdivided to create 1 new waterfront lot. 	<ul style="list-style-type: none"> 4 total new dwelling units 	<ul style="list-style-type: none"> 34 single-use docks/piers.

Inventory Segment	Redevelopment of Developed Lots	Development of Existing Vacant Lots	Potential New Lots from Subdivision	Total Potential New Dwelling Units	New Overwater Structures
Segment 7: Waughop Lake	None.	None.	None.	None.	<ul style="list-style-type: none"> • 1 new City-owned public access pier as part of planned park improvements.

5.0 SMP PROVISIONS AND IMPACT ASSESSMENT

5.1 GENERAL GOALS, POLICIES, AND REGULATIONS

The proposed SMP contains numerous goals, policies, and regulations intended to protect shoreline areas and achieve no net loss of ecological function. Some of the most relevant policies and regulations are summarized below.

- Critical areas within the shoreline jurisdiction shall be regulated by the provisions of the City's Environmentally Sensitive Areas Ordinance, which is incorporated into the proposed SMP (Chapter 3.B.3).
- Protect shoreline process and ecological functions through regulatory and non-regulatory means that may include acquisition of key properties, conservation easements, regulation of development within the shoreline jurisdiction and incentives to encourage ecologically sound design (SMP 3.B.4.b.1).
- Shoreline developments that propose to enhance environmentally sensitive areas, other natural characteristics, resources of the shoreline, and provide public access and recreational opportunities to the shoreline are consistent with the fundamental goals of this Master Program, and should be encouraged (SMP 3.B.4.b.4).
- All shoreline uses and developments shall be located, designed, constructed and mitigated to result in no net loss of ecological functions necessary to sustain shoreline natural processes (SMP 3.B.4.c.1)
- All shoreline uses and activities shall be located and designed to prevent or minimize the need for shoreline protection structures (bulkheading, riprap, etc.) and stabilization, landfills, groins, jetties, or substantial site regrades (SMP 3.B.4.c.2).
- Preservation and enhancement of the public's visual access to all shoreline areas should be encouraged through the establishment of setbacks and height limits that ensure view corridors. Enhancement of views should not be construed to mean excess removal of vegetation that partially impairs views (SMP 3.B.5.b.11).
- Reclaim and restore to the greatest extent feasible areas which are biologically and aesthetically degraded while maintaining appropriate use of the shoreline. Improve the water quality of all water bodies within the shoreline management area by managing the quality and quantity of stormwater in contributing systems, consistent at a minimum with the latest Washington Department of Ecology Stormwater Management Manual for Western Washington (SMP 3.B.6.b.1).
- Target Waughop Lake (Fort Steilacoom Park), American Lake North Park, Harry Todd Park, and Edgewater Park for restoration of shoreline natural resources and functions while ensuring continued public access to the shoreline (SMP 3.B.6.c.1).
- Restoration of aquatic and riparian habitat along Clover Creek should be encouraged and accomplished over time through incentives for private property owners, stormwater management improvements and City capital improvement projects (SMP 3.B.6.c.2).

- Improve the health of lake shorelines by removing bulkheads and replacing these features to the extent feasible with bioengineered stabilization solutions to improve aquatic habitat conditions (SMP 3.B.6.c.5).
- Improve the health of streams and habitat with stream bank stabilization using native vegetation (SMP 3.B.6.c.6).
- Target American Lake North Park and Harry Todd Park for limited habitat enhancements that are designed and sited to be compatible with the heavy active recreation use at these parks. Opportunities include planting of native vegetation where appropriate (SMP 3.B.6.c.7).
- Decrease the amount and impact of overwater and in-water structures within SMP lakes through minimization of structure size and use of more environmentally friendly materials, including grated decking (SMP 3.B.6.c.10).
- Target American Lake North Park, Harry Todd Park, Springbrook Park and Open Space, and Chambers Creek Canyon Park for the use of environmentally friendly materials and design during the future planned development of recreational facilities (SMP 3.B.6.c.11).
- Preserve and restore native vegetation along shorelines to the greatest extent feasible (SMP 3.B.6.c.12).

5.2 GENERAL CUMULATIVE IMPACTS ASSESSMENT

The following section summarizes potentially impacted processes, relevant SMP policies and other regulatory provisions, and anticipated net effect on shoreline function for each shoreline inventory segment. A discussion of the effects of shoreline development on each type of ecological function is provided in Section 4.2.

5.2.1 Resources at Risk

Upland Development Activities

Upland development is anticipated to consist of new and expanded residential and commercial development, leading to a potential increase in impervious surface area and clearing of vegetation above the OHWM. These development activities have the potential to negatively impact hydrologic, vegetation, and habitat resources, as described in Section 4.2. Specifically, upland development activities have the potential to impact the following ecological processes and functions associated with streams:

- Recruitment of large woody debris and organic material;
- Improvement of water quality;
- Sediment removal and bank stabilization
- Physical habitat space and conditions for life history; and
- Wildlife food production and delivery.

Upland development activities also have the potential to impact the following ecological processes and functions associated with lakes:

- Water and sediment storage;
- Removal of excess nutrients and toxic compounds;
- Recruitment of large woody debris and organic material;
- Improvement of water quality;
- Sediment removal and bank stabilization
- Physical habitat space and conditions for life history; and
- Wildlife food production and delivery.

Nearshore Development Activities

Nearshore development consists of construction activities performed at the interface between a water body and its adjacent upland areas. Development activities at the land/water interface typically consist of shoreline stabilization and vegetation clearing.

Streams

Very little nearshore development is anticipated to occur along Chambers Creek or Clover Creek. Currently adopted stream buffers prevent buildings from being constructed close enough to the creek to require shoreline stabilization, so no bulkheading or stream channelization is anticipated to be required.

Lakes

Near-shore development in lakefront portions of the shoreline jurisdiction is anticipated to consist of shoreline modification and stabilizations measures associated with upland residential development. These modifications may include installation or expansion of shoreline stabilization structures that could adversely affect hydrologic, vegetation, hyporheic, and habitat resources, as described in Section 4.2. Specifically, nearshore development activities would impact the following ecological processes and functions associated with lakes:

- Attenuation of wave energy;
- Recruitment of large woody debris and organic material;
- Sediment removal and bank stabilization
- Removal of excess nutrients and toxic compounds;
- Water storage;
- Vegetation support;
- Maintenance of base flows; and
- Physical habitat space and conditions for life history.

Overwater Development Activities

Streams

The streams do not support recreational swimming or boating, so no new overwater structures are anticipated to be constructed on Chambers Creek or Clover Creek.

Lakes

As described in Section 4.3, overwater development on the lakes is anticipated to consist of up the development up new docks or piers, as well as the gradual replacement and repair of existing overwater structures. Overwater development is anticipated to result in a net increase in overwater coverage. The presence of overwater structures can adversely affect hydrologic and aquatic habitat resources and would specifically impact the following ecological processes and functions:

- Attenuation of wave energy;
- Removal of excess nutrients and toxic compounds;
- Physical habitat space and conditions for life history; and
- Wildlife food production and delivery.

The level of overwater development anticipated in the shoreline jurisdiction varies by water body, as shown below:

	American Lake	Lake Steilacoom	Gravelly Lake	Lake Louise	Waughop Lake
New Structures Anticipated	<ul style="list-style-type: none"> • 1 new City public access pier • 1 new joint-use pier • 20 new single use piers • Replacement, repair, and expansion of existing structures 	<ul style="list-style-type: none"> • 1 new City public access pier • 1 new joint-use dock • 37 new single use docks • Replacement, repair, and expansion of existing structures 	<ul style="list-style-type: none"> • 9 new single use docks • Replacement, repair, and expansion of existing structures 	<ul style="list-style-type: none"> • 34 new single use docks • Replacement, repair, and expansion of existing structures 	<ul style="list-style-type: none"> • 1 new City public access pier
Potential Increase in Overwater Coverage	Up to 11,820 square feet	Up to 19,980 square feet	Up to 4,320 square feet	Up to 16,320 square feet	Up to 1,400 square feet

5.2.2 Effect of Proposed SMP Regulations

Upland Development Activities

As described in Section 5.2.1, upland development activities within the shoreline jurisdiction have the potential to increase impervious surface coverage and clear riparian vegetation, which

could negatively affect ecological functions and processes. The SMP would ensure no net loss of ecological function from upland development by requiring compliance with the following standards.

Maximum Impervious Surface Standards

All areas of the shoreline jurisdiction are subject to limits on impervious surface coverage. Lower levels of impervious cover reduce stormwater flows by preserving the ability of water to infiltrate into the soil, which in turn helps reduce the flow of excess nutrients and toxics into receiving lakes and streams, thus preserving water quality. Maximum allowed impervious surface coverage varies by water body, shoreline environment, and underlying zoning. The proposed SMP regulations limit impervious surface coverage for each parcel in the shoreline jurisdiction to 10% below the amount currently allowed by the underlying zoning. Property owners may develop at the coverage limits contained in the zoning code in exchange for incorporation of pervious paving systems. (SMP 4.C.2)

Minimum Shoreline Setback Requirements

Development in all areas of the shoreline jurisdiction would be subject to minimum shoreline setback requirements. Setbacks prevent new development from locating in areas that may be subject to shoreline erosion and reduce the need for shoreline vegetation clearing and shoreline stabilization. Areas with sensitive resources, such as wildlife habitat or threatened species, benefit from increased shoreline setbacks.

The SMP also provides incentives that allow reduction of shoreline setbacks in certain environments in exchange for shoreline enhancement activities. Even with a reduced setback, the incorporation of shoreline enhancement can provide increased ecological function. Shoreline setbacks vary by water body and shoreline environment, as shown below (SMP 4.C.2):

	Shoreline Residential	Urban Stream Protection	Urban Conservancy	Natural
Areas Covered	<ul style="list-style-type: none"> • American Lake • Lake Steilacoom • Gravelly Lake • Lake Louise 	<ul style="list-style-type: none"> • Clover Creek 	<ul style="list-style-type: none"> • Chambers Creek South • Park areas on American Lake, Lake Steilacoom, and Gravelly Lake 	<ul style="list-style-type: none"> • Chambers Creek North • Waughop Lake
Shoreline Setback by Waterbody	<ul style="list-style-type: none"> • 75 feet • 50 feet with implementation of approved shoreline enhancement 	<ul style="list-style-type: none"> • 75 feet • 50 feet with implementation of approved shoreline enhancement 	<ul style="list-style-type: none"> • 150 feet on Chambers Creek • 100 feet for lakes (75 feet with enhancement) 	<ul style="list-style-type: none"> • 150 feet on Chambers Creek (reduction allowed only by variance) • 100 feet for Waughop Lake (75 feet with enhancement)

Minimum Lot Frontage

Development in all areas of the shoreline jurisdiction would be subject to minimum lot frontage requirement for new parcels created through subdivision. Minimum lot frontages limit the level and intensity of development along the shoreline and prevent excessive vegetation clearing and development of large contiguous areas of impervious surface. The proposed SMP would require a minimum lot width of 100 feet for properties along Chambers Creek, Clover Creek, and lakefront parcels designated Urban Conservancy or Natural. A minimum width of 50 feet is required for Shoreline Residential parcels on Lake Louise, a minimum width of 60 feet is required for Shoreline Residential parcels on American Lake and Gravelly Lake, and a minimum of 70 feet is required for Shoreline Residential parcels on Lake Steilacoom. (SMP 4.C.2)

Stormwater Treatment and Control Standards

The SMP's Water Quality, Stormwater, and Non-Point Pollution policies and regulations would require new development to implement best management practices for the control, detention, and treatment of stormwater runoff. The regulations also require control of solid waste, liquid waste, and untreated effluent to prevent degradation of surface water quality. (SMP 3.B.9.c)

Future development would also be required to adhere to the standards in the Department of Ecology's *Stormwater Manual for Western Washington*, which the City has adopted. The proposed SMP regulations also require the use of Low Impact Development (LID) techniques to the maximum extent feasible. (SMP 3.B.9.c.6) Implementation of these stormwater standards and LID techniques would reduce pollutant flows into surface waters, thereby reducing impacts to water quality.

Vegetation Conservation Standards

Upland development throughout the shoreline jurisdiction would be subject to the SMP's requirements to conserve and retain native vegetation and mature trees (SMP 3.B.8.c.) in order to maintain wildlife habitat, reduce stormwater runoff, maintain surface water quality, and reduce erosion and sedimentation of creek banks. The conservation standards state that clearing, grading filling, and alteration of any natural drainage features be limited to the minimum necessary for development, and those properties within the buffers associated with Chambers Creek, Clover Creek, and Waughop Lake must maintain natural vegetation in an undisturbed state, as required by the City's Environmentally Critical Areas and Natural Resource Lands ordinance (LMC 14.A.154).

In addition, the proposed SMP standards would require the preparation of a Vegetation Management Plan for any project that obtains a Shoreline Substantial Development Permit and involves tree removal or land clearing. The management plan will include appropriate mitigation measures and performance assurances, including monitoring activities, to assure no net loss of ecological function as a result of the development. (SMP 3.B.8.c.9)

Connection of Development to Sanitary Sewer

Septic runoff is a major component of surface water pollution in residential areas, and many of the water quality issues in Lakewood are compounded by untreated septic effluent flowing into surface water bodies. In particular, the Tillacum area on the south shore of American Lake has a large number of properties using on-site septic systems for wastewater treatment. Stormwater runoff from these properties carries pollutants into American Lake and degrading water quality.

The proposed SMP regulations would require parcels currently on septic to connect to sanitary sewer when undergoing substantial redevelopment. (SMP 3.B.9.c.7) Over time, this requirement would result in a reduction in the number of properties using septic systems, thereby reducing the amount of untreated effluent entering surface water bodies and having a positive effect on water quality.

Nearshore Development Activities

Nearshore development consists of construction activities performed at the interface between a water body and its adjacent upland areas. Development activities at the land/water interface typically consist of shoreline stabilization and vegetation clearing.

Streams

As described in Section 5.2.1, minimal nearshore development is anticipated to occur along Chambers Creek or Clover Creek. However, any development activities would be required to adhere to the SMP's standards for vegetation conservation (as discussed above), as well as the provisions for shoreline modifications. Chapter 5 of the SMP contains standards restrict the use of shoreline modifications, including installation of shoreline stabilization, clearing, grading, dredging, and fill.

Lakes

Impacts on ecological functions in the near-shore area would primarily result from the presence of shoreline stabilization structures, such as bulkheads. The SMP places strict limits on new structural stabilization measures, as well as the repair or replacement of existing structures. Bio-engineered shoreline protection measures are the preferred means of erosion prevention, and structural solutions shall only be allowed where it can be demonstrated that such methods are necessary to protect existing development and that non-structural stabilization solutions are infeasible or would not provide adequate protection (SMP 5.C.2.c). Likewise, new structural stabilization measures on developed lots shall only be allowed to protect an existing structure. The applicant must demonstrate a need for the armoring in the form a geotechnical report that confirms the existing structure will be damaged within 3 years due to shoreline erosion, and must also show that non-structural stabilization measures are infeasible or would not provide adequate protection to prevent damage to the property.

New development, including land subdivision, would be required to be located and designed to minimize the need for shoreline stabilization, and new non-water dependent uses shall be prohibited from constructing stabilization that would cause significant impacts (SMP 5.C.2.c).

Additional regulations on shoreline stabilization structures require that existing stabilization structures shall not be replaced with similar structures unless it can be demonstrated that non-structural methods are inadequate to protect existing development from ongoing erosion caused by currents or waves. The proposed SMP would allow for minor repairs of existing armoring, but as existing stabilization structures fail over time, replacement will result in the conversion of many properties that currently use structural protection methods to non-structural protection, reducing impacts on near-shore ecological functions and improving shoreline conditions.

Overwater Development Activities

Streams

As described in Section 5.2.1, no overwater development is anticipated to occur along Chambers Creek or Clover Creek.

Lakes

Piers, docks, and recreational floats are permitted uses in the Shoreline Residential environment when accessory to residential development; piers and docks are permitted in the Urban Conservancy environment, though recreational floats are prohibited. Docks, piers, and recreational floats are prohibited in the Natural environment, except for Lake Waughop, where docks and piers are conditionally permitted. Impacts on ecological functions would be limited by application of the SMP's regulations for docks, piers, and moorage structures (SMP 5.C.5.d), and well as regulations for recreational floats (SMP 5.C.5.e). These regulations require that any components of overwater structures that contact the water shall be free of toxic substances that may contaminate the lake, thus protecting water quality, and all recreational floats shall be grated to allow passage of light to the water, thus reducing impacts on growth and behavior of aquatic organisms. In addition, the proposed SMP requires that all reconstructed, repaired, or modified overwater structures provide mitigation to ensure no net loss of ecological function. (SMP 5.C.5.d.2)

The proposed SMP would also restrict the size of new docks and piers to limit impacts on aquatic organisms and ecological processes. Single use piers are limited to 480 square feet of surface areas, and joint-use piers are limited to 700 square feet. Piers used by more than 2 property owners may exceed this limit by 120 square feet for each additional owner, up to an overall maximum of 1,400 square feet. Overwater structure size varies across water bodies, from 299 square feet on Lake Louise to 1,313 square feet on American Lake. Median structure sizes for Lake Steilacoom and Gravelly Lake both exceed 700 square feet. As these existing docks and piers age, replacement structures will be required to comply with the proposed size limits, which will result in a decrease in overwater coverage over time. (SMP 5.C.5.d, Table V)

In addition, fixed-pile piers that are elevated at least two feet above the OHWM are preferred over floating docks, and floating docks shall only be allowed if no floating elements are located within 20 feet of the shoreline.

The SMP also contains a provision that the primary walkways for piers and docks on Lake Steilacoom must be fully grated or use materials that allow at least 40% light transmittance to the water below. (SMP 5.C.5.d, Table V, Note 3) Based on communication with state natural resource agencies, light transmission through decking material is not a critical factor on water bodies that do not support anadromous fish or native salmonids, such as American Lake, Gravelly Lake, Lake Louise, and Waughop Lake. Therefore, the light transmission standard applies only to Lake Steilacoom.

5.2.3 Effect of Other Regulatory Requirements and Restoration Activities

In addition to the provisions of the SMP, the City's Critical Areas and Natural Resource Lands Regulations (LMC 14A.142), which has been incorporated into the SMP, governs development that may have adverse impacts on environmentally sensitive areas, such as wetlands, fish and wildlife conservation areas, geologically hazardous areas, critical aquifer recharge areas, and frequently flooded areas. LMC 14A.142 requires the implementation of measures to limit alteration of sensitive areas and ensure no net loss of ecological function.

All future development in the City of Lakewood would be subject to the requirements of the Department of Ecology's *Stormwater Manual for Western Washington*, which has been adopted by the City. As described in Chapter 3, the City's Stormwater Management Program is designed to fulfill the conditions of their Phase II NPDES permit by increasing public awareness of water quality issues and working to improve treatment of runoff and eliminate unmonitored and illicit discharges of effluent to surface water bodies. Development and redevelopment under these regulations is anticipated to result in a gradual improvement in water quality in the City's lakes and streams as properties come into compliance with the requirements of the program.

In addition to City review, any development activities taking place in or over water, including wetlands, would require review by the Washington State Department of Fish and Wildlife, the U.S. Army Corps of Engineers, and the Washington State Department of Ecology. Each of these agencies has the authority to review proposals for in-water work and apply conditions and mitigation measures before granting permits.

5.2.4 Net Effect on Ecological Function

Segment 1: Chambers Creek

Because of the large amount of publicly owned park and open space land in the northern portion of Chambers Creek, as well as the limited potential for development, ecological function for this area is anticipated to remain moderate/high. Any future development along Chambers Creek would be required to comply with the standard shoreline setbacks required by the SMP or provide shoreline enhancement in exchange for setbacks that can be reduced by one third. Land along Chambers Creek would be designated as either Natural or Urban Conservancy, the two most restrictive environment designations in the proposed SMP. The proposed SMP regulations would limit upland impervious surface, maintain the presence of shoreline vegetation, require mitigation for upland and aquatic impacts necessary to meet no net loss, and require the use of non-structural shoreline stabilization measures for any future development, thus protecting ecological function. Future development along Chambers Creek would also be subject to the requirements of the City's current stormwater standards, which are designed to reduce non-point source pollution and eliminate illicit discharges that could impair water quality, and the proposed SMP would also require the implementation of LID techniques whenever feasible. As a result, redevelopment of existing developed properties is anticipated to have a positive effect on ecological function in the Chambers Creek area, particularly with regard to surface water quality.

Segment 2: Clover Creek

As described in Chapter 4, Clover Creek has relatively little potential for new development or subdivision. The greatest potential for future development in this portion of the shoreline jurisdiction consists of the redevelopment of commercial and multifamily parcels. The proposed SMP regulations would limit upland impervious surface, maintain the presence of shoreline vegetation, require mitigation for upland and aquatic impacts necessary to meet no net loss, and require the use of non-structural shoreline stabilization measures for any future development, thus protecting ecological function. Future development along Clover Creek would also be subject to the requirements of the City's current stormwater standards, which are designed to reduce non-point source pollution and eliminate illicit discharges that could impair water quality, and the proposed SMP would also require the implementation of LID techniques whenever feasible. As a result, redevelopment of existing developed properties is anticipated to have a

positive effect on ecological function in the Clover Creek area, particularly with regard to surface water quality.

Any future development along Clover Creek would be required to comply with the 75-foot shoreline setbacks established for the Urban Stream Protection environment or provide shoreline restoration/enhancement in order to reduce setbacks to 50 feet. As future redevelopment occurs, it is anticipated that at least some property owners will take advantage of these incentives and implement enhancement projects that will improve shoreline ecological function in Clover Creek.

Segments 3-6: American Lake, Lake Steilacoom, Gravelly Lake, and Lake Louise

While the shoreline jurisdiction surrounding the city's lakes is extensively developed, moderate potential for additional development exists, primarily through infill development on vacant lots and creation of new lots via subdivision of currently developed lots. Ecological function for most of the lake shorelines is currently low to moderate with small pockets of moderate/high function, and development of up to 88 new frontages has the potential to further degrade ecological function. As described in Chapter 2, impervious coverage is already estimated to be in the range of 20-30% in two of the lake shoreline areas, based on the Landsat data available for the area. Construction of new residences and expansion of existing homes could potentially increase the level of impervious coverage. However, application of the City's stormwater regulations, combined with the proposed SMP requirement for new development to implement LID techniques to the maximum extent feasible and to conserve shoreline vegetation, would limit the level of impervious coverage and reduce pollutant loading from stormwater runoff, thereby reducing impacts to water quality and having a net positive effect on ecological function.

Development surrounding the city's lakes could also entail the potential construction of approximately 104 new overwater structures (22 on American Lake, 39 on Lake Steilacoom, 9 on Gravelly Lake, and 34 on Lake Louise). The proposed SMP includes standards to limit the impacts associated with construction of new docks and piers, including limitations on size and the use of toxic materials. Many existing docks and piers are currently larger than would be allowed under the proposed SMP, and as these structures age and are replaced, they will be required to conform to the new SMP regulations regarding size and materials, leading to a net decrease in overwater coverage. In addition, any new docks or piers constructed on Lake Steilacoom would be required to allow passage of light to the water beneath in order to limit shading impacts on anadromous fish.

Development of vacant waterfront property, including creation of new lots through subdivision, also has the potential to increase the level of shoreline modification, though widespread use of shoreline armoring is not anticipated due to the proposed SMP's regulations regarding shoreline stabilization. As described in Section 5.2.2, the SMP strictly limits the construction of new structural shoreline stabilization measures to circumstances when erosion is a significant hazard and non-structural methods would not provide adequate protection of an existing legal structure. In addition, the proposed SMP prohibits the replacement or expansion of shoreline armoring with similar structural measures unless there is a demonstrated need to protect an existing legal principal use, and non-structural measures are not feasible.

In addition to the proposed SMP's restrictions on the construction of new shoreline armoring, it is anticipated that many property owners will take advantage of the flexible setback system and implement shoreline enhancement measures. The removal of existing bulkheads and hard

armoring would allow property owners to qualify for reduced shoreline setbacks, and portions of the lake shorelines that are currently armored would convert to non-structural stabilization methods over time, which would have a positive effect on ecological function..

Segment 7: Waughop Lake

While most of the City’s shoreline jurisdiction is extensively developed, the shoreline of Waughop Lake remains relatively intact. Surrounded by Fort Steilacoom Park, the lake has been protected from private development and is anticipated to remain so for the foreseeable future. As described in Section 4.3.7, the City has completed a master plan for Fort Steilacoom Park that includes several improvements near the lake, though most of these would be constructed outside the shoreline jurisdiction. Improvements within the shoreline jurisdiction would be limited to bicycle/pedestrian trails and a public access pier and small non-motorized boat launch area, which would be designed and constructed to comply with the development standards contained in the proposed SMP and provide shoreline enhancement and mitigation where necessary to assure no net loss of ecological function.

Upland construction activities associated with implementation of the master plan, such as vegetation clearing and increased impervious surface from new trails and parking areas, may affect shoreline ecological functions, particularly maintenance of water quality. The City will comply with all provisions of the proposed SMP when constructing improvements to Fort Steilacoom Park, including conservation of native site vegetation, use of stormwater management BMPs, limits on impervious surface, and implementation of mitigation measures to assure that development of the park does not result in a net loss of ecological function.

5.2.8 Summary of Cumulative Impacts

Table 5 summarizes the potential for cumulative impacts within each analysis segment and the anticipated net effect on ecological function.

Table 5 Summary of Cumulative Impacts

Potential Alteration and Resource at Risk	Location	Effect of Proposed SMP Policies and Regulations	Effect of Other Regulatory Requirements and Restoration Activities	Net Effect on Ecological Performance
<p>Upland Development Activities: Increased impervious surface and vegetation clearing may negatively impact hydrologic, vegetation, and habitat resources, specifically water storage and quality, recruitment of LWD, bank stabilization, and wildlife food production and delivery.</p>	<ul style="list-style-type: none"> All areas within shoreline jurisdiction. 	<p><u>Creation of New Frontages Through Subdivision:</u></p> <ul style="list-style-type: none"> Minimum lot frontages vary from 50 feet on Lake Louise to 100 feet on Chambers Creek. Minimum frontages limit subdivision potential and the level and intensity of development along the shoreline and help prevent excessive vegetation clearing and development of large contiguous areas of impervious surface. <p><u>Increased Impervious Surface:</u></p> <ul style="list-style-type: none"> Maximum impervious cover allowed is 10% below the level allowed under current zoning. Property owners may qualify to develop at the full coverage allowed if they incorporate pervious paving systems. Proposed SMP would require the implementation of LID techniques whenever feasible, further reducing impervious surface levels and stormwater runoff flows. <p><u>Vegetation Clearing:</u></p>	<p><u>Critical Areas Ordinance:</u> Applicable sections of Lakewood’s critical areas ordinance (LMC 14A.142) have been incorporated into the proposed SMP to protect environmentally sensitive areas.</p> <p><u>City Stormwater Management Program:</u> All future development in the City of Lakewood would be subject to Department of Ecology’s <i>Stormwater Manual for Western Washington</i>, which has been adopted by the City. The City’s Stormwater Management Program is designed to fulfill the conditions of their Phase II NPDES permit by reducing pollutant discharges to surface water bodies.</p> <p><u>State and Federal Review:</u> WDFW, U.S. Army Corps of Engineers, and Washington Department of Ecology each have regulatory authority to review development</p>	<p>Implementation of the SMP regulation regarding upland development activities would result in a net increase in ecological function over time, particularly for American Lake and Lake Steilacoom, where large amounts of shoreline vegetation have been removed. Shoreline restoration and conservation of vegetation in these areas will improve water quality by reducing untreated stormwater flows to the lakes.</p>

Potential Alteration and Resource at Risk	Location	Effect of Proposed SMP Policies and Regulations	Effect of Other Regulatory Requirements and Restoration Activities	Net Effect on Ecological Performance
		<ul style="list-style-type: none"> • SMP would require minimum setbacks to prevent development from locating too close to the shoreline and disturbing riparian vegetation. Reduced setbacks would be allowed in exchange for implementation of shoreline restoration or enhancement, which is likely to leverage improvement in existing conditions in currently degraded areas that comprise a large percentage of the shoreline area. (SMP 4.C.2) • SMP would require compliance with vegetation conservation standards to minimize disruption of habitat and maintain the ability of water to infiltrate on the site. (SMP 3.B.8.c) <p><u>Stormwater Treatment and Control:</u></p> <ul style="list-style-type: none"> • SMP would require compliance with stormwater control regulations to prevent degradation of water quality. (SMP 3.B.9.c) • Future development would be required to comply with City's adopted stormwater manual and incorporate LID 	<p>activities taking place in or over water, including wetlands. Permits for in-water work may be required from each of these agencies on a project-specific basis, allowing each agency to impose design and mitigation requirements to avoid and minimize adverse environmental impacts.</p>	

Potential Alteration and Resource at Risk	Location	Effect of Proposed SMP Policies and Regulations	Effect of Other Regulatory Requirements and Restoration Activities	Net Effect on Ecological Performance
		techniques where feasible, which would further reduce pollutant loading and stormwater flows.		
<p><u>Nearshore Development Activities:</u> Shoreline modification and stabilization activities associated with residential development may negatively affect hydrologic, hyporheic, vegetation, and habitat resources, specifically attenuation of wave energy on lakes, attenuation of flow energy in streams, recruitment of LWD, water storage and quality, habitat space and maintenance of base flows.</p>	<ul style="list-style-type: none"> • American Lake • Lake Steilacoom • Gravelly Lake • Lake Louise 	<p><u>Shoreline Stabilization:</u></p> <ul style="list-style-type: none"> • SMP limits new structural stabilization measures, preferring bio-engineered and non-structural solutions. Structural solutions would only be allowed to protect existing development where non-structural methods would not provide adequate protection. (SMP 5.C.2.c) 		<p>Application of the SMP regulations will result in a net improvement in ecological function, particularly with regard to water quality and attenuation of wave energy. As existing shoreline armoring ages and is replaced, due to the implementation of the proposed standards, a significant percentage of the lake shorelines are expected to transition to “soft” armoring and non-structural stabilization systems.</p>
<p><u>Overwater Development Activities:</u> Overwater development is anticipated to consist of approximately 105 new docks and piers and gradual replacement/repair of existing structures. Increased overwater coverage can adversely affect hydrologic and habitat functions, specifically attenuation of wave energy, water quality, and food and forage requirements for aquatic organisms.</p>	<ul style="list-style-type: none"> • American Lake • Lake Steilacoom • Gravelly Lake • Lake Louise • Waughop Lake 	<p><u>Overwater Structures:</u></p> <ul style="list-style-type: none"> • SMP limits the size of overwater structures on all water bodies and requires that decking material allow at least 40% of light to penetrate to the water below on Lake Steilacoom to minimize impacts on anadromous fish (SMP 5.C.5). • SMP would require a joint-use 		<p>Implementation of the SMP will result in no net loss of ecological function due to construction of overwater structures. While a limited number of docks/piers will be built as vacant properties develop, their size will be restricted, and many existing docks that are</p>

Potential Alteration and Resource at Risk	Location	Effect of Proposed SMP Policies and Regulations	Effect of Other Regulatory Requirements and Restoration Activities	Net Effect on Ecological Performance
		<p>dock or pier in this Segment if the parcel is subdivided into 3 or more lots. (SMP 5.C.5.d.7)</p> <ul style="list-style-type: none"> ● Piers are preferred over floating docks, and docks shall be required to “bridge” the first 20 feet from the shoreline. (SMP 5.C.5.d.3) ● Mitigation shall be provided for all reconstructed, repaired, or modified overwater structures to ensure no net loss of ecological function. (SMP 5.C.5.d.2) 		<p>larger than allowed under the proposed SMP will be converted to smaller structures as they age and are replaced, resulting in a net decrease in the level of overwater coverage. In addition, the proposed SMP would require implementation of mitigation measures when piers or docks are modified or constructed, which would have a net positive effect on ecological function over time.</p>

